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Digital Health Landscape Assessment: Mongolia Report

Ulaanbaatar
Mongolia
2024

Prepared for the Government of Mongolia by Asia eHealth Information Network (AeHIN). The Asia eHealth Information Network is funded by Digital Square, a PATH-led initiative funded and designed by the United States Agency for International Development, the Bill & Melinda Gates Foundation, and a consortium of other investors, in support of the Digital Health Convergence Workshop in Mongolia

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Foreword

The real wealth of a country is people, especially healthy people. In this sense, protecting the population's health is one of the top goals of the Government of Mongolia.
In the last 3 years, Mongolia's digital transformation has been successfully progressing not only in the public sector but also in the private sector. The most important pillar of this digital transformation is the "e-Mongolia" government service system, which is currently in its 4th version, providing more than 1,000 government services to citizens through 6 main channels, and serving as the pillar for our goal of creating a citizen-centered government.

The Ministry of Health and the Ministry of Digital Development and Communications worked together to establish a working group to deliver the benefits of this digital transformation of public services to the citizens, and to create the foundational technological prerequisites and legal framework for digitally transforming the most important service, the healthcare services.

This “Digital Health Landscape Assessment” is a crucial part of the above task and a good understanding of where we are today will be key to future development.

We believe that completing this assessment will lay the foundation for a successful and sustainable digital transformation in the healthcare sector and the report will establish an important guiding document to define the main goals for this effort.

Battsetseg Bataa

Head of the Technical Working Group,
State Secretary of the Ministry of Digital Development, Innovation, and Communications

Preface

The Ministry of Digital Development and Communications (MDDC) aims to enable information exchange between software and databases used for healthcare provision under its scope of directing the coordination of intersectoral digital transformation throughout Mongolia. Therefore, in July 2023, the State Secretary of the Ministry of Digital Development and Communications submitted a request for technical assistance regarding the evaluation of the current situation of digital transformation in the health sector, the redesign of the digital transformation of healthcare services, international best practices, and related standards to UNICEF, (the United Nation's Children's Fund) Representative to Mongolia.

On December 21, 2023, the Prime Minister of Mongolia issued an order to set up a Working Group led by the Minister of Digital Development and Communications which consisted of representatives from the Prime Minister's Office, the Cabinet Secretariat of Mongolia, the Ministry of Health (MOH), the Ministry of Digital Development and Communications and other relevant organizations to accelerate digital transformation in the health sector.

As a result of such efforts, the Government of Mongolia, public and private institutions, specialists, and researchers conducted this Digital Health Landscape Assessment with support from UNICEF and technical assistance from the Asia eHealth Information Network.

Acknowledgements

The successful completion of the digital health landscape assessment in Mongolia was made possible through the contributions and support of numerous individuals and organisations. Foremost gratitude is extended to the core assessment team, whose dedication and expertise were instrumental in executing this comprehensive assessment.

- Jai Ganesh Udayasankaran, Executive Director, Asia eHealth Information Network (AeHIN)
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- Sunny Ibeneme, Digital Health Specialist, UNICEF
- Ameera Hamid-Saldulker, Consultant, AeHIN
- Zoljargal (Zoey) Lkhagvajav, Working Council Member, AeHIN
- Tengis Sukhee, Advisor, MDDC and Consultant, AeHIN
- Enkhtulga Ganbat, Expert for Cross-Sector Coordination, Digital Governance Department, Ministry of Digital Development and Communications

Profound appreciation goes to members of the Mongolian government who played a pivotal role in supporting the core team with by availing their time and resources to ensure the successful completion of the assessment.

From the Ministry of Digital Development and Communication:

- Battsetseg Bataa, State Secretary of the Ministry of Digital Development and Communications
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- Sarantuya Bayarsukh, Specialist for telemedicine, Center for Health Development
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Acknowledgement is also given to the significant technical and funding support provided by development partners, UNICEF and AeHIN. Their assistance in sourcing the relevant domain expertise and supporting the execution of the assessment was crucial to its success.

- Bataa Chuluunbaatar, Health Specialist
- Uranchimeg Davaadorj, Health Program Officer

Appreciation is extended to all other individuals and organizations who contributed their time, knowledge, and resources to this assessment. Their collective efforts have been instrumental in advancing the digital health landscape in Mongolia.

- Jared M Erwin - Lecturer at the Department of Biomedical Informatics and Medical Education, University of Washington
- Nomundari Baatar

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Abbreviations

AeHIN	Asia eHealth Information Network
CDA	Clinical Document Architecture
CCD	Continuity of Care Document
DHLA	Digital Health Landscape Assessment
DICOM	Digital Imaging and Communications in Medicine
ERP	Enterprise Resource Planning
ESB	Enterprise Service Bus
FHIR	Fast Healthcare Interoperability Resources
GDHM	Global Digital Health Monitor
GDPR	General Data Protection Regulation
GoM	Government of Mongolia
HIGO	Health Insurance General Office
HL7	Health Level Seven International
HMIS	Health Management Information System
ICD-10	International Classification of Diseases, 10th Revision
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ITU	International Telecommunication Union
LA	Landscape Assessment
LOINC	Logical Observation Identifiers Names and Codes
MDDC	Ministry of Digital Development and Communications
MoH	Ministry of Health
NDC	National Data Centre
ODIN	Open Data Inventory
PPP	Public-Private Partnership
SNOMED CT	Systematized Nomenclature of Medicine – Clinical Terms
UHC	Universal Health Coverage
WHO	World Health Organization

Executive Summary

The Digital Health Landscape Assessment (DHLA) of Mongolia offers a detailed evaluation of the country's digital health ecosystem, identifying critical gaps, challenges, and opportunities. The assessment aims to align Mongolia's digital health initiatives with its Vision 2050 goals and the broader global health agenda. This summary provides a snapshot of the comprehensive findings and strategic recommendations presented in the report.

Mongolia's digital health landscape is characterised by significant strides in aligning initiatives with national priorities and international commitments. The Ministry of Health (MoH) and other relevant bodies have secured funding and established essential policies and regulations. However, current funding levels are insufficient to meet the ambitious goals outlined in Vision 2050. A phased approach to digital health implementation is recommended, focusing on major health system bottlenecks. There is a pressing need for a comprehensive governance structure to ensure cohesive efforts across all levels of the health system. Improved communication with sub-national levels is crucial for the successful implementation of national plans. Tools like the Total Cost of Ownership tool from Digital Square can assist in developing costed plans and investment roadmaps, which are essential for securing the necessary resources and funding.

The assessment also highlights a significant gap in regional leadership, with a lack of champions and specialists to drive digital health efforts. This gap underscores the need for enhanced human capacity development and stronger collaboration with the private sector. By building relationships with private sector entities, the MoH can ensure that digital health applications are better suited to regional contexts and scalable. Investing in workforce training and gaining a deeper understanding of data infrastructure are critical steps toward achieving seamless interoperability and informed system development.

Operationally, health facilities face substantial challenges related to infrastructure, knowledge, and skill capacity. Smaller facilities, in particular, struggle to keep pace with the digital transformation goals set by the national government. Tailored solutions are necessary to accommodate the varying capabilities of different facilities. Health workers express frustration over redundant data entry, which is time-consuming and detracts from patient care. Reducing these redundancies through integrated systems is vital for improving efficiency. National digital health plans must be contextualised to address the specific needs and resources of different facility types, ensuring that smaller facilities can catch up with larger ones.

The report presents several strategic recommendations. Governance and coordination efforts should focus on establishing a centralised governance structure with clear roles and responsibilities. Developing a comprehensive digital health strategy that aligns with both national and international priorities is essential. Enhancing collaboration between the MoH and E-Government departments and creating forums to improve communication with sub-national levels will facilitate more effective implementation of digital health initiatives.

Funding and investment strategies must secure sustainable funding sources for digital health projects. Encouraging private sector investment, particularly in ICT for rural areas, is crucial. Developing costed plans and an investment roadmap will help in lobbying for necessary resources.

The policy and regulatory environment need robust policies specific to digital health, covering data exchange, storage, and system development. Establishing a centralized knowledge platform for digital health strategies and projects will enhance coordination and transparency.

Human capacity development is critical. Investing in comprehensive workforce training and long-term capacity building will support the development of regional champions and specialists. These efforts will drive digital health initiatives and advocate for necessary reforms.

Addressing disparities in technological infrastructure between urban and rural areas is essential for equitable access to digital tools. Ensuring interoperability across health information systems through national standards for data exchange and mandatory ICT staff training will strengthen the digital health framework.

Operational improvements should focus on providing targeted support to smaller health facilities. Tailored solutions and integrated systems will enhance their capacity to adopt and maintain digital health technologies. Fostering a culture of patient-centric care and continuous improvement will further improve healthcare delivery.

In conclusion, Mongolia is on a promising path toward digitising its health sector, but significant challenges remain. Achieving the Vision 2050 goals requires focusing on strategic governance, sustainable funding, comprehensive workforce training, and robust infrastructure development. Investing in digital health enabling environment factors defined in the National eHealth Strategy Toolkit by WHO/ITU alongside the adoption of applications and systems is crucial. Collaboration between the public and private sectors and leveraging international partnerships will be vital in overcoming these challenges and building a resilient digital health ecosystem. The DHLA provides a clear roadmap for advancing digital health in Mongolia, offering actionable insights and recommendations to drive meaningful progress. By addressing the identified gaps and following the proposed strategic pathways, Mongolia can enhance healthcare delivery and outcomes, ensuring a healthier future for all its citizens.

Chapter 1: Rationale for a Digital Health Landscape Assessment

Introduction

Mongolia has made significant strides towards achieving universal health coverage (UHC)[1] for over 90% of its population .(1) Still, the health system faces several challenges, including shortages of healthcare workers, resource allocation issues, medication distribution problems, and a rising prevalence of non-communicable diseases. Since 2010, substantial policy changes have been implemented to expand access to quality healthcare services. A particular focus has been placed on leveraging information and communication technology (ICT) to enhance the performance of the health system. Early investments in ICT, reinforced by the country's Vision 2050 policy, have shown promising results, particularly in enabling the government to respond effectively to the COVID-19 pandemic. Nevertheless, these investments remain fragmented, hindering the government's ability to fully realise improvements in the efficiency and quality of health services.

To ensure that ongoing investments and the adoption of ICT in health, also known as digital health, effectively address these challenges and support the achievement of health system goals, the government must conduct a thorough assessment of the current digital health ecosystem. This assessment is crucial to understanding the factors that influence ICT adoption, implementation, and maintenance. Without a comprehensive analysis of these factors, the continued digitalization of the health sector risks further fragmentation and inefficiency, the selection or development of inappropriate systems, poor sustainability of systems, and an increasing digital divide.

What is a digital health landscape assessment?

A digital health[2] landscape assessment (DHLA) evaluates the development and capabilities of various factors essential for a robust digital health ecosystem, highlighting strengths, weaknesses, and opportunities for digital transformation. Critical components of a DHLA include the availability and affordability of ICT infrastructure, the existence of essential digital tools (such as unique ID systems, electronic health records, telehealth, and mHealth), readiness for information sharing, enablers of adoption and trust (such as strategies, governance, and capacity building), and quality improvement, monitoring, and evaluation processes. The outcomes of the assessment inform the resources needed for digital health planning, strategy development, implementation, and quality improvement, ensuring alignment with the health system's needs.

Purpose of the digital health landscape assessment.

The primary goal of this Digital Health Landscape Assessment (DHLA) is to identify barriers to adopting digital health across different regions of Mongolia, evaluate readiness for further digital transformation, and determine the necessary investments

[1]Universal health coverage means that everyone can access quality health care whenever they need it, regardless of where they live, without financial hardship. “Universal Health Coverage: Primary healthcare” Information Booklet - WHO https://cdn.who.int/media/docs/default-source/assistive-technology-2/phc-information-package-in-mongolian-language-2019.pdf?sfvrsn=71959a6a_1&download=true

[2] The broad scope of digital health includes categories such as mobile health (mHealth), health information technology (IT), wearable devices, telehealth and telemedicine, and personalized medicine. - FDA https://www.fda.gov/medical-devices/digital-health-center-excellence/what-digital-health

in knowledge, personnel, policies, and equipment to maximise the impact of digital health.

The specific objectives of the DHLA are to:

- **Provide a Digital Health Profile:** Support the Government of Mongolia with detailed information to aid in digital health planning.
- **Evaluate the Current Application Environment:** Identify existing systems, their challenges, and areas for improvement.
- **Identify Priorities:** Establish key priorities for the forthcoming national digital health strategy.

Chapter 2: Background

This chapter provides an overview of Mongolia, its health system, and the collective efforts towards digital transformation specifically relevant to digital health. The information presented here has been gathered through desk reviews and consultations with relevant stakeholders. In the context of the digital health landscape assessment, this section offers readers the foundational context necessary to understand the assessment outcomes and to potentially explain some of the findings.

Country Context

Mongolia, a vast landlocked nation covering 1.564 million km², is renowned for being the world's least densely populated country, with a population of 3,546,263. About half of this population resides in the bustling capital city, Ulaanbaatar, while approximately 30-40% are herders living in rural and remote areas. (2) The rapid pace of urbanisation has led to significant economic and health disparities, not only between rural and urban regions but also within urban settings, such as the traditional ger districts and modern apartment areas.

The effects of climate change and global warming are becoming increasingly evident in Mongolia, impacting vital natural resources such as water, rangelands, land use, snow cover, and permafrost. These environmental changes also affect key economic activities like arable farming and livestock rearing, subsequently impacting human health and living standards.(3)

According to the International Telecommunications Union (ITU), Mongolia boasts higher overall internet connectivity than the global and regional averages. Urban residents benefit from internet access through fixed connections and mobile usage. However, significant discrepancies in digital accessibility persist among nomadic herders and those living in ger districts, primarily due to the lack of basic infrastructure. (4) The proliferation of infrastructure remains a challenge, particularly for households in ger districts that lack direct fibre connections and for rural inhabitants who face poor coverage and signal strength. Additionally, making the internet affordable for all Mongolians is a pressing issue. On average, people spend slightly over 2% of their monthly income on internet access, but with approximately 30% of the population living below the poverty line, internet access remains prohibitively expensive for many. (4)

Over the past two decades, Mongolia has achieved notable improvements in health outcomes. Average life expectancy has increased, and there have been reductions in infant, child, and maternal mortality rates. Despite these advances, significant challenges remain. Ulaanbaatar experiences some of the worst air pollution globally, and many healthcare facilities lack access to centralised water supplies, relying instead on open-pit latrines. (5) Mongolia also faces a dual burden of communicable and non-communicable diseases, with the highest global rates of liver cancer, over 95% of which are linked to hepatitis B and C.(6)

The Mongolia Health System

Understanding the national and sub-national context of Mongolia's health system is crucial for selecting suitable digital health technologies to address the challenges in delivering quality health services to all Mongolians. This background leverages the WHO health system building block framework to outline the current state of Mongolia's health system, highlighting key areas for potential digital health interventions.

Leadership and Governance

Since 1990, Mongolia has implemented several reforms aimed at moving from a hospital-based system to a more efficient, client-centered model. Several policy documents and strategic plans have been implemented in the health sector at the national and sectoral levels to implement reforms. These include but are not limited to: 1999 State Policy on the Development of Mongolian Traditional Medicine, 2001 State Policy on Public Health, 2006-2015 Health Sector Master Plan, and 2017 State Health Policy. According to the order A/609 of the Minister of Health from December 15, 2022, the "2022-2025 Strategic Plan of the Health Sector" is being implemented. (7) These plans outline the strategic directions for the health sector, including major health priorities and programs. Despite the long-term vision intended by these plans, rapid and frequent political changes often disrupt the continuity of policy implementation and planning, resulting in a predominance of short-term strategies.

The health system has transitioned from the Soviet Union's Semashko model to a more decentralised structure, with increasing involvement of private sector providers. (8) The two-tier health system comprises primary care facilities, including family, village and soum health centres, and referral care facilities, such as regional centres and referral hospitals.(9) However, there are significant disparities in the distribution of health facilities and human resources, with urban centres like Ulaanbaatar having a higher concentration of specialists and facilities compared to rural areas. (10)

Health Financing

The health sector in Mongolia is funded through four primary sources: the state budget, the health insurance fund, out-of-pocket payments, and international aid and loans. (11) While referral health services are theoretically free when accessed through referrals from primary care providers, many citizens bypass primary care, leading to high out-of-pocket expenses.(8) Social health insurance, introduced in 1993, aimed to supplement the declining state budget. Nonetheless, out-of-pocket payments increased from 14.5% of total health expenditure in 1995 to 33.5% in 2021.(12)

Strategic health purchasing is critical for efficiently directing funds to priority services and populations. The Health Insurance General Office (HIGO), a Government Implementing Agency, uses a case-based payment system with diagnosis-related groups (DRGs) for inpatient services, and health facilities can charge user fees for certain services. However, providers face a global cap on revenue, limiting their financial flexibility.

Health Workforce

As of the statistics of 2022, Mongolia faces a shortage of healthcare workers in rural and remote areas of the country (, with a healthcare worker-to-population ratio of 189.6 per 10,000. (13) The Mongolian National University of Medical Sciences (MNUMS) is the primary institution for training health professionals, producing over 90% of the country's healthcare workers.(14) Despite this, there are insufficient numbers of qualified providers, particularly in rural areas. (13) Health workers must pass licensing exams every five years to practise, ensuring ongoing professional development.

Health Service Delivery

The delivery of health services in Mongolia is challenged by the country's low population density and vast territory. The health system is shifting from a curative to a preventative focus, with significant investments in primary health care. However, service readiness and coverage remain low, with major deficiencies in diagnostic capacity, essential medicine supply, and basic equipment availability in the rural areas. (10)

Healthcare services are provided at two levels: primary care through family health centres, soum health centres, village health centres and intersoum hospitals; referral care through district and Aimag general hospitals, rural general hospitals, private clinics; multispecialty central hospitals and specialised centres in Ulaanbaatar.

Access to Essential Medicines and Technology

The Medicine and Medical Devices Regulatory Authority, a Government Implementing Agency, oversees pharmaceutical policy and regulation. Mongolia has an Essential Drugs List to ensure the availability of necessary medicines. However, issues such as the uncontrolled sale of prescription-only drugs and the entry of counterfeit drugs into the market persist.(15) Medical equipment procurement is regulated, but maintenance and repair remain problematic, impacting the overall quality of healthcare.

Health Information Systems

The Centre for Health Development coordinates the routine statistical health reporting across the health sector. All other management and coordination of health information systems is regulated through a joint working group between the MoH and MDDC, chaired by a representative of the MoH. It was recently decided to appoint the Centre for Health Development as the secretary for this joint group. As part of the health sector digital transformation, the Centre for Health Development will also oversee technical coordination of health information systems.

Mongolia in the Digital Age

Mongolia's journey towards digital transformation is deeply rooted in its administrative structure and the strategic initiatives undertaken by the government. The country operates under a unitary state principle, where the central government and three tiers of subnational governance – Aimags (provinces), soums (rural districts), and bags (rural sub-districts), along with their urban counterparts (capital, districts, and khoroos) – share power and responsibilities for public service provision.

E-Government and Digital Initiatives

Mongolia's e-government initiative has significantly improved access to various government services. This initiative has evolved into the E-Mongolia platform, which aims to streamline public service delivery. Structural changes include the establishment of the Standing Committee on Innovation and Digital Policy in 2020 and the Ministry of Digital Development and Communications in 2022. These bodies oversee the digitalization of public services and the development of key e-government subsystems. According to the MDDC, the eMongolia platform which offers 1251 public services of 86 organizations, has collectively saved citizens and the government over 268 billion Mongolian Tugriks by reducing transportation costs, time spent in government services and paperwork costs.

As of January 2024, out of about 430 laws in force in Mongolia, 120 were considered to have created conditions that would slow down the digital transformation, and a draft for amendments was submitted. Of these, 109 laws were finally approved by the Parliament session to be amended. As a result, opportunities have been opened to use the advancement of digital technology, reduce human intervention, and save bureaucracy and budget in all government services such as communication, customs, taxation, state registration across various sectors such as healthcare, education, economy, banking. In 2021, the Parliament approved crucial laws for digital transformation, including the Law on Public Information and Transparency, the Law on Electronic Signatures, the Law on Cyber Security, and the Law on Personal Data Protection. These laws aim to strengthen digital infrastructure, e-governance, cybersecurity, and digital literacy.

Achievements and Future Prospects

One of Mongolia's major achievements in the digital era is the introduction of electronic ID cards and comprehensive e-government services supported by a developing digital public infrastructure. The country has shown significant improvement in the ICT development index, with the International Telecommunication Union (ITU) ranking Mongolia 88th out of 154 countries in 2009. The UN E-Government Survey of 2010 noted Mongolia's dramatic rise to 53rd place globally, attributed to enhancements in its national portal and ministry websites.

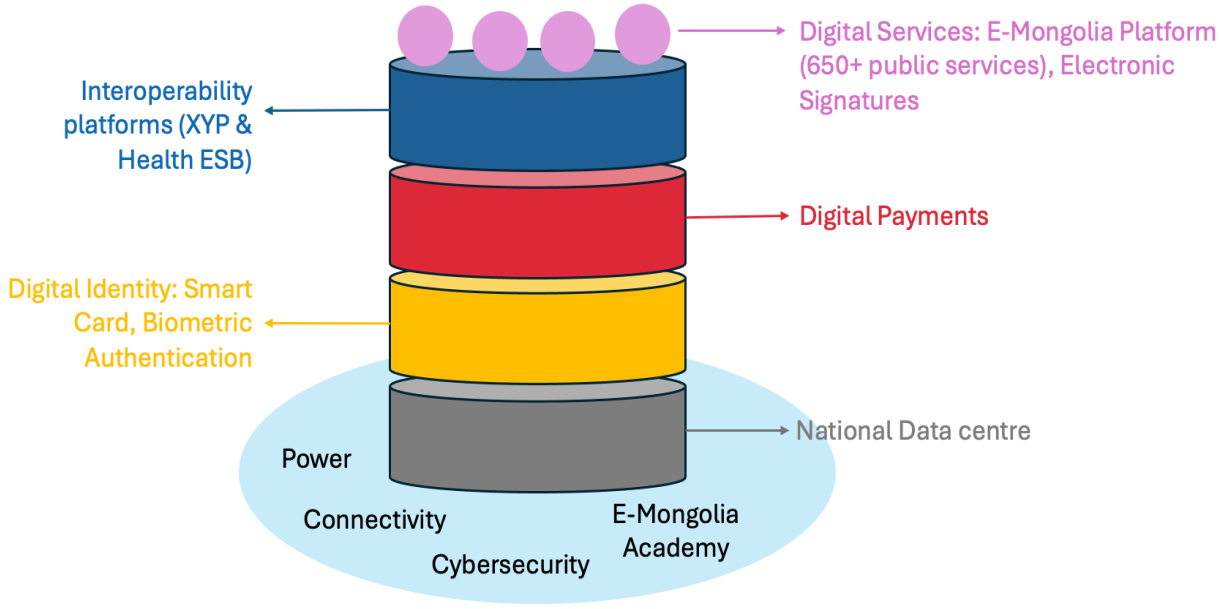


Figure 1. Digital Public Infrastructure in Mongolia.

Mongolia's Vision 2050 long-term development policy outlines the government's ambition to transform the country into a "Digital Nation."

Infrastructure Challenges

Despite progress in digital transformation, Mongolia faces significant deficiencies in its digital infrastructure. While the national road network has expanded, maintenance issues persist. Energy infrastructure also poses a challenge, with over 10% of the population lacking access to electricity and less than 25% having access to direct heating. In Ulaanbaatar, approximately 50% of the population has access to centralised water and sanitation services, but significant gaps remain, especially in ger districts and private houses. (16) The E-Mongolia Programme aims to address these challenges by expanding fibre optic connectivity and improving internet access across the country.

Health Sector Digital Transformation

The Mongolian government has actively integrated digital solutions into the health sector since 1990, beginning with the introduction of the first computer into the health system. This early step laid the groundwork for subsequent developments, including the launch of the first health information system, H-Info version 1, in 1997. By 2003, Mongolia’s commitment to advancing digital health was further demonstrated with the introduction of the country’s first professional program in health information technology.(17)

Key milestones in Mongolia’s digital health journey include the 2005 implementation of the first paperless hospital project at the Third Central Hospital, the establishment of the first regulatory procedure for health technology use in 2008, and the creation of a national telemedicine network in 2012. This network facilitates remote consultations across all 21 provinces in collaboration with countries like South Korea. The integration of eHealth with the HUR system in 2020, which enabled citizen access to health services through the eMongolia platform, was particularly significant. (17) The eMongolia platform played a crucial role during the COVID-19

pandemic: allowing citizens to view test results and obtain vaccine certificates, contact tracing, health promotion and more, underscoring the importance of digital health in crisis response.(18) Ongoing efforts in developing data dictionaries, health standards, and health information exchange frameworks continue to enhance Mongolia's digital health landscape.(17)

Telemedicine in Mongolia has been globally recognized as a successful use case of digital health initiatives. The first telemedicine project, launched in 2003, targeted cardiovascular disease management and was later expanded in 2007 to include maternal and newborn health, with support from the Government of Luxembourg and UNFPA. These early initiatives helped establish a tele-consultation network that significantly improved maternal and newborn care in rural areas. Over time, telemedicine in Mongolia has evolved to include tele-mentoring, continuous medical education, tele-conferences, and specialized services like tele-cervicography and pediatric surgery.(19)

Mongolia has also embraced mobile health (mHealth) to reach its most remote and vulnerable populations. The Health Sector Strategic Plan (2022-2025) explicitly calls for the expansion of mobile services and technologies at the primary healthcare level. This policy aims to better serve target groups, including those in remote areas and disadvantaged communities such as herders, migrants, and low-income groups. The mHealth initiative, which has been implemented across all 21 provinces and 9 districts of Ulaanbaatar City, involves primary healthcare providers delivering integrated services through home visits, mobile health services combined with home visits, and health center services. These services encompass health examinations, screenings, and health promotion activities related to maternal and child health, communicable diseases, and non-communicable diseases.(20,21)

Chapter 3: Design and Implementation

The assessment consisted of 4 phases that was conducted from January to May 2024. Key stakeholders that were involved in the design and implementation of the assessment included members of the landscape assessment (LA) working group convened by the MoH, MDDC, and the Centre for Health Development.

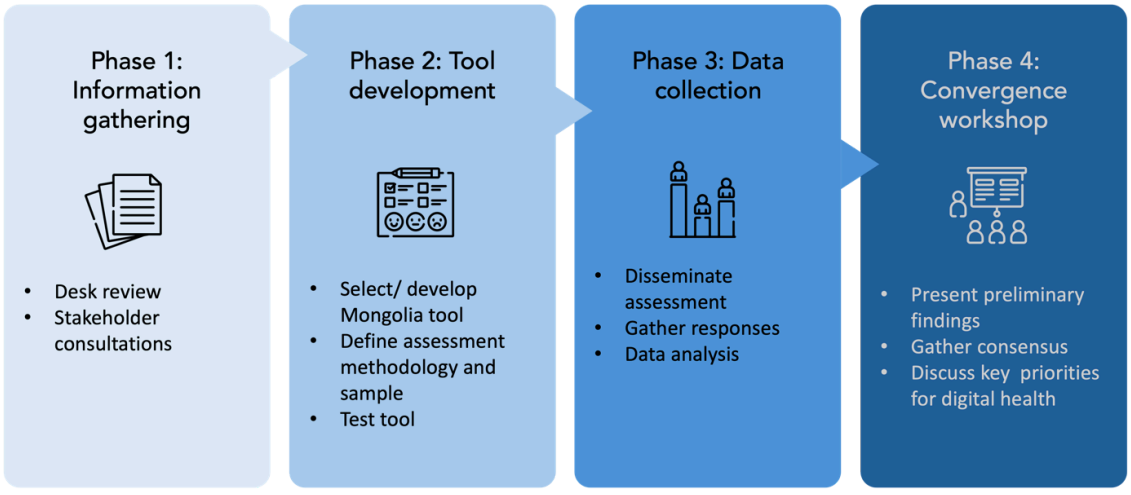


Figure 2. Phases of the Mongolia digital health landscape assessment

Information gathering

The initial step in preparing the Digital Health Landscape Assessment (DHLA) involved gathering information through desk reviews and stakeholder consultations. The desk review entailed examining key national documents, relevant reports, and publications obtained from the internet or provided by the Government of Mongolia. This review established the necessary context for the assessment, taking into account both the health and ICT landscapes, as well as Mongolia's unique context. The findings from this review are summarised in Chapter 2. Stakeholder consultations with various staff from the Ministry of Health (MoH) and the Ministry of Digital Development and Communications (MDDC) supplemented the desk review. These consultations aimed to clarify any findings from the desk review and gather additional relevant information.

Tool development

The development of the DHLA tool was a collaborative effort, incorporating inputs from both the Department of Policy and Planning at the MoH and the LA working group under the MDDC. This collaboration ensured the assessment addressed goals across both digital health and e-government. To accommodate the broad objectives and ambitious timeline of the assessment, the assessment integrates relevant elements from existing digital maturity tools rather than developing a new tool. This approach also ensured alignment with evidence-based indicators and global comparability. The tool was initially developed in English and later translated into Mongolian by the team members.

The following tools were referenced:

- The Global Digital Health Monitor (GDHM) (22)
- The Digital Health Profile and Maturity Assessment Toolkit (DHPMAT) (23)
- The Dynamic Digital Health Maturity Model Handbook
- The Early-Stage Digital Health Investment Toolkit (EDIT) (24)
- The Data Interoperability Maturity Model (from the National Archives of Australia) (25)
- The Interoperability Maturity Model (from GRID Modernisation Laboratory Consortium) (26)
- The Health Information System Stages of Continuous Improvement Toolkit (HIS-SOCI) (27)
- The Information Systems for Health Toolkit (IS4H) (28)
- The SCORE for Health Data Technical Package (29)
- Assessing the Enabling Environment for Establishing a Contextualized National Digital Health Strategy Handbook (30)
- Digital Health Platform: Building a Digital Information Infrastructure for Health (31)
- Classification of Digital Interventions, Services, and Applications in Health (32)

The final tool and indicators were reviewed and approved by stakeholders from the Department of Policy and Planning and members of the LA working group. A secondary review was conducted after the tool was translated into Mongolian to ensure there were no mistranslations or changes in context. Additionally, the tool was tested by three members of the LA working group before being disseminated to participants.

The questions in the final tool were organised into relevant themes under nine domains.

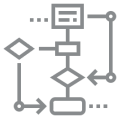
Governance & Coordination. Examines the structures, processes and instruments in place to guide stakeholders involved in digital health. Without governance and coordination stakeholder activities may become fragmented, exacerbating inequalities and minimising the benefits of digital technologies.

Strategy & Investment. Considers the alignment of digital health initiatives with the needs of the health system and plans for financial sustainability. Without a comprehensive strategy and an investment roadmap, digital health efforts may progress in silos and fail to be sustainable without ongoing project funding.

ICT Infrastructure. Investigates the basic resources to support digital tools, such as connectivity, electrification, hardware, software, technical support and processes to maintain these resources. Without adequate ICT infratructure, some participants in the health system may not be able to participate in digital transformation, or may be limited to only a few options for digital transformation.

Human Capacity. Explores the leadership capacity for digital health, current workforce skills to adopt technologies and capacity building plans to equip the workforce. Without sufficient human capacity, digital transformation may be slow or even resisted.

Data Ecosystem. Assesses the reliability and availability of data sources for health planning, as well as how data is collected, analysed and used to support health system functions. Inadequate data ecosystems may become more inefficient and less usable when digitised.



Business Processes. Explores the availability of workflows for standardising day-to-day operations for consistency, quality and compliance with rules. Workflows are helpful in identifying bottlenecks and support the design of applications that are suitable for the environment. Some digital applications will result in workflows changing to improve the quality, efficiency or cost.

Interoperability. Understands the data exchange across the health system. It includes a range of technologies, processes and human capabilities to establish an interoperable architecture. Lack of interoperability results in duplication and ineffective planning and use of data.

Knowledge Management and Innovation. Investigates how digital technologies are evaluated and selected, and how knowledge is shared to reduce implementation times and errors in future digital health implementations.

Applications and Interventions. Explores the types and functions of existing applications, including their benefits and challenges.

The assessment gathers information across three dimensions—strategic, management, and operational—each related to different levels of the health system, types of stakeholders, and their roles in digital health transformation. Segmenting the assessment into these dimensions allowed for a comprehensive understanding of the challenges across different levels of the health system, identify digital health interventions needed and recommend targeted priorities for successful digital health

transformation. These dimensions encompass various domains, but not all domains are included within each dimension. The strategic dimension included 8 domains and a total of 132 assessment questions. The management dimension included 7 domains and a total of 92 assessment questions. The operational dimension included 5 domains and a total of 103 assessment questions.

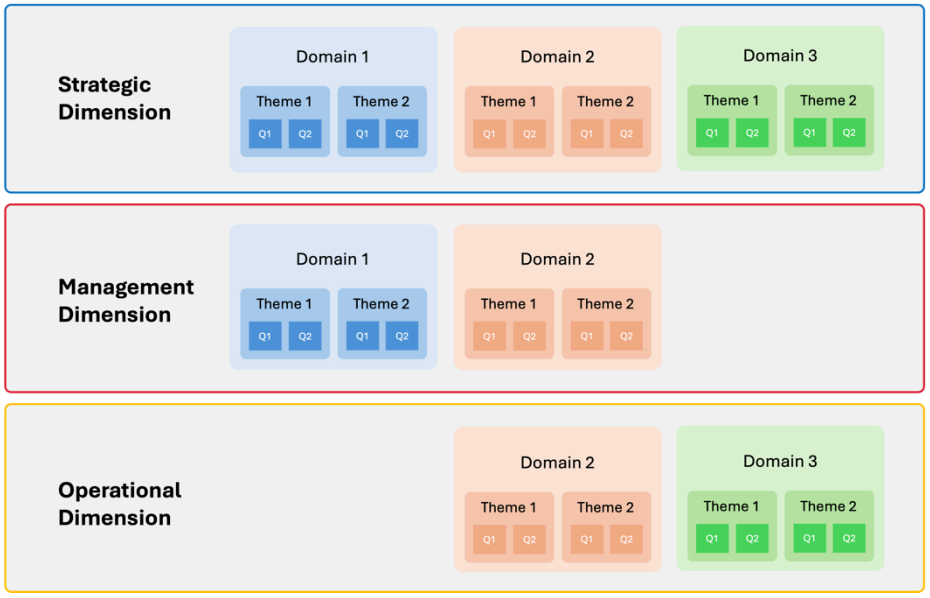


Figure 3. Structure of the DHLA tool.

- Strategic Dimension: This dimension evaluates the country's ability to provide oversight and direction, as well as establish the necessary infrastructure for digital health. The assessment targets entities and agencies at the national level, such as ministries, ministry departments, government implementing agencies, and tertiary educational institutions.
- Management Dimension: This dimension focuses on sub-national management and coordination of digital health activities within regions or provinces of the country. Departments of Health from the capital and the 21 Aimags (provinces) were targeted for this part of the assessment.
- Operational Dimension: This dimension is directed towards a range of health facilities, assessing their operational capabilities and involvement in digital health initiatives.

The tool included both qualitative and quantitative questions. While qualitative questions provided additional context and information in the assessment results, they were not included in the scoring process. The scored questions were designed as multiple-choice with 3 or 5 answer options. The scoring process involved averaging the responses for each theme, and subsequently averaging the theme scores to derive a domain score. Finally, the scores for all domains were averaged to derive an overall score for the dimension. Scores were calculated to one decimal point to emphasise nuances between stakeholder responses, a practice especially needed in the management and operational dimensions where the assessment results were stratified further. The following scale was established to interpret the scores of the assessment.

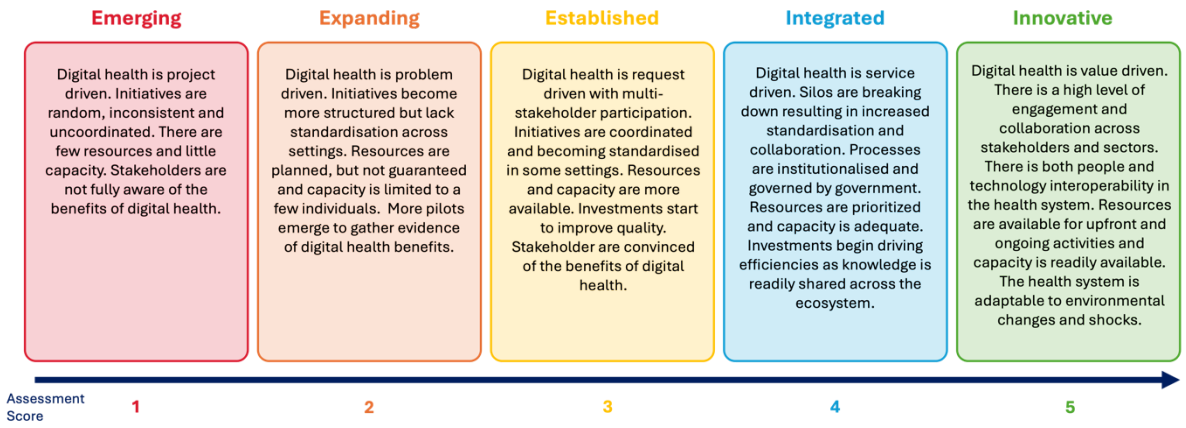


Figure 4. Interpretation of assessment scores.

Participant and Sample Selection

Strategic Dimension

Participants for the strategic dimension were selected and nominated by the Ministry of Health (MoH) and the LA working group. The selection process involved reviewing the questions within the dimension to determine which government department, unit, or affiliated agency possessed the best knowledge to respond accurately.

Management Dimension

For the management dimension, no sampling approach was applied. Instead, the MoH and LA working group disseminated the survey to all Aimags and the Capital. This strategic decision aimed to understand the capacity and readiness across all provinces in Mongolia, thereby supporting optimal planning based on the assessment outcomes.

Operational Dimension

For the operational dimension, a random stratified sampling methodology was employed. The Centre for Health Development provided a comprehensive list of all health facilities across Mongolia, encompassing 4095 public and private health facilities, detailing the type and location within each province and district. The following formula was used to determine the total representative sample size for the assessment:

$$n = \frac{Z^2 \times \rho(1-\rho)}{E^2}$$ where,

n = assessment sample size
Z = Z-score corresponding to a 95% confidence level (approximately 1.96)
p = estimated proportion or probability of success in the population (0.5 for maximum variability)
E = 5% margin of error (desired level of precision, expressed as a proportion)

This calculation yielded an assessment sample size of 385. Subsequently, a stratified sample formula was applied to estimate the number of each facility type to be included in the total assessment sample:

$n_h = \frac{N_H}{N} \times k.n$ where,

n_h = stratum sample size
N_H = facility type population size
N = total number of facilities (4095)
n = assessment sample size (385)
k = variable facility type coefficient applied by the assessment team to represent the proportionality of that facility type as well as its utilisation by the population.

The coefficient reduced the total sample size to 364 facilities stratified across 10 facility categories. The stratified sample estimates were selected from the Capital and each of the 21 Aimags across Mongolia, ensuring relative representation from various districts (soums and khoroos). To maintain the randomness of the sample, a non-Mongolian team member oversaw the selection process. The final list of sample facilities was vetted by the MoH to ensure the selected sites were actively operating at the time of the assessment.

Implementation Approach

To gather responses for the assessment, an online facilitator-led approach was employed. For each dimension of the assessment, at least two half-day Zoom sessions were organised to accommodate participant schedules. Prior to this, participants received an invitation from the LA working group and the Ministry of Health (MoH), along with a copy of the assessment. This allowed them to review the questions in advance and prepare any queries they might have. Invitations further instructed participants to recruit a multi-disciplinary team consisting of clinical, administrative/ managerial and technical staff members to ensure the accuracy of responses.

Google Forms was chosen as the platform for disseminating the assessment questions due to its familiarity and ease of use given the limited time availability. Three separate forms were developed, corresponding to each dimension of the assessment. The Zoom sessions were conducted in Mongolian to ensure that participants fully understood the questions and felt comfortable engaging with the facilitator. This language choice facilitated better comprehension and allowed participants to seek clarification on any aspect of the assessment. During the Zoom, the facilitator discussed all questions and answer options in the assessment for all three dimensions, allowing participants to clarify their concerns or uncertainty regarding any part of the assessment.

Both facilitators conducting the Zoom sessions were directly involved in the development of the tool and possessed sufficient knowledge to address any questions from participants. Participants were encouraged to complete the assessment either synchronously during the session or immediately afterward to ensure timely and accurate responses.

Data Collection and Analysis

Data collection was conducted over a six-week period to accommodate participants' schedules and ensure ample time for completing the assessment. Throughout this

period, the LA working group and the Ministry of Health (MoH) sent regular email reminders to participants to encourage timely submissions.

At the conclusion of the data collection phase, the responses from Google Forms were exported into Excel. OpenAI tools were utilised to bulk translate the free text responses from Mongolian to English for subsequent analysis. The translated responses were then reviewed and corrected when necessary to ensure accuracy and fidelity. Three or five option responses did not need translation these were numerically coded in both the English and Mongolian versions to facilitate data extraction and analysis of the responses. Responses were then processed and cleaned before analysis. Duplicate responses were identified and removed, retaining only the most recent time-stamped entry. Additionally, questions that yielded unclear or poor responses were excluded from the analysis.

For quantitative questions, descriptive analyses were performed. Qualitative responses underwent thematic analysis, which involved coding the individual responses and organising them into relevant themes. This dual approach ensured a comprehensive understanding of the data, facilitating detailed and nuanced insights.

Within the operational dimension an Ordinary Least Squares (OLS) Multiple Linear Regression was conducted to provide insights into how the number and type of healthcare facilities affected Aimags performance scores. OLS was selected because this method minimises the sum of the squared differences between the observed dependent variable and those predicted by the linear function of the independent variables. In the analysis, the overall provincial total score for each province was the dependent variable, with the count of different types of healthcare facilities in each province as the independent variable. The model was fitted with a constant term to the independent variables to account for the intercept and used the “statsmodels” library in Python to fit the OLS regression model to the data. The output includes the coefficients (β) for each independent variable, their standard errors, t-values, p-values (0.05), and confidence intervals. The R-squared and Adjusted R-squared values indicate the proportion of variance in the dependent variable explained by the model. The F-statistic and its p-value test the overall significance of the model.

Convergence Workshop

Following the data collection period, a convergence workshop was co-hosted by the Government of Mongolia, UNICEF, and the Asia eHealth Information Network (AeHIN). This workshop brought together various stakeholders across the health system, including representatives from health facilities, technology stakeholders, Ministry of Health (MoH) departments, other ministries and donor and implementing partners.

The primary objective of the workshop was to discuss the progress of digital health activities to date, share lessons learned, and identify priorities for the short, medium, and long term based on the landscape assessment's findings. A key outcome of the workshop was to agree on strategic priorities for the forthcoming national digital health strategy for Mongolia. Further activities and outcomes of the workshop are detailed in a separate report to be published by AeHIN.

Assessment Outcomes: Strategic Dimension

The strategic dimension evaluates the overall direction of the health sector, ensuring alignment with national priorities and international commitments. It encompasses decisions made by government leadership to secure sufficient funding and to establish essential policies and regulations that guide stakeholders in providing quality and safe health services. Key stakeholders in this dimension include the Ministry of Health, Ministry of Finance, other government ministries, implementing agencies, and professional councils, all of whom are motivated to ensure a productive and prosperous population.

Eight domains are assessed within this dimension, and the scores are compared to global achievements to provide a comprehensive understanding of Mongolia's digital health positioning.

Participants

The assessment gathered responses from 14 participating entities:

- Ministry of Health
- Ministry of Digital Development and Communications
- Ministry of Education and Science
- Information Security Department of General Intelligence Agency of Mongolia
- National Statistics Office
- Regulatory Agency of Government Digital Service
- Health Insurance General Office
- Medicine and Medical Devices Regulatory Authority
- National Center for Public Health
- E-Mongolia Academy
- National Data Center
- Information Technology Centre for Custom, Taxation and Finance
- Center for Health Development
- Mongolian National University of Medical Sciences

Pre-assessment

Four pre-assessment questions were administered to all participants to evaluate their comprehension of the Mongolian health system and assess the coherence of their perspectives. A shared understanding across stakeholders will ensure coordinated efforts in addressing current and future health system needs effectively. These questions explored participants' views on the essential components for achieving Universal Health Coverage (UHC), knowledge of the primary objectives outlined in the health sector plan, recognition of key challenges facing the health system, and acknowledgment of climate-related factors impacting healthcare delivery.

Essential components for achieving universal health coverage in Mongolia

Participant responses demonstrated a consensus around the importance of enhancing the quality of primary healthcare services, prioritising health promotion, prevention and health education within the healthcare framework, and emphasising efficient financial planning that benefits both the health system and citizens. Additionally, the MoH and MDDC emphasised the need for a citizen-friendly

digitalization of the health system. These collective insights reflect a deep understanding of UHC and the necessary strategies to realise it effectively.

Primary objectives of the health sector plan
Responses highlighted a priority to foster cooperative stakeholder efforts to cultivate healthy habits and an active lifestyle among citizens through a robust, accessible, and effective healthcare system. Furthermore, the MoH emphasised leveraging digital technologies to broaden the scope of health services, while the health insurance general office emphasised the importance of establishing unified health funding mechanisms. These responses demonstrate a firm grasp of national plans and objectives among stakeholders at the national level.

List 5 key challenges of the health system.
The analysis revealed four overarching themes: human resource challenges, management and coordination challenges, health services challenges, and digital transformation challenges. Within these themes, notable concerns included skills and knowledge gaps among health workers and IT staff, shortages of health workers, financial constraints, governance issues, service coverage gaps, access to quality medication, and deficiencies in data and information systems. The identification of these challenges highlights potential areas for digital innovation and challenges for its implementation.

Effect of climate change on the health system
Participants noted adverse effects such as harsh cold weather leading to poor air quality from household fires and increasing temperatures exacerbating issues like flooding and water source contamination due to global warming. Recognizing the impact of climate change on population health is relevant to planning resilient healthcare services. Furthermore, digital health has a role in proactively detecting health-related challenges stemming from unpredictable climate change.

Strategic Dimension Score

The overall score for the strategic dimension was 2.7, indicating that digital health is well established at the country level. This score reflects a request-driven approach to digital health, where stakeholders actively pursue digital health to improve the and enhance the health system. There is robust multi-stakeholder participation involving government ministries, departments, and agencies. Coordination of initiatives is facilitated through working groups dedicated to standardising the health system. Resources and capacity are increasingly available to support the effective implementation of digital health initiatives. The progressive investments in digital health applications and interventions over the last decade are leading to quality improvements in data management, service delivery, and health worker skills, demonstrating significant progress and commitment to digital health advancements.

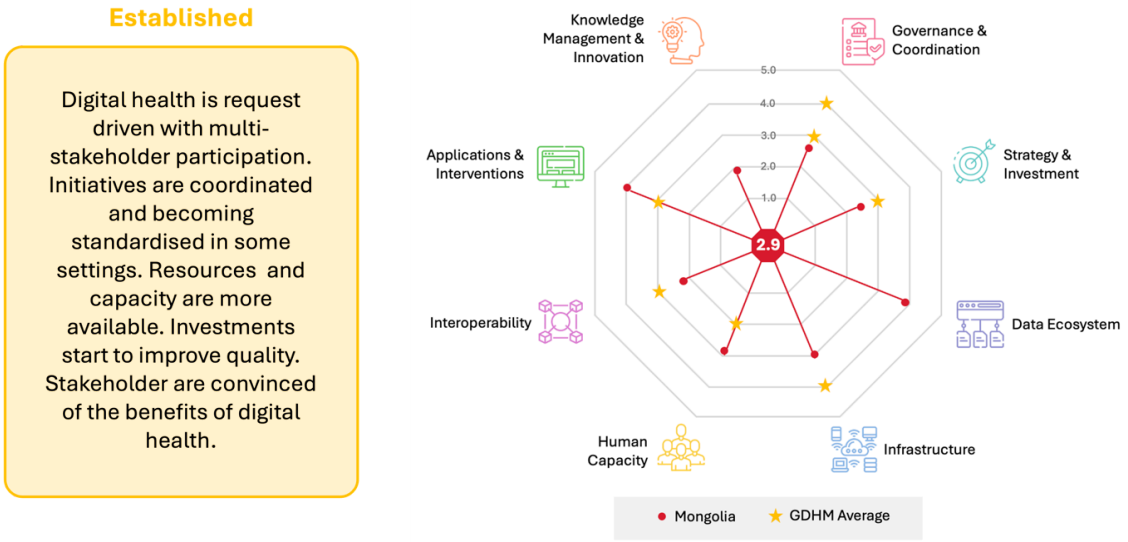


Figure 5. Overall score for the Strategic Dimension.

While a direct global comparison was not entirely possible due to the customization of the assessment tool and the lack of complete globally available information, Mongolia's strategic dimension score aligns well with the overall digital health maturity score of 3 on the Global Digital Health Monitor (GDHM). However, there are notable differences at the domain level. Mongolia surpasses global performance in two key domains. The high number of nationally scaled applications and interventions in Mongolia has likely contributed to this higher performance. Additionally, the government's proactive role in developing the digital public infrastructure for digital health has likely bolstered the country's human capacity score. Although at sub-national levels, as demonstrated by scores in the management and operational dimensions, human capacity decreases significantly, aligning more closely with the GDHM global average.

In other domains, such as strategy and investment, as well as policy and regulation (assessed under the governance and coordination domain), Mongolia lags only slightly behind. The government's current prioritisation and momentum in digitising public services are expected to enable the country to catch up to the global average within the next few years. However, other domains such as interoperability, infrastructure, and governance require greater efforts to meet global standards. Mongolia's proactive steps in digital health are commendable, yet continued focus on these areas will ensure a more robust and sustainable digital health ecosystem, ultimately improving health outcomes for all citizens.

Detailed outcomes and insights across the nine domains are discussed below.

Governance & Coordination

Effective governance and coordination are crucial in digital health to ensure the successful implementation and sustainability of digital health initiatives. Robust governance structures provide clear leadership, accountability, and strategic direction, aligning digital health efforts with national health priorities and international standards. Coordination among stakeholders, including government ministries, healthcare providers, technology partners, and donor agencies, ensures that resources are utilised efficiently and that initiatives are harmonised to avoid duplication and fragmentation. Ultimately, it fosters an environment where

innovations can thrive and interoperability between systems is supported, leading to better health outcomes and a more resilient health system.

Three themes were assessed within the governance and coordination domain, producing an overall score of 2.6.

Figure 6. Strategic Dimension: Governance and Coordination Score Summary.

Active and Functional Governance for Digital Health

Digital health governance involves several key components and roles to ensure effective coordination, implementation, and oversight of digital health initiatives. These governance structures are crucial for coordinating efforts, avoiding duplication, and ensuring that digital health initiatives in Mongolia are sustainable and impactful.

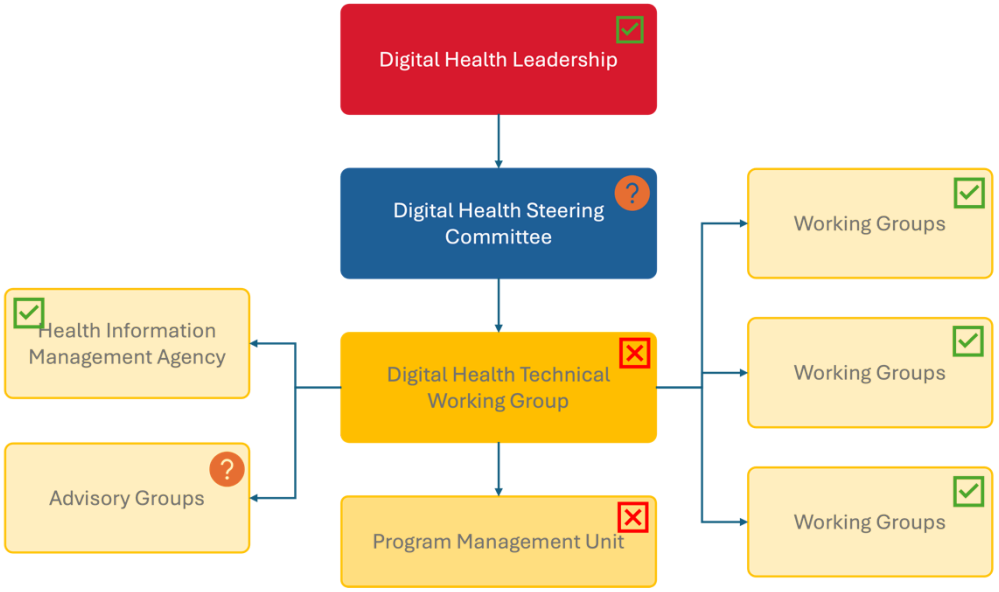


Figure 7. Digital health governance in Mongolia.

Digital health leadership in Mongolia is spearheaded by two key ministries: the Ministry of Digital Development and Communications (MDDC) and the Ministry of Health (MoH). The MDDC is responsible for the digitalization of various public services, including health services, and leads the development of essential public digital infrastructure. On the other hand, the MoH, through its Department of Planning and Policy, provides digital health leadership and is responsible for developing the digital health strategy.

The assessment revealed that digital health governance in Mongolia is primarily managed through multiple working groups or sub-working groups formed on an as-needed basis. This approach, while flexible, results in working groups that lack formal establishment, regular meeting schedules, and well-defined terms of reference. Both the MoH and MDDC coordinate these working groups, leading to potential duplication of efforts and inconsistencies in policy and system development. Moreover, with responsibilities dispersed across various entities, accountability for the success or failure of digital health initiatives can be ambiguous.

The following governance structures have been established to support digital health:

- In 2018, the Standing Committee on Digital Policy under the Parliament of Mongolia, in 2020 the Standing Committee on Innovation and Digital Policy under the Parliament of Mongolia, in 2022 Ministry of Digital Development and Communications were established to implement digital transformation in Mongolia. These committees ensure that digital initiatives are aligned with national priorities and that there is a cohesive approach to implementing digital solutions.
- In December 2023, a joint working group was established by the Prime Minister's decree 206 to further the digital transformation in the healthcare sector. The main focus of this joint working group is to explore opportunities for health information exchange between systems.
- In January 2024, three sub-working groups were established under an order from the Minister of MDDC:
    - A Landscape assessment sub-working group to investigate the status of digital transformation in the health sector
    - A digital services sub-working group to develop information systems of the healthcare sector, connect with the main supporting systems and enable exchange of information.
    - A policy and regulatory sub-working group to develop draft amendments to rules, procedures, and administrative instruments in relation to the digital transformation of the healthcare sector.

Within the health sector, there are no specific groups dedicated to identifying, developing or adapting health data standards, software selection, or emerging digital health technologies such as AI. These topics are discussed broadly within existing working groups or departments within the government.

The Centre for Health Development under the MoH is responsible for maintaining health information systems and has a team focused on health information technology development and implementation.

A notable gap identified in the assessment is the absence of a formal program management unit for digital health. This unit would be crucial for monitoring and tracking digital health initiatives. While the government has defined some eHealth indicators that are monitored, a program management unit would coordinate the implementation of digital health projects across both ministries, manage resources effectively, ensure compliance with national policies, and engage stakeholders at various levels to achieve a cohesive and efficient digital health ecosystem.

A notable gap identified in the assessment is the absence of a formal program management unit for digital health. This unit would be crucial for monitoring and tracking digital health initiatives, coordinating the implementation of digital health projects across both ministries, managing resources effectively, ensuring compliance with national policies, and engage stakeholders at various levels to achieve a cohesive and efficient digital health ecosystem. However, the MDDC noted that the internal audit department and state audit office often conduct performance monitoring and evaluation of public services, possibly including digital health activities.

Stakeholder Coordination

Effective digital health requires collaboration with multiple stakeholders both inside and outside the MoH. Managing this diverse range of stakeholders necessitates a structured process for engagement. It is crucial to carefully document projects and share information about digital health strategies, plans, and ongoing initiatives across the country. This approach ensures that stakeholders, such as donors and implementing partners, can align their initiatives and support with national priorities.

The assessment revealed that the MoH is regularly involved in digital health projects with implementing partners and donors. Established processes for approving projects are in place, indicating a proactive approach to stakeholder engagement. However, the absence of a dedicated programme management unit means that donor and partner projects are not centrally recorded. Instead, these projects are coordinated by the respective departments working with stakeholders on specific initiatives. This decentralised approach can lead to inconsistencies and gaps in project documentation and tracking.

A gap identified in the assessment is the lack of a centralised knowledge platform or repository. Such a platform would serve as a comprehensive resource for information on digital health strategies, plans, and projects across the country. The emerging eMongolia website could possibly fulfil this function. By having this centralised repository, stakeholders—including implementing partners, donors, and vendors—can better align their actions and efforts with each other and the government. This alignment is crucial for ensuring that all digital health initiatives contribute towards the common national goals.

Establishing a knowledge platform would not only facilitate better coordination but also enhance transparency and accountability. It would provide a clearer picture of digital health development, making it easier to attract additional investors and partners. Although information is currently shared through various websites and online platforms, the scattered nature of this information makes it challenging to understand the full scope of digital health activities in Mongolia.

Policy and Regulatory Guidance

As part of Mongolia's strategy to enhance public services through e-governance, as outlined in the long-term development plan, Vision2050, the government of Mongolia has made significant strides in improving the legislative environment for the adoption and use of ICTs across all public sectors. Many of these legislations and regulations are also pertinent to digital health implementation, such as the Law on Cybersecurity and the Law on Personal Data Protection. Additionally, digital health requires its own

set of regulations and policies to govern stakeholders and the use of ICT within the health sector.

When asked about such regulations, policies, and legislation, there was considerable variance in participant responses. Some indicated that these regulations are still under development, while others suggested they are well-established and fully enforced. This suggests that there might be communication gaps between stakeholders or a lack of awareness regarding relevant regulations for digital health.

> **Policy on health data exchange**: Although a health ESB has been established to support data integration across digital health systems, participants were unclear about the existence of a specific policy guiding health data exchange. The Ministry of Health (MoH), National Data Centre, Information Technology Centre for Customs, Taxation and Finance, and the Centre for Health Development noted that such a policy exists but is not fully implemented or enforced, while others commented that it does not exist or is under development.
> **Legislation on cross-border data exchange:** Five participants, including the MoH, eMongolia Academy, National Centre for Public Health, Centre for Health Development, and National Data Centre, commented that legislation on cross-border data exchange exists with variable implementation and compliance. However, others noted that it does not yet exist.
> **Regulations for health data storage:** Only the MoH and the Centre for Health Development reported that a policy on the storage of health data was established. Other participants responded that it might exist but is not fully implemented, or that it is still under development.
> **Policy on specifications and development of digital health systems:** Three participants, including the National Data Centre, National Centre for Public Health, and Medicine and Medical Devices Regulatory Authority, agreed that specifications and guidelines for digital health systems development are under development. Meanwhile, the MoH, Centre for Health Development, and University commented that it exists with variable implementation and enforcement. The General Department of Health Insurance reported that it does not exist.

The variance in responses suggests that different entities may have their own policies and regulations. When different government entities have their own policies for digital health, several implications arise that can impact the efficiency, security, and effectiveness of the health information system: fragmentation, interoperability challenges, security risks, and compliance issues. To address the variability in responses regarding digital health regulations, a literature search was conducted. This confirmed that regulations for cross-border sharing, health data exchange, storage of health data, and guidelines for digital health system development are not available in the accessible literature. However, the search only considered English data sources and may have missed evidence available in Mongolian. Furthermore, ongoing efforts by the government to develop such legislation may not have been captured in the available literature.

The adoption of digital health solutions also has significant implications for existing health policies, regulations, and legislation, necessitating their revision and updating

to ensure the appropriate use of digital health technologies across the health system. During the assessment, participants were asked whether policies, regulations, or legislation related to drug and product procurement and distribution, civil registration and statistics within the health system, health information management, and national health insurance included aspects of digital health. Although the Ministry of Health reported that these areas had been addressed to some extent (though not fully implemented), there was variability in responses from other participants. This suggests that there is a lack of communication about updated regulations and policies or a lack of awareness among participants.

Overall, this component of the assessment highlights the need to improve the dissemination of information and knowledge about relevant digital health policies and regulations among stakeholders, especially those involved in implementation. Enhancing communication and education efforts can ensure that all relevant parties are aware of and adhere to the updated guidelines, fostering a more cohesive and effective digital health environment.

Recommendations for Governance & Coordination

- Establish a clear centralised governance structure and programme management unit for digital health, as there are unique implications for digital transformation in the health sector.
- Clarify the roles and functions of working groups through clear Terms of References (ToRs) that are published and available. These are needed especially where decision-making powers may overlap.
- Establish a digital health repository, such as the Digital Health Atlas to coordinate digital health efforts and strengthen the value and impact of digital health investments. The DHA provides a highly standardised format for stakeholders to access, report, and share information on digital health projects online. Digital health project implementers can research projects on DHA to design a health intervention without duplicating the effort, register a digital health project online in standardised formats, and enhance the coordination and governance of national digital health.
- Health sector regulations and policies must also be reviewed and revised to address the use and effect of digital health adoption.
- Establish clear and transparent compliance mechanisms for stakeholders to meet the requirements of digital health policies and regulations.

Strategy & Investment

The absence of a comprehensive digital health strategy can have several significant implications for a country's health system. It can lead to fragmented systems, where different health services and departments use incompatible technologies, resulting in inefficiencies and duplication of efforts. This fragmentation can also limit access to information, making it difficult for healthcare providers to obtain a complete view of a patient's history, which can negatively impact patient care.

Furthermore, without a digital health strategy, there can be inequity in health services, as regions with more resources may be able to implement advanced technologies, while less resourced areas fall behind. This disparity can widen the gap in health outcomes between different regions. Inadequate data security is

another concern, as the lack of a unified approach to digital health can result in inconsistent and potentially inadequate protection of sensitive health data.

Stagnation in innovation is a risk when there is no clear strategy to guide the integration and advancement of digital technologies in healthcare. This can prevent the health system from benefiting from the latest technological advancements. Inefficient resource utilisation is also a problem, as the absence of a coordinated approach can lead to wasteful spending on redundant or incompatible technologies.

To avoid these pitfalls, it is crucial for countries to develop and implement a comprehensive digital health strategy. This should guide the integration and advancement of digital technologies in healthcare, ensuring that all regions and services are aligned and working towards common goals.

In Mongolia, although a dedicated digital health strategy is not currently in place, various country strategies and plans support digital transformation in the health sector. This domain considered the alignment of these strategies and the efforts to support sustainable funding for digital health initiatives. The overall score was 2.3, indicating that the lack of a digital health strategy significantly impacts the ability to fund and effectively implement digital health initiatives. Addressing this gap by developing a robust digital health strategy could enhance the efficiency, equity, and security of the health system, fostering innovation and better resource utilisation.

Figure 8. Strategic Dimension: Strategy and Investment Score Summary.

Digital Health Strategy and Alignment

Mongolia had first developed a digital health strategy for the period of 2010-2014 and is currently in the process of developing an updated strategy to support effective and sustainable digital health transformation. In the absence of a digital health strategy, other key national documents such as the Vision 2050 policy have provided some direction for digital health development, but they lack implementation plans to guide stakeholders. Digital health systems that have been implemented nationally in the absence of a digital health strategy were also a concern highlighted by the assessment.

Even if digital health is incorporated into other key national plans, having a dedicated digital health strategy remains crucial for several reasons: While digital health elements in broader national plans are beneficial, a dedicated digital health strategy is essential for providing focused vision, comprehensive frameworks and coordinated implementation. It ensures that digital health is prioritised and integrated seamlessly into the overall health system, maximising its potential to improve healthcare delivery and outcomes.

Funding and Investment for Digital Health

Participants confirmed that Mongolia currently does not have a costed plan and investment roadmap for prioritised digital health initiatives. Instead, these initiatives are budgeted on an ad hoc basis as projects and activities arise. Developing a costed plan and investment roadmap in accordance with a digital health strategy would allow the government to allocate financial resources efficiently and effectively, preventing waste and ensuring that investments are directed toward the highest priority areas. A costed plan and investment roadmap offer several benefits:

- Efficient Resource Allocation: Ensures that resources are used where they are most needed, aligning with strategic priorities.
- Attracting Investments: Provides confidence to donors, investors, and development partners that contributions will be used effectively and that there is a clear plan for achieving results.
- Mitigating Risks: Helps identify potential risks and challenges in advance, allowing for the development of mitigation strategies.

Currently, the budget for digital health in Mongolia is less than 1% of the total health budget, allocated variably toward purchasing equipment and software licences. The private sector and non-governmental organisations also contribute significantly to digital health activities, although the exact figures and specific activities funded were not clear from the assessment. This highlights the need for digital health investments to be monitored and reported through a central coordinating unit to better understand the investment environment for digital health.

Regarding long-term funding plans, the Ministry of Health (MoH) commented that the forthcoming digital health strategy will be instrumental in establishing these. Additionally, funding for digital health could be provided through the national health insurance scheme. The MoH indicated that this is being done to some extent, but further amendments to the National Health Insurance law and related policies are necessary before it can be formally established.

A positive finding from the assessment was the collaboration between local private organisations and the Government of Mongolia. Seven technology companies in Mongolia have entered into a public-private partnership to develop and maintain digital health systems. As more of these partnerships are established, the MoH would need to develop a well-structured framework to monitor them and ensure adherence to policies and guidelines for developing digital health systems.

Recommendations for Strategy & Investment

- Develop costed plans and an investment roadmap aligned to the digital health strategy.
- Establish mechanisms to track digital health funding and investments from government and non-government organisations.
- Set up an innovation fund to support investment and development of digital health. Gather funding from private sector CSR initiatives and unspent health budgets.

Data Ecosystem

Reliable data on the health of the country is essential to helping the government of Mongolia prioritise health challenges, develop policies, allocate resources effectively and monitor the progress towards Sustainable Development Goals (SDGs) and Universal Health Coverage (UHC). This domain assesses the availability and coverage of key data sources to achieve this. It also investigates the data management practices in place to ensure the reliability and integrity of the data for use. Furthermore, by assessing the current data ecosystem and health information management practices, the MoH can ensure digital health systems are well integrated, resource-efficient and tailored to meet the specific needs of the health sector. The overall score was 3.9, highlighting several strengths and some areas needing improvement.

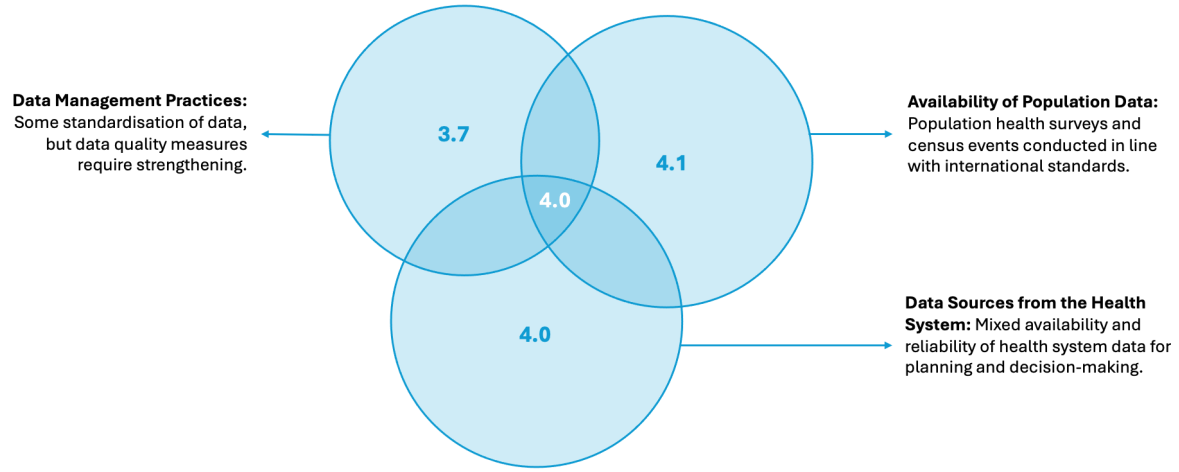


Figure 9. Strategic Dimension: Data Ecosystem Score Summary.

Availability of Population Data

Population data gathered through national surveys and census events are indispensable in identifying geographic distributions, demographic factors, health behaviours of people and other socioeconomic factors that highlight inequities in health status and access to healthcare. Altogether the assessment produced a score of 4.0 for the availability of this data to serve as critical inputs for resource allocation and targeted health program interventions. In the assessment, population health and socio-economic data, collected through the population and housing registration system (linked with the civil registration system), was reported to cover most of the important issues of public health and met the requirements of most international standards. Similarly, census data from the survey conducted in 2020, can be disaggregated in various ways. The rigorous methods used to collect this data demonstrates Mongolia's commitment to generate regular, high-quality, nationally representative statistics with equity dimensions on the population.

Data Sources from the Health System

Within the health system, various data is collected to support the national government in monitoring the health status of citizens, identifying gaps in service delivery, and managing resources. In Mongolia, the government collects data on births and deaths, public health surveillance, health indicators, financial and workforce statistics, and patient satisfaction. For effective planning, decision-making,

and policy development, this data should be equitable, nationally representative of all populations, and of high quality.

The Open Data Inventory (ODIN) is a global index that measures the completeness and international standard compliance of a country's statistical data. It includes three health-related categories: health facilities, health outcomes, and reproductive health data. In 2022, Mongolia ranked 8th in the Open Data Inventory with an overall score of 82, combining a data coverage sub-score of 70 and a data openness sub-score of 92. However, within the health data categories, coverage scores were lower than the overall score. Health facilities data scored 70 with a coverage sub-score of 50, health outcomes data scored 75 with a coverage sub-score of 50, and reproductive health data scored 90 with a coverage sub-score of 80.

Similar observations were made in the assessment. Some data sources demonstrated high coverage and quality, while others highlighted gaps. Births and deaths data, health indicator data, and workforce data were rated as having more than 75% coverage and mostly reliable, with only a few quality discrepancies. These data are typically reported into the health insurance system and H-Info, which are implemented across most facilities, likely contributing to their good coverage and quality.

Surveillance data, health facility information (including services provided), and patient satisfaction data were reported to have good coverage up to 75% with moderate reliability and quality issues. Challenges in collecting surveillance data in Mongolia may be related to geographical dispersion and migration of populations, lack of training and capacity to conduct surveillance activities, and lack of interoperability across systems. Similarly, patient satisfaction data depends on facilities having processes to collect patient perspectives.

Data on medical products and their availability ranked lowest across all participants, with about 50% coverage across the country and significant reliability issues. Although Mongolia has a logistics management system, the organisation of the pharmaceutical sector in Mongolia is highly fragmented across multiple ministries and councils. By strengthening collaboration and establishing interoperability across systems data availability and quality across all categories may be improved.

Data Management Practices

As data is collected from various sources across the health system, the Ministry of Health (MoH) requires sufficient capacity to analyse and interpret this data to produce actionable information for planning and decision-making. The assessment confirmed that this capacity is adequately available at the national level, with various units, departments, and centres responsible for processing, analysing, and producing informative reports. However, other entities, such as the National Data Centre, National Centre for Public Health, and General Department of Health Insurance, which manage specific domain-related data, demonstrated less capacity to manage their data. With digital health supporting increased data collection across the health system, it is essential for these entities to prioritise data management capabilities within their organisations.

In addition to analysing and interpreting the collected data, strategic dimension stakeholders must ensure data is well-managed within the health system. This involves implementing standardised forms and instruments to collect statistical and health data, ensuring mechanisms to collect data across public and private sectors, and establishing guidelines for data quality, storage, and use. The assessment found that Mongolia has made significant efforts to standardise health records and registers in health facilities. The Ministry of Health has been working on implementing standardised electronic health records (EHR) systems across various healthcare facilities. These efforts aim to improve the consistency, accuracy, and accessibility of health data, which is crucial for effective health service delivery and public health management. The standardisation includes the use of uniform data collection forms and electronic systems to ensure that health records are maintained consistently across different regions and types of healthcare facilities. Private sector health facilities are also required to report clinical and health data to the Department of Health or the Ministry of Health, as part of the broader effort to ensure comprehensive health data collection and management across the entire health system. However, the degree of implementation and adherence to these standards may vary across different facilities and regions. Nevertheless, plans to improve data coverage and reliability are ongoing, informed by existing gaps and quality issues.

To ensure data is well-managed at the point of collection, it is crucial to establish and implement guidelines for good data collection practices, data quality management, and use at health facilities. Participants reported that this function is decentralised to sub-national and local health departments. However, processes for monitoring data management practices have not yet been established, apart from providing feedback to health facilities. By enforcing data management practices, establishing in-service training programs, and including them in performance reviews, the government of Mongolia can ensure good quality data from its point of collection, rather than having to clean data after it has been collected.

Recommendations for the Data Ecosystem

- Ensure data collection across the health system supports digital and non-digital pathways.
- Develop health data and metadata dictionaries and registries to standardise health data collection across all facilities in Mongolia, regardless of digital or non-digital data collection systems.
- Implement data quality guidelines to ensure the reliability of data collected across the health system.
- Provide data management in-service training programs for different levels of the health system.

Infrastructure

While Mongolia has made significant improvements in ICT infrastructure and is prioritising the development of digital public infrastructure to support its Vision 2050 policy, the health sector plays a crucial role in ensuring sufficient digital infrastructure for digital health implementation. This domain considers the responsibilities of the health sector to influence national policies to include digital health priorities, ensure secure communication platforms and establish capacity to maintain and support

digital health infrastructure. The overall score for this domain was 3.0 and highlights various strengths and gaps to prioritise in future plans.

Figure 10. Strategic Dimension: Infrastructure Score Summary.

Infrastructure & Equipment for Digital Health

To ensure the equitable digital transformation of the health sector, the Ministry of Health (MoH) must engage in collaborative planning with other sectors and private stakeholders. This collaboration should focus on establishing basic infrastructure across the health system, ensuring stable internet connectivity, and providing electrification for all health facilities. Additionally, it should address the need for sufficient data storage facilities for health data, develop requirement specifications for digital health systems (such as telemedicine, electronic health records, and interoperability), and provide suitable ICT hardware to support digital health systems.

When asked about these plans in an assessment, there was a significant difference between the MoH's response and that of other participants. The MoH reported having a sector plan aligned with the national ICT plan, which includes fully resolved funding requirements for the planned period and a digital health governance structure responsible for monitoring and evaluating the plan's implementation according to established methodologies. Conversely, other participants commented that while there is a national development plan and a health sector master plan, digital health priorities have not been fully captured.

Upon further assessment of these plans, several key objectives and projects relevant to supporting digital health were identified

Table 1: Digital Health Related Objectives and Projects in National Plans.

Long-term development strategy for 2021-2030	Health Sector Master Plan (HSMP) for 2019-2027
Healthcare Enhancement: Upgrading healthcare facilities, expanding access to healthcare services, and implementing advanced health technologies. **Energy Projects:** Developing renewable energy sources, improving energy efficiency, and expanding the energy grid. **E-Government Services:** Expanding the e-Mongolia platform to digitise more government services, improving public service delivery and reducing bureaucracy. **Digital Literacy:** Enhancing digital literacy across all demographics to ensure inclusive access to digital services and opportunities. **Cybersecurity:** Strengthening cybersecurity infrastructure to protect against digital threats.	**Service Delivery Enhancement**: Restructuring and upgrading healthcare facilities, including hospitals and regional diagnostic centres, to provide more comprehensive and integrated services. **Electronic Health Records (EHR)**: Implementation of a nationwide EHR system to streamline patient information management and improve care coordination across different levels of the health system. **Telemedicine and Telehealth Services**: Expanding telemedicine services to reach remote and rural populations, ensuring they have access to specialist consultations and health services without the need for travel. **Health Workforce Development**: Training programs for healthcare professionals at all levels, focusing on modern medical practices, digital health tools, and management skills to improve service delivery and health outcomes. **Institutional Capacity Strengthening**: Enhancing the planning, monitoring, and coordination capabilities of the Ministry of Health to effectively implement and oversee health policies and programs. **Sustainable Health Financing Mechanisms**: Developing and implementing sustainable financing models to ensure adequate funding for health services, including increasing the budget allocation for primary healthcare and introducing new funding mechanisms like per capita payments and case-based payments.

Specific digital health topics for further elaboration include:

Interoperability and Integration of Digital Health Systems: Ensuring seamless data exchange between various health information systems.
Advanced Analytics: Leveraging machine learning and artificial intelligence for health data analysis and decision-making.
Digital Health Capacity Building: Training for technical and non-technical workers to effectively use and manage digital health systems.
Digital Health Infrastructure: Establishing standards for digital health infrastructure in health facilities.
Incident Response Teams and Protocols: Developing teams and protocols to address cybersecurity threats and breaches.
Data Storage Facilities: Ensuring adequate and secure data storage for health information.

Addressing these gaps would establish the foundations for digital health across the health system, thereby reducing digital inequities and enhancing the digital transformation of the health sector.

The increasing expansion of digital health in Mongolia creates a need for adequate health data storage facilities. Mongolia is well prepared for this since establishing the National Data Centre (NDC) in 2009. This centre hosts several health sector systems and software, supporting digital health infrastructure. As more private sector stakeholders assist the MoH in developing key digital health systems, ensuring seamless collaboration with the NDC will be essential to ensure that health data is owned and managed by the government.

Adequate hardware is required at all levels of the health system to utilise digital health and ICT software and systems. Among the stakeholders assessed, about half reported having sufficient hardware that meets the required standards for the technologies currently being used. However, others, including the NDC, indicated that current hardware is insufficient or outdated.

Communication Platforms

In Mongolia, the use of official email addresses among national level government employees and stakeholders is only moderate, with a significant number of employees still relying on personal accounts for official communication. This practice not only poses substantial security risks but also underscores the urgent need for stricter policies and comprehensive training on the use of official communication channels. The sporadic use of secure document-sharing programs, despite the availability of a national Enterprise Resource Planning (ERP) system, further complicates matters. Enhanced and consistent utilisation of the ERP system can significantly improve the sharing of key policies and regulations and ensure the secure storage of critical health sector documents.

Currently, many employees resort to using social media platforms for official communication. This poses additional security risks, such as data breaches and unauthorised access, which can compromise sensitive information. The lack of secure and consistent communication platforms can lead to inefficiencies, miscommunication, and potential data leaks. It is essential to implement secure communication channels rigorously and train employees to use them effectively to safeguard information and maintain the integrity of official communications.

Maintenance of ICT Equipment

The maintenance of ICT infrastructure is crucial for the effective implementation and sustainability of Mongolia's digital health ecosystem. The government has a specific responsibility to ensure that national health systems function without interruptions or issues. This includes establishing and enforcing policies for the regular maintenance and timely upgrade of equipment and systems when they break down or become outdated. Furthermore, the MoH must develop and implement contingency plans to address potential infrastructure threats and destruction, ensuring the continuity of digital health services during emergencies.

The assessment results highlight several areas requiring improvement. Firstly, the MoH faces significant challenges in human resources for maintaining ICT and data processing equipment. While some departments have adequate staff, others receive support from private and international organisations. The use of PPPs in Mongolia provides an opportunity for the MoH to supplement its internal capacity for ICT maintenance.

Secondly, the policy for regular maintenance and upgrades of hardware and devices is either not available or not fully implemented in many areas. This inconsistency can lead to outdated and inefficient technology, hindering the performance of digital health systems. Furthermore, contingency and backup plans for electronic infrastructure are underdeveloped or not fully implemented. Establishing and regularly updating such policies, with secured funding, is necessary to keep the ICT infrastructure up to date.

Thirdly, there are barriers to purchasing ICT equipment, primarily due to lengthy tender processes and financing issues. Addressing these barriers through streamlined processes and better financial planning will facilitate timely procurement of necessary technology.

Finally, the backup of health information to the National Data Centre NDC varies, with some data not being backed up at all. Ensuring comprehensive backup of all health information at the NDC is crucial for data protection and continuity of services.

Recommendations for Instructure

- Implement clear policies to maintenance policies and guidelines for digital health infrastructure.
- Provide training and policy guidance for the use of unofficial communication platforms.
- Review sector plans and include objectives to improve the enabling environment for digital health.

Human Capacity

Effective leadership capacity, comprehensive workforce training, and long-term capacity development are foundational elements for Mongolia's digital health transformation. Strong leadership is essential to drive strategic vision, make informed decisions, and foster a culture of innovation within the health sector. This leadership must be complemented by a well-trained workforce equipped with the skills necessary to implement and manage digital health technologies effectively. Continuous in-service training ensures that current employees stay abreast of technological advancements and best practices, while pre-service training prepares future health professionals to seamlessly integrate digital tools into their practice. Long-term capacity development through both in-service and pre-service training programs helps create a resilient health system capable of adapting to evolving digital landscapes. Together, these elements ensure that digital health initiatives are sustainable, scalable, and capable of delivering improved healthcare outcomes. In evaluating these factors in the assessment, the overall score for the human capacity domain was 2.9 and demonstrated sufficient leadership capacity compared to workforce training and long-term capacity development.

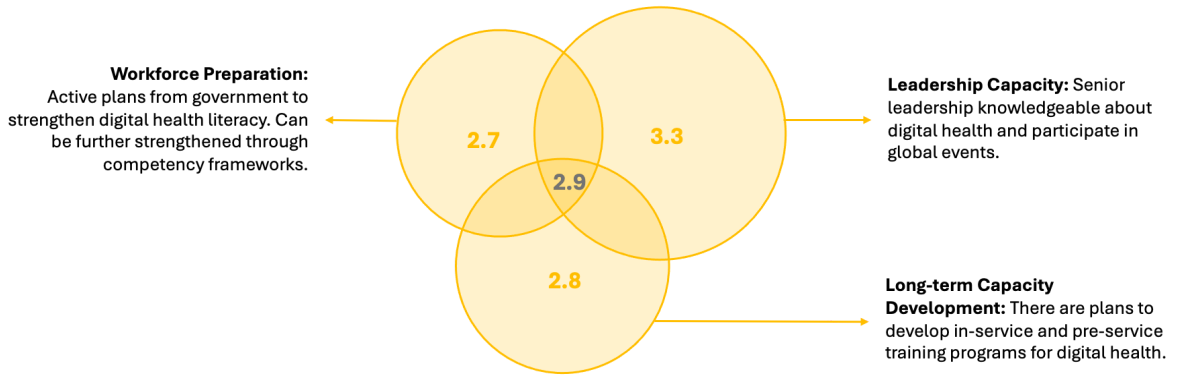


Figure 11. Strategic Dimension: Human Capacity Score Summary.

Leadership Capacity
The leadership capacity for digital health in Mongolia reveals a mixed but promising landscape. Leadership skills are somewhat concentrated, with some skills limited to 1-2 individuals or specific areas or ministries. However, the Mongolian government has been actively engaging in global workshops, seminars, and conferences to increase the knowledge of leaders on key digital health topics. These efforts enable Mongolian leaders to learn how various countries address similar challenges, enhancing their capacity to lead digital health initiatives effectively. Additionally, ICT teams established within various stakeholder organisations indicate a commitment towards digital transformation. This diverse representation and dedicated leadership are crucial for driving digital health initiatives effectively.

In terms of digital health training for decision makers and middle managers, the overall score is 3.2. Initially, there appears to be a lack of training, as indicated by some participant responses. However, Mongolia has prioritised capacity building for digital transformation in the Vision 2050 Policy.(33) The government has established partnerships with global leaders in digital transformation such as Estonia to ensure sufficient skills transfer. Furthermore, the establishment of the e-Mongolia Academy with a mission for research and training underscores the government's commitment to rolling out comprehensive digital health capacity-building programs. These efforts reflect an active focus and strategic planning by the government to enhance the skills necessary for managing and implementing digital health initiatives.

Workforce Preparation
Workforce preparation for digital health is multifaceted, involving not only the availability of training programs but also the description of necessary knowledge and skills in human resource plans and job specifications. Ensuring that these elements are in place is critical for the successful implementation of digital health initiatives. The assessment of workforce preparation for digital health in Mongolia reveals several important findings.

First, it's important to note that Mongolia has approximately 15 universities and colleges that train healthcare workers. According to the Ministry of Education and Science, these institutions produce around 1200 medical professionals and approximately 1100 nurses annually. However, these figures were significantly lower than those reported by the Centre for Health Development and the Health Insurance Government Office. This discrepancy may be attributed to the exclusion of internationally trained professionals and recruits. Nonetheless, it underscores the need for a centralized health workforce registry to ensure accurate and consistent data.

Currently, the participation in digital health training amongst managers and decision-makers is intermittent, with some gaps in comprehensive training programs. Although there have been efforts to provide digital health training, detailed data on the extent of training specifically in digital health planning and coordination is lacking. This underscores the need for more structured and widespread training programs to ensure all relevant personnel are adequately equipped to handle digital health initiatives effectively.

In terms of integrating digital health responsibilities and hiring persons for digital health within the human resource plans, progress is still in the early stages. While there are intentions to update human resource plans to include roles related to digital health, full implementation is pending. This delay may be affected by budgets and skills availability in the market. Once organisations define digital health roles and skills, they would be better positioned to implement training programs, thereby enhancing overall preparedness for digital transformation.

Competency frameworks for digital health activities are essential for defining the skills needed for effective implementation and management. Although there are plans to establish these frameworks, their development and approval are ongoing. Globally, frameworks such as the Australian Health Informatics Competency Framework and the NHS Digital Academy's standards offer comprehensive guidelines for digital health competencies, including areas like IT literacy, health information management, digital communication, and data privacy and security. These frameworks support the development of accredited courses, job descriptions, and professional appraisals, ensuring that healthcare workers are prepared to meet the demands of a digital health environment.

Improving digital health literacy among citizens is equally important, as it empowers them to engage effectively with digital health services. Efforts to educate citizens on using health information technology, such as telehealth services, have shown some progress. Activities and campaigns have been planned and partially implemented, but there is a lack of comprehensive evaluation of their impact on citizens' abilities. Fully implementing these educational activities and regularly assessing their effectiveness will be vital for enhancing public engagement with digital health services.

List of Trainings Attended by Government Stakeholder

On April 19-20, 2022, within the framework of the "E-Health-2" project sponsored by the World Bank, a Health Sector Electronic Skills Development Training was organised for 120 employees in cooperation with the Ministry of Digital Development and Communications.

From April 2023 to February 2024, within the framework of the "E-Health-1" project funded by the Chinese government,

1. IT Admin Certificate online training for 150 employees
2. Capacity building training for health information technology specialists and biostatisticians for 150 employees
3. Information technology specialist and biostatistician capacity-building training of other countries (South Korea) for 50 employees were organised.

On June 5 and 6, 2023, 3 people attended the "Cyber Security" training at BlueSky's Jade conference hall.

According to the order No. 2/1769 of the Ministry of Health dated April 20, 2023, 5 people participated in the training "Improving the capacity of health information technology specialists and biostatisticians" between April 25, 2023 and June 2, 2023.

2 people participated in a short-term training course on Health Management Information System in South Korea between June 22, 2024 and Jan 27, 2024.

Long-Term Capacity Development

Long-term capacity development ensures that nurses and doctors graduating in 5-10 years from now have the necessary skills to work in a health facility that has fully adopted digital applications. This also includes training programs to ensure the current workforce are kept up to date with digital health trends and innovation. The assessment indicates that in-service training programs for healthcare workers in digital health and health information systems are still in the planning stages, as reflected by a score of 2.7. External training programs are available through post-graduate courses, but accreditation of these programs require significant enhancement and training budgets need to be reviewed. However, overall implementation of in-service training is inconsistent, and coverage is insufficient to meet the demand. This underscores the importance of establishing comprehensive and widely recognized training programs to ensure healthcare workers are adequately prepared for digital health roles.

Implementing pre-service curriculums for digital health amongst the health workforce requires collaboration with the Ministry of Education and Science and training institutes. Regarding the capacity of universities to teach digital health curricula, the score of 3.1 reflects mixed perceptions. While there are plans to prepare human resources for digital health training programs, current resources are limited and often depend on development partners. There is a need to ensure that universities have sufficient faculty and resources to conduct comprehensive digital health training. Some responses indicate that resources are available to conduct training in specific topics according to fixed plans, and human resources are deemed sufficient in some contexts. However, a more structured and well-resourced approach is necessary to fully realise these plans.

The assessment also indicated a need to increase programs related to digital health, such as bioinformatics or health informatics, to improve the capacity to manage digital health at facilities. Currently only 1-2 accredited institutes in Mongolia offer this, lacking the production capacity to support digital health transformation. Although there are opportunities for students to study these topics in foreign schools through student exchange programs, awareness and accessibility are limited. Plans to create training programs in domestic universities are underway, with at least one university already offering a health information technologist curriculum. However, expanding these programs to several training institutes is necessary to meet the growing demand for digital health professionals.

Recommendations for Human Capacity

- Develop in-service and pre-service training programs to ensure a competent and engaged workforce.
- Leverage existing training programs such as the TechChange Digital Health Planning National Systems course, developed collaboratively with USAID, UNICEF, WHO and ITU.

Interoperability

Interoperability[3] is a cornerstone of effective digital health implementation, ensuring that diverse health information systems can seamlessly communicate and exchange data. Critical areas for strategic dimension stakeholders to focus on include ensuring sufficient technical capacity for interoperability, establishing key documents, such as an architecture blueprint, coordinating and guiding the use of health data standards and establishing a robust health information exchange (HIE) platform. Without these, the benefits of digital health initiatives, such as improved patient outcomes, increased efficiency, and enhanced data-driven decision-making, cannot be fully realised. The assessment revealed an overall score of 2.2 for interoperability, highlighting several areas needing priority focus and investment, such as technical capacity for interoperability.

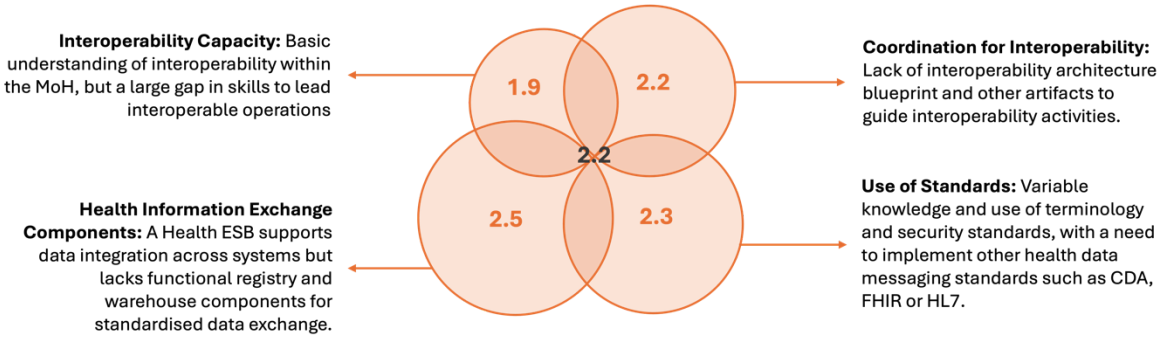


Figure 12. Strategic Dimension: Interoperability Score Summary.

Interoperability Capacity

The assessment reveals several key insights about interoperability capacity. Firstly, there is a lack of a clear government definition of health information interoperability, as indicated by a variety of uncertain responses. This absence of a standardised definition has significant implications. Without a clear and shared understanding of what health information interoperability entails, efforts to ensure compliance and coordinate digital health activities across different levels of the health system are hindered. This is particularly critical in Mongolia, where language barriers can exacerbate the challenges of implementing international standards and translating technical terms accurately. A well-defined, government-endorsed definition would provide a consistent framework for all stakeholders, facilitating better communication, planning, and execution of interoperability initiatives.

When it comes to the knowledge and skills of decision-makers and middle management staff regarding interoperability, the responses indicate a significant gap. Many respondents noted the absence of specialists with the necessary knowledge to ensure compliance of health information systems to interoperability standards and a limited understanding of required skills. Some mentioned the definition and documentation of basic skills and job functions, along with the participation of specialists in regional and international conferences, suggesting some level of expertise and engagement in the field. However, the overall picture points to an

[3] "Interoperability is the ability of two or more systems to exchange health information and use the information once it is received." - The Office of the National Coordinator for Health Information Technology
https://www.healthit.gov/sites/default/files/factsheets/onc_interoperabilityfactsheet.pdf

urgent need for capacity building and support from development partners to fill these knowledge gaps.

Training and activities aimed at developing knowledge and skills about health information exchange are present but seem to be insufficiently structured or widespread. There are curriculum plans and organised training sessions, both scheduled and ad hoc, often supported by development partners or conducted in collaboration with neighbouring regions. On-the-job training and certification courses for ICT specialists are mentioned, but overall, the responses suggest a need for a more comprehensive and cohesive approach to training and capacity building. Despite some professionals actively participating in conferences and sharing experiences internationally, there is an evident need for a defined framework and systematic implementation of training programs to enhance the overall interoperability capacity.

Coordination for Interoperability

Several initiatives assist countries in coordinating and facilitating interoperability across a diverse range of stakeholders and systems. The assessment examined three key aspects: the presence of a digital health blueprint outlining the health information architecture to be followed, mechanisms to ensure private systems and vendors comply with interoperability policies and standards, and the existence of data catalogues and data dictionaries to standardise data use across systems. These initiatives are crucial for developing a cohesive digital health ecosystem, ensuring that all stakeholders can efficiently exchange and utilise health information.

Mongolia has introduced a Health Enterprise Service Bus (H-ESB) on a pilot basis to facilitate data exchange across health systems. However, the assessment revealed mixed responses regarding the existence of a documented plan or architecture for its design and development. This lack of clarity poses significant challenges for expanding the platform as digital health systems grow in Mongolia. It also prevents stakeholders, such as technology vendors, from proactively developing systems that align with the required architecture. Without a fully implemented and regularly updated eHealth architecture, efforts to integrate and standardise health information across different regions and health facilities will be hampered, leading to inefficiencies and potential data silos.

The compliance mechanisms to monitor private or custom-built systems with government-developed regulations and standards also reveals notable gaps. Many respondents report the absence of any evaluation system or process, while some mention plans to adopt processes within an e-governance framework. The existence of a national agency or authority that assesses health information systems and issues certificates of compliance is mentioned by only a few respondents. This inconsistency in compliance assessment can lead to uneven implementation of standards and varied quality of health information systems, undermining the reliability and interoperability of health data.

Regarding the availability and maintenance of a data catalogue and data dictionary, the responses indicate significant shortcomings. While some health programs have attempted to establish catalogues, the quality is generally insufficient, and full implementation remains limited. Even where data dictionaries exist, they are not

used regularly, pointing to a lack of integration into routine data management practices. Only a small fraction of respondents indicate that a regularly updated data catalogue exists, which checks for data duplication and documents problems. This lack of comprehensive and regularly maintained data standardisation tools severely impacts the ability to ensure accurate and consistent health data, which is essential for effective decision-making and resource allocation in the health sector.

Use of Health Data Standards

Health data standards are essential for ensuring the consistency, accuracy, and security of health information across different systems and settings. There are four primary types of health data standards: terminology standards, content standards, message standards, and security standards. Terminology standards, such as ICD-10 and SNOMED CT, provide a common language for describing medical terms and conditions, facilitating clear and consistent communication among healthcare providers. Content standards, including HL7 CDA and FHIR, define the structure and format of health information, ensuring that data is organised and presented uniformly. Message standards, such as HL7 and DICOM, govern the exchange of health information between systems, enabling seamless interoperability and data sharing. Finally, security standards, like HIPAA and ISO/IEC 27001, establish protocols for protecting health data, ensuring its confidentiality, integrity, and availability. The assessment findings underscore the need for enhanced awareness, training, and structured implementation strategies for health data standards across Mongolia.

Table 2. Adoption of Health Data Standards at the National Level of Government.

Type of Standard	Adoption
Terminology	Most participants (67%) have a general knowledge about terminology standards such as ICD10/11, LOINC and SNOMED-CT for example, but no plan to implement them. Only the Centre for Health Development and National Centre for Public Health have official documents specifying the standards to be chosen and used.
Content	Most participants (67%) have a general idea of content standards such as HL7, CDA, CCD and FHIR, but no implementation plan. The Centre for Health Development plans to adopt at least one standard, and the National Centre for Public Health has official documents for standards selection and use.
Messaging	Messaging standards such as HL7, DICOM, and IHE match the responses for the content standards above.
Security	Adoption of data privacy and security standards like HIPAA, GDPR, and ISO/IEC 27001 indicates awareness, but lacks adoption. The majority of participants (78%) have a general idea but no plans to implement. The Centre for Health Development plans to use at least one standard and the National Centre for Public Health has official documents for the use of security standards.

Overall, the assessment revealed that while there is a general awareness and understanding of health data standards, gaps remain in technical expertise and concrete implementation plans. Prioritising capacity building for interoperability is essential to ensure that future health system expansions are both interoperable and seamlessly connected.

Health Information Exchange Components
The Open Health Information Exchange (OpenHIE) framework recommends several key components to facilitate effective health information exchange within health systems. These components include various registries and data warehouses that track entities and support business services for planning and decision-making.

- Terminology Service: This registry ensures that all systems use consistent and standardised medical terminologies, such as ICD, LOINC, and SNOMED CT, which is crucial for accurate data exchange and interpretation.
- Client Registry: This central registry tracks patient identities across different health systems, ensuring that each patient has a unique identifier. This helps in consolidating patient records and improving continuity of care.
- Health Worker Registry: This registry maintains a comprehensive list of health workers, including their qualifications and locations, which helps in workforce planning and management.
- Facility Registry: This registry contains information about all health facilities, such as their locations, services offered, and capacities. It supports the efficient allocation of resources and coordination of services.
- Shared Health Record (SHR): This component aggregates patient data from various sources into a single, consolidated health record. It ensures that health information is accessible and up to date for clinical care across different points of service.
- Health Management Information System (HMIS): This warehouse collects and analyses data on health services, outcomes, and resource use. It supports public health reporting, program monitoring, and strategic planning.
- Logistics Management Information System (LMIS): This system tracks the supply chain for medical products, ensuring that health facilities have the necessary supplies and medications. It supports inventory management and forecasting.
- Medical Product Catalogue: This registry includes detailed information about medical products and drugs, including their specifications and regulatory statuses. It helps in standardising procurement and ensuring quality control.

These components work together to create a robust health information exchange infrastructure, improving data consistency, accessibility, and utility across the health system. By implementing these registries and warehouses, health systems can enhance their planning, decision-making, and overall service delivery.

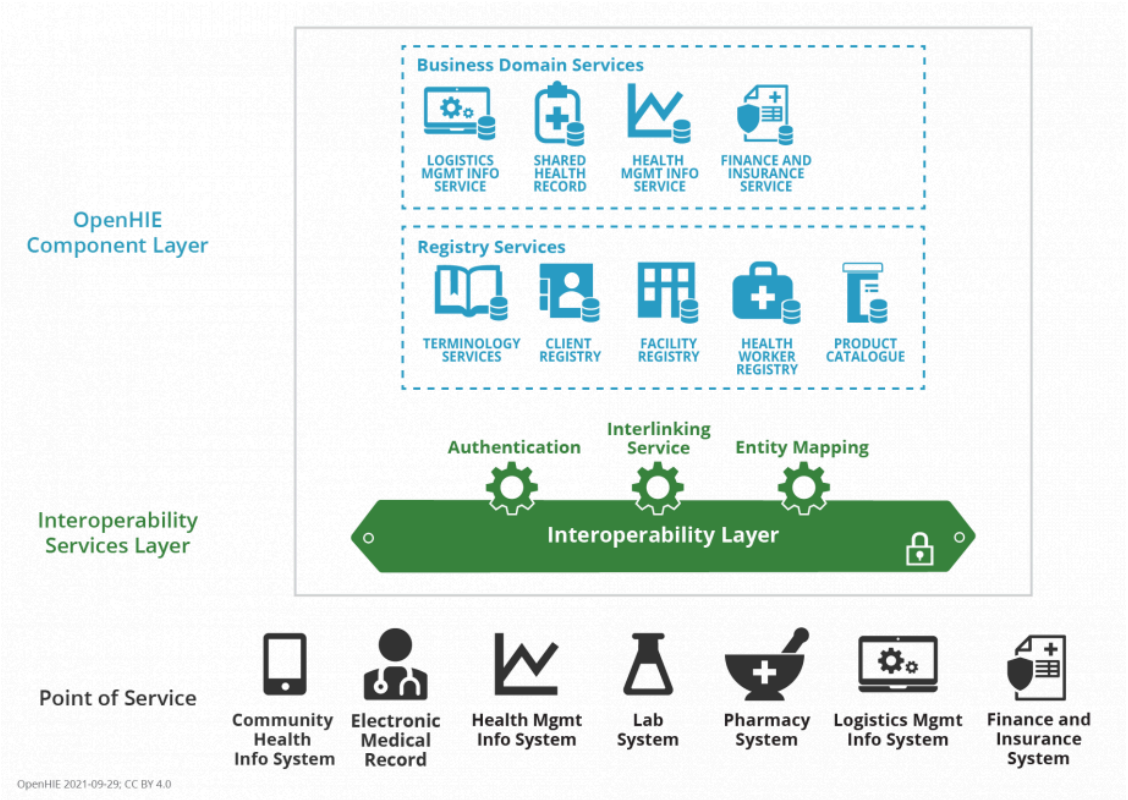


Figure 13. Recommended Health Information Exchange Platform for Health Systems.

The assessment of health information exchange (HIE) components based on the OpenHIE framework in Mongolia revealed significant variance amongst participant responses, highlighting a lack of awareness and coordination across stakeholders. The highest agreement and most developed component are the Financial and Health Insurance System, suggesting it may serve as a model for improving other components. Notably, the facility registry and shared health record show lower scores and higher variance in responses, highlighting areas that require significant improvement and standardisation efforts. Overall, the scores across different HIE components generally indicate moderate development, with most components existing as isolated lists but lacking in consistency, comprehensiveness, and accessibility. In terms of a unique patient registration number across healthcare facilities, most responses indicate either the presence of multiple registration numbers or a unique number that is not fully implemented.

Table 3: Existence of HIE Components at the National Level of Government.

HIE Component	Assessment Findings
Terminology Registries	The average score of 2.5 indicates that while there are manual or digital lists for these components, they are often inconsistent and not always up to date. There is limited accessibility across the health system.
Client Registry	Despite Mongolia's well established citizen ID system, the use of it as a unique patient identifier across digital health systems is variable. The assessment revealed the client registry to exist in multiple forms but lacks consistency and comprehensive accessibility.
Facility Registry or MFL	Scoring 2.1, this component is less developed, with many respondents noting the existence of fragmented lists that are not fully integrated or accessible.
Health Worker Registry	Like the client registry, the health worker registry scored 2.4, indicating fragmented and inconsistent databases.
Logistics Management System	With a score of 2.4, LMIS is noted to exist in various forms but is not fully accessible or standardised across the health system.
Medical Product and Drug Catalogue	Scoring 2.6, this component has slightly better integration but still suffers from inconsistency and limited system-wide accessibility.
Shared Health Record	This component has a lower score of 2.1, indicating significant fragmentation and inconsistency in existing records.
Health Management Information System	Scoring 2.6, the HMIS shows moderate development but still faces issues with consistency and accessibility.
Health Financing and Insurance Information System	This component scored highest at 3.0, suggesting better integration and a more consistent, regularly maintained system compared to other components.

Recommendations

- Prioritise and develop a digital health architecture blueprint.
- Define health data standards based to be used for different health data across the health system.
- Establish an organised data catalogue and data dictionary to help users find and access data more efficiently

Applications & Interventions

Within the applications and interventions domain, the assessment focused on identifying the types of systems implemented at the national government level. The Ministry of Health (MoH) was asked to provide information on the availability of 30 systems as listed in the "Classification of Digital Interventions, Services, and Applications in Health" published by the WHO. Additionally, the MoH was requested to specify the type of software and the ownership of these applications.

The MoH reported having 21 out of the 30 system categories. All systems were developed by private sector vendors and were described as open-source software. However, during site visits, it was discovered that these systems were custom developed for the government. Nonetheless, through the public-private partnership under which they were developed, the MoH and the government of Mongolia have

access to the source codes of these systems. It was unclear if these systems were being hosted by the private vendors or within the National Data Centre.

Furthermore, other participants in the assessment demonstrated low awareness and knowledge of the existing systems, highlighting the need to enhance communication about the available applications. Strengthening this communication would streamline the selection and adoption of digital health applications across Aimags and healthcare facilities.

Available Systems

- Clinical Decision Support Systems (e.g., Clinical Decision Support Tools, such as electronic diagnostic and treatment guidelines)
- Diagnostic Information Systems (e.g., PACS or other imaging information systems)
- Electronic health record system
- Laboratory information system
- Personal health record (electronic health record open to patients)
- Pharmaceutical Information System
- Telehealth services and mobile device-based systems
- Transfusion and Supply Information System
- Health Financing and Insurance Information System
- Health management information systems
- Information systems used in health programs (e.g., TB and HIV information systems)
- Health Resource Information System (e.g., Health Human Resource Management)
- Learning System
- Material supply management information system (allocation of drugs and equipment, stock control)
- Patient Management System (Registration and Appointment Management)
- Census and Population Information System
- Civil registration and basic statistical information system
- Facility management information systems
- Immunization Information System
- Surveillance and public health systems
- Emergency Preparedness and Response System

Knowledge Management & Innovation

In the evolving landscape of digital health, sharing knowledge and generating evidence are crucial for several reasons. Sharing knowledge across stakeholders accelerates development and enables the adoption of successful strategies and helps implementers and investors make well-informed decisions to optimise their support. Additionally, the process of gathering evidence is vital for the effective selection and evaluation of innovations. It allows for the assessment of digital investments to determine whether continued investment or necessary changes are required to achieve long-term health system impacts. Collecting information before committing to digital health investments ensures the chosen solutions are the best fit

for the specific context and challenges of a country. In assessing these aspects, the overall score for this domain was 1.9, highlighting a need to strengthen knowledge sharing and evidence-based practices.

Figure 14. Strategic Dimension: Knowledge Management & Innovation Score Summary.

Knowledge Sharing

The assessment revealed that information dissemination occurs across multiple platforms. Various organisations share information through their websites, while additional data is hosted on third-party websites. The E-Mongolia Academy provides general information about digital transformation in the country, and an ERP system is variably utilised for internal knowledge sharing. Although having information available across multiple platforms can be beneficial, it poses a challenge for stakeholders who need to navigate these platforms, thereby hindering effective collaboration and engagement.

The assessment highlighted the need for a central knowledge hub for key stakeholders, which could integrate analytics tools to generate insights and trends from the collected data. This would support evidence-based decision-making and strategic planning in digital health initiatives. Furthermore, the assessment found that knowledge sharing, which could enhance collaboration and engagement among external stakeholders and international partners, is limited due to the lack of translated information. Currently, outside of press releases and interviews shared by third-party websites, only a few strategic documents and publications are available in other languages.

During the information-gathering phase of the project, it was noted that key documents such as policies, reports, and assessments were mostly available in Mongolian. While this approach is suitable for internal stakeholders, it restricts external stakeholders from accessing vital insights needed to inform their support. The assessment recognized that translating these documents is an expensive process, likely contributing to the limited availability of translated information.

Evidence Generation

Evidence-gathering practices in Mongolia reveals several areas for development and growth. The responses indicate that while research on digital health is conducted by educational institutions and organisations at various levels (provincial, capital, or regional), there is a valuable opportunity to centralise and enhance government-led research efforts. Many participants noted the significant role of international organisations, which presents a strong foundation upon which Mongolia can build a more focused national structure dedicated to digital health research.

Participants highlighted that projects through development partners and international organisations report lessons learned. This indicates an existing framework that, with regular use and formalisation, can evolve into a robust government-developed system to evaluate the effectiveness and importance of digital health solutions. Regular use of such an evaluation framework will enable systematic assessment and continuous improvement of digital health implementations, thereby enhancing integration and scale.

Regarding the selection of digital health solutions, the varied responses suggested a lack of a standardised approach. However, best practices, international standards and partnerships with global leaders in digital health (such as Estonia) are used to guide government decisions.

Recommendations

- Utilise the E-Mongolia Platform as a foundation for the knowledge hub, expanding its scope to include more detailed and technical information about digital health transformations and initiatives. Incorporate analytics tools into the knowledge hub to generate actionable insights and trends from the collected data.
- Invest in translating key documents, such as policies, reports, and assessments, into multiple languages to make vital insights accessible to external stakeholders and international partners.

Assessment Outcomes: Management Dimension

The management dimension includes stakeholders such as Departments of Health and local government, who are responsible for regional health planning, resource distribution from the national health budget, ensuring functional health programs, and performance evaluation. Within the digital health ecosystem, they are tasked with establishing plans to implement national digital strategies, ensuring awareness of key national policies that influence implementation, and providing technical support for digital health initiatives. The assessment evaluated seven domains within this dimension: Governance & Coordination, Strategy and Investment, Infrastructure, Human Capacity, Data Ecosystem, Business Processes, and Interoperability.

Participants

Eighteen Aimag Departments of Health and Ulaanbaatar participated in the assessment. Khovd, Selenge, and Govisumber were the only Aimag Departments of Health that did not participate. The roles of the participants varied, including management and health information positions. Among them were 7 information and technology officers, 6 information and technology specialists, a Head of Department, a health statistics specialist, a Head of Medical Aid Department, and a Head of Management Information.

Pre-Assessment

Prior to administering the assessment, participants were asked five pre-assessment questions. These questions aimed to understand the health challenges faced in the Aimag, explore the interest and investments in digital health over the past three years, as well as the planned activities for the next year, and investigate the funding sources for digital health activities.

Key health challenges in Aimags

Participants identified numerous challenges in the health sector, which were grouped into five overarching themes: human resource challenges, ICT infrastructure, information management, funding, and health service challenges. These echoed some of the issues described in the strategic dimension of the assessment.

- Human Resource Challenges: The most frequently reported issue was a shortage of health cadres, which increases the burden on existing staff. Other concerns included a lack of competitive salaries and training deficiencies in both health and ICT knowledge and skills.
- ICT Infrastructure: The second most common issue, participants reported insufficient data storage equipment, poor physical and ICT infrastructure to support software use, outdated equipment, slow internet speeds, and concerns about information security.
- Information Management: Challenges included the lack of system integration and standards, making it difficult to consolidate data for reporting, and inadequate software to support reporting needs.
- Funding Challenges: Participants highlighted low budgets and the high costs of acquiring equipment and technology as significant barriers.
- Health Service Challenges: These varied from insufficient organisational management capacity and old buildings that do not meet quality standards for service delivery to a lack of health equipment such as ambulances, low service coverage in some Aimags, and a lack of health education among the population.

Describe recent and future ICT investments

In the last three years, Aimags have made several investments in ICT, largely around implementing key digital health software promoted by the MoH and MDDC. These include H-info for statistical reporting, ERP for organisational management, Health.gov for health insurance reporting and reimbursements, eHospital for patient and facility management, and App kiosks for patient services. Some investments targeted specific health program areas, such as telemedicine, mobile technology, and AI diagnosis in cardiovascular and cancer programs. Other investments included purchasing ICT equipment, upgrading equipment, and acquiring IT staff.

Most provinces could invest in up to two activities, reflecting their limited budgets and the high cost of investing in ICT. Five provinces were unable to make any ICT investments in the last three years. This situation is more optimistic compared to Aimags' plans for the next year, in which 13 provinces mentioned they had no plans for ICT activities. The remaining provinces responded with plans for investment in software, such as introducing telemedicine or adding new modules to existing software.

The primary source of funding for these activities was the health budget allocated by the government. Four Aimags admitted that this budget was insufficient to support ICT activities. As a result, many Aimags sought additional funding from international organisations and donors such as UNICEF, WHO, and The Global Fund. However, the disadvantage of these funding streams is that they are usually short-term and often restricted to specific health programs. This impacts digital health implementation, as it may be limited to only some areas of the health system, furthering fragmentation and digital divides.

Reasons for adopting health ICTs

When asked about their motivations for investing in ICT, most participants reported the need to improve health service delivery, coverage, health outcomes, and patient satisfaction. This reflects a high awareness of the benefits of digital health among participants. Some mentioned that their investments were made by government order as part of the country's digital transformation, indicating alignment with national priorities. Other reasons included improving access to information and supporting research activities, showing a data-driven culture and a desire to use evidence-based practices.

Management Dimension Score

The overall score for the management dimension was 2.8, indicating that digital health readiness and capabilities have room for improvement to ensure consistency and sustainability. The data ecosystem and business processes domains scored the highest, reaching nearly four points in the assessment, while the human capacity domain scored the lowest.

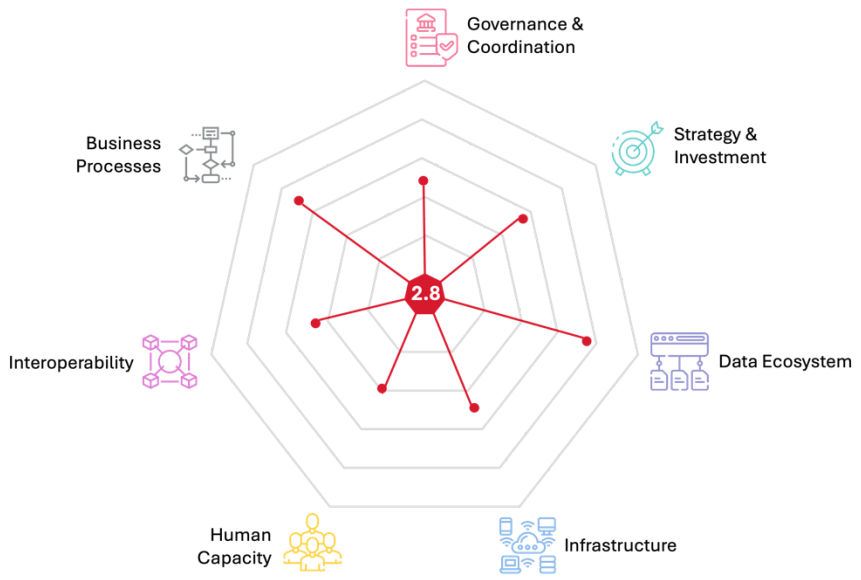


Figure 15. Overall Score for the Management Dimension.

Governance & Coordination

Given Mongolia's somewhat decentralised health system, it was important to assess the sub-national government's ability to coordinate digital health activities and implement national policies. This domain also investigated the stakeholders involved in digital health activities, ensuring a mix of ICT, health, and management roles.

Another key function of departments of health is to facilitate communication between the national and facility levels of the health system, ensuring they understand and effectively communicate national plans to the facilities adopting digital health. The overall score for this domain was 2.5.

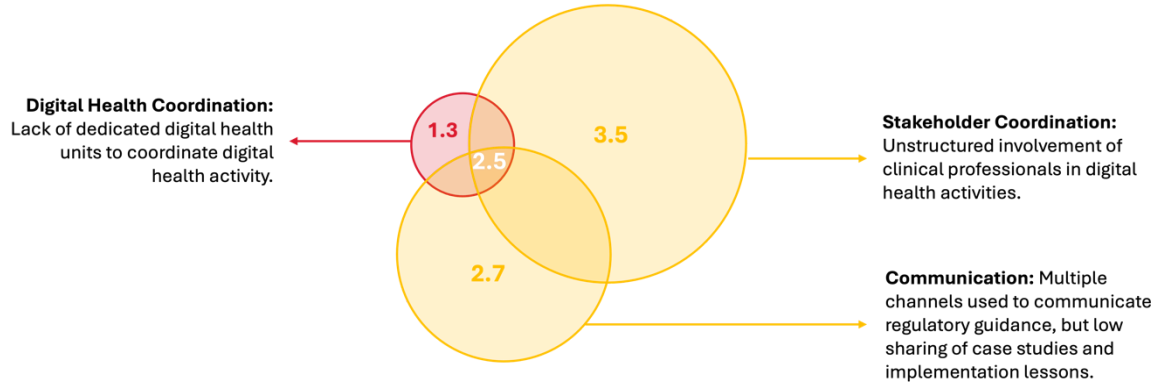


Figure 16. Management Dimension: Governance & Coordination Score Summary.

Digital Health Coordinating Structures

Sub-national governance committees have not yet been fully established in Mongolia's digital health ecosystem. Participants noted that digital health activities are currently managed by one or two individuals on a case-by-case basis, rather than through a formalised unit. However, there are examples of formal coordination by management departments in the capital, Bayan-Ulgi, and Zavkhan. This finding underscores an important opportunity to enhance the coordination of digital health activities. Establishing formal governance structures can help ensure prioritised funding for digital health initiatives and improve interoperability across digital health systems.

Inclusive Stakeholder Engagement

The inclusion of clinical professionals in digital health initiatives is essential for developing and implementing effective, user-friendly, and relevant digital health solutions. While ICT professionals possess the technical knowledge to develop systems, they may lack the unique insights into the health system that clinical professionals offer. Therefore, regularly involving clinical professionals in digital health planning and implementation is crucial. Responses from Aimags reflect this importance: 11 Aimags indicated that they sometimes include clinical professionals, 6 Aimags reported always including them, while 4 Aimags mentioned not including clinical professionals at all. This could be due to the shortage of clinical professionals, who are often burdened with other commitments within the health system. Addressing this gap presents a valuable opportunity to enhance digital health planning and execution.

Effective communication

Clearly established communication channels ensure that Departments of Health can stay updated on national plans and policies and effectively communicate these to facilities. In the assessment, Aimags indicated several channels for receiving information, news, and updates from the national government through online platforms, television, social media, and more appropriately through organisational

platforms such as the government ERP. Online platforms and social media were the most popular channels for receiving information. Four Aimags described additional channels through organisational training platforms and the official letter system. This variety in communication channels ensures Aimags with differing ICT capabilities can receive important information for planning and coordination.
Similar communication channels are used to disseminate information to health facilities within the Aimags, with a greater use of written letters for communication.

The communication network is also essential for sharing information about digital health activities, allowing health facilities and the national government to gather valuable insights on digital project successes and lessons learned. When asked about the process of sharing such information, only 3 Aimags reported having a structured process, compared to 9 Aimags that said they have a process but do not implement it consistently. Notably, 6 Aimags did not have a process for sharing information on digital health initiatives. This presents an opportunity to enhance communication practices, ensuring consistent and structured sharing of information to support digital health planning and implementation effectively.

Recommendations for Governance & Coordination

- Establish dedicated teams comprising health, ICT, and management professionals to coordinate digital health activities effectively.
- Ensure Departments of Health develop a comprehensive digital health implementation plan aligned with national policies and strategies, including detailed resource requirements, cost estimates, and robust monitoring and evaluation frameworks.
- Develop a communication strategy that describes the approved channels for communication, including which channels to use based on the information being shared.

Strategy & Investment

Within this dimension, the strategy and coordination domain investigated two key responsibilities of the Department of Health: ensuring digital health activities were documented in quarterly and annual plans and allocating sufficient budgets towards these planned activities. The overall score was 2.8, indicating that while digital health activities were partially included in plans, they were less likely to have dedicated budgets allocated to them.

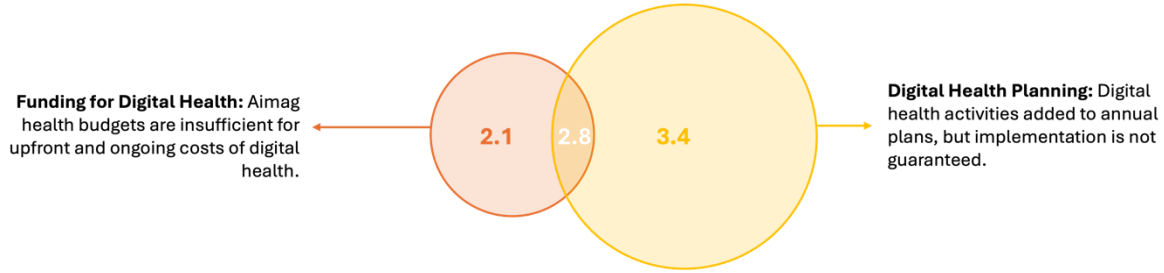


Figure 17. Management Dimension: Strategy & Investment Score Summary.

Planned Digital Health Activities

Fifteen Aimags reported including digital health activities in their annual implementation plans. However, eight noted that these activities only reflected a portion of their desired plans due to funding and procurement constraints. Four Aimags indicated they had not included digital health activities in their national plans. Although the assessment did not explore the specific reasons for this, funding limitations and other health program priorities are likely contributing factors. As the government of Mongolia formalises its new national digital health strategy, it is likely that Aimags' plans will increasingly incorporate digital health activities, aligning with the Ministry's priorities to address health system challenges.

Dedicated Budget for Planned Activities

To ensure the sustainability of digital health implementation, Aimags must allocate sufficient budgets to support both periodic upfront investments and ongoing operational expenses. Most Aimags (12) indicated that these activities receive less than 1% of their health budget. Only four Aimags – Ulaanbaatar, Sukhbaatar, Umnugovi, and Arkhangai – reported being able to allocate up to 3% of their budgets for digital health activities. Conversely, Khuvsgul, Uvs, and Zavkhan mentioned that no budget allocation was possible for them. This underscores the need to review budget allocation policies at the ministry level to help Aimags secure adequate funding for prioritised digital health activities. Additionally, some provinces mentioned they could secure external funding through donors, but these funds were insufficient to support the ongoing maintenance expenses for digital health initiatives.

Recommendations for Strategy & Investment

- Identify key digital health priorities through a national digital health strategy for Aimags to include in their national plans.
- Collaborate with the banking sector to support discounted loans or investment funds to support upfront digital health activities.

Data Ecosystem

Health data serves different purposes at various levels of the health system. At the sub-national level, it is crucial for supporting regional planning, resource distribution, disease control, and performance evaluation. This depends on receiving high-quality data promptly from health facilities and having well-managed processes to extract, process, analyse, and interpret the data. This domain investigated these activities and achieved an overall score of 3.8 in the assessment. This reflects a well-managed data ecosystem that can be further enhanced with an interoperable digital health infrastructure.

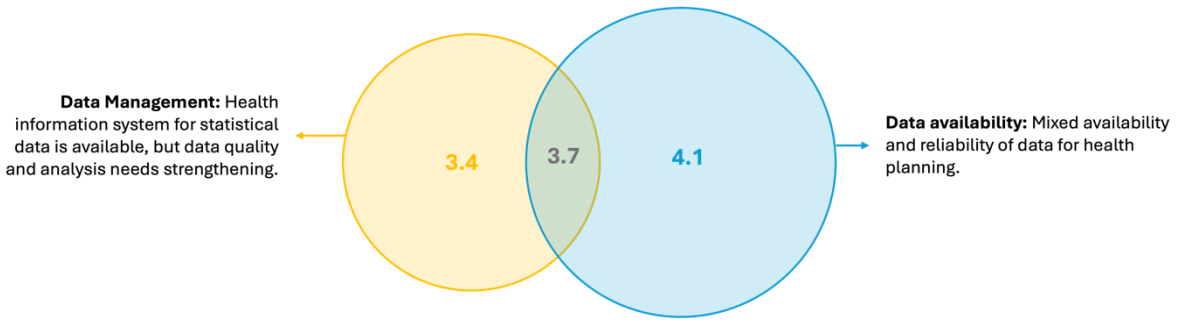


Figure 18. Management Dimension: Data Ecosystem Score Summary.

Data Received from Health Facilities

The assessment evaluated the availability and quality of six data categories from health facilities: birth registration, death notifications, surveillance data, public health indicators (e.g., immunisation coverage, admissions, etc.), service delivery data (e.g., medication stock levels), financial data, health worker data, and patient satisfaction survey data. The results revealed that birth and death registrations, health financing data, and health service delivery data are available and reliable across most Aimags. However, health facility indicators, patient monitoring, and individual health workforce data showed some inconsistencies, with several Aimags reporting reliable data but others displaying gaps. Patient satisfaction survey data showed significant variability, indicating a need for improvement. Enhancing the consistency of this data and addressing gaps can lead to more effective regional planning, resource allocation, improved patient services and overall health system performance.

Data Management and Use

Participants were asked various questions to assess their data management and use practices. The H-Info application is a key system for Departments of Health to collect health facility data, but data is also collected through other systems. Since these systems are not interoperable and don't exchange data into a central warehouse, extracting the data is a major challenge. Other challenges that were prominently noted across various Departments included a lack of human resources, data quality concerns, standardisation issues and data completeness problems. These challenges underline significant areas that require focused improvement efforts. Regarding the capacity to analyse, process, and report health data, the mean score was 3.7, with a mode of 5, indicating that most health departments have a high capacity in these areas. However, a few departments have lower capacities, scoring either 1 or 3, highlighting some disparities in capabilities. Most departments utilise the data primarily for reporting to the MoH. Other uses include performance evaluation, planning, research, and policy development. This structured use of data highlights the importance of having robust data management systems and practices to support various administrative and planning functions.

Recommendations

- Implement data standards and guidelines to ensure consistency and accuracy in data collection and reporting.
- Integrate automated data quality checks into digital health systems to identify and correct errors in real-time.

Infrastructure

In Mongolia's decentralised government structure, Departments of Health play a crucial role in establishing and maintaining the infrastructure necessary for effective digital health initiatives. They are responsible for securing funding and allocating resources appropriately to support digital health infrastructure and providing ongoing technical support and training to healthcare workers within their region. Furthermore, Departments of Health must establish and enforce data security and privacy protocols to protect patient information, including secure data storage solutions and cybersecurity measures. This support is crucial for enhancing the overall efficiency, accuracy, and accessibility of health services, ultimately contributing to improved health outcomes across the region. The overall score for this domain was 2.5, highlighting a need to strengthen the operational infrastructure and ICT maintenance framework.

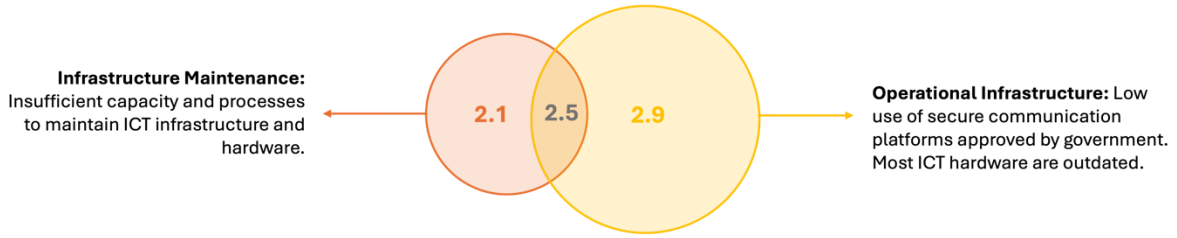


Figure 19. Management Dimension: Infrastructure Score Summary.

Regional Infrastructure Landscape

The infrastructure landscape across Aimags reveals several gaps and diverse needs. Notably, 38% of respondents reported no ICT infrastructure development in the past year. This highlights a considerable gap in infrastructure upgrades, which is a critical component for effective digital health implementation. Among those who did report development, efforts mainly focused on enhancing internet connectivity, such as installing high-speed internet and fibre optic cables. However, a majority (68%) of these developments were not aligned with any national plans, indicating a lack of coordinated and standardised guidelines. The most commonly cited infrastructure needs included hardware improvements, software integration for unified platforms, and budget allocations for technology investments, alongside a notable demand for specialised IT staff and technical support. Positively, the responses indicated a varied number of internet service providers that ranged from 4 to 6, suggesting some level of competition but also potential disparities in service quality and coverage.

Operational Infrastructure

The availability of hardware and devices such as desktop computers, laptops, video conferencing devices, and smart devices varies across Departments of Health. While

some regions report that all staff have access to necessary hardware (25%), others indicate insufficient resources (25%) or only shared access (20%). This suggests a need for targeted investments to ensure equitable access to digital tools across all regions.

The use of official email addresses is inconsistent. A notable portion of the health department staff still relies on personal email accounts (35%), while some regions have managed to implement official email systems (30%). The use of secure, organisation-provided document sharing applications is also limited. Although 30% regions have implemented an ERP, the overall usage remains low, with many employees continuing to use personal or unofficial channels for communication. Social media platforms such as Viber, Facebook Messenger, and Telegram are commonly used for official communication. This practice is widespread due to the lack of official communication tools or difficulties in using existing ones. Many respondents highlighted the ease of use and familiarity with these platforms as reasons for their preference. However, this reliance on non-secure platforms raises concerns about data security and the confidentiality of health information. These findings highlight the urgent need for strategic planning and investment in digital infrastructure to support the health departments across Mongolia.

Infrastructure Maintenance

d or only available through external vendors (90%). This highlights a significant gap in internal capacity, suggesting an urgent need for developing and retaining skilled IT personnel within the health departments or establishing long-term partnerships with ICT vendors. Furthermore, Departments of Health lack necessary policies for the regular maintenance and upgrades of hardware and devices. Many regions (55%) reported having no policy in place, while some are in the process of developing or approving such policies (25%). Only a small fraction (15%) has a fully implemented policy that includes planned budgeting for maintenance and upgrades. The presence of contingency or backup plans in the event of an emergency, disaster, or cybersecurity incident is another area of concern. As many as 55% reported having no such plans, while some are in the process of developing or reviewing plans (30%). Only 10% have approved and fully enforced contingency plans. This gap poses a significant risk to the resilience and security of the health departments' ICT systems.

The most commonly cited barrier to purchasing ICT equipment is budget constraints, mentioned by 77% of respondents. Issues such as insufficient funding, lack of budget approval, and financial constraints were frequently highlighted. Additionally, some responses pointed out vendor issues and process-related challenges, further complicating the acquisition of necessary ICT tools.

Recommendations

- Establish long-term partnerships with Internet service providers to reduce and standardise the cost of internet connectivity for health facilities. This may also ensure quick turnarounds in technical support related to connectivity issues.
- Review procurement policies for ICT and ensure they are updated to support digital health transformation needs.
- Educate and train Departments of Health on the importance of infrastructure maintenance.

Human Capacity

The shortage of human capacity and skills is a well-documented challenge across Mongolia. This assessment examined the readiness of the Departments of Health to coordinate and support digital health implementation across their respective regions. The low overall score of 2.0 underscores the critical need for innovative approaches to bridge these gaps. It also highlights the importance of ensuring that digital health competencies are integrated across all levels of the workforce. Addressing these issues will be essential for the successful implementation and sustainability of digital health initiatives in Mongolia.

Figure 20. Management Dimension: Human Capacity Score Summary.

Most departments have designated individuals or units responsible for coordinating eHealth activities, such as IT specialists or departments. However, digital health capabilities are inconsistently described in their job-function. Digital health training for these individuals and units' managers is limited. Many regions reported no available training, although there are plans to develop leadership capacity for digital health planning and implementation. This inconsistency in training provision suggests a need for more structured and widespread training programs to ensure managers are equipped to handle eHealth initiatives effectively.

The percentage of administrative staff attending eHealth training in the past year varies significantly, with some regions reporting less than 3% participation. This low participation rate underscores the need for mandatory training programs to ensure that administrative staff are adequately prepared for digital health tasks. English proficiency was noted as a barrier for attending external training programs for digital health.

Training in data management, data analysis, and data quality for middle managers is not widely available. Although there are plans to provide such training, it is often not mandatory or is only available through limited channels. This gap suggests a need for comprehensive training programs that are integrated into regular management training.

The availability of ICT staff at the Departments of Health was reported to be inadequate. Many regions report having only one ICT specialist, which is often insufficient. Some regions have ICT teams, but they are not large enough to meet the demand. This shortage of ICT personnel is a significant barrier to effective digital health implementation. The types of IT professionals available include software and hardware specialists, network engineers, and security experts. However, the ability of IT professionals to read and understand information in English is variable, with some regions reporting less than 50% proficiency.

Recommendations

- Create social media groups or online communities where staff can share resources, ask questions, and receive support from their peers. Host webinars and live Q&A sessions with experts in digital health to provide ongoing learning opportunities.
- Develop certification programs that provide recognition for completing digital health training, which can motivate staff to participate.
- Collaborate with technology companies and non-governmental organisations (NGOs) to access resources, expertise, and funding for training programs.

Interoperability

Given the geographical challenges, variable infrastructure, and somewhat decentralised management of the health system in Mongolia, adopting a decentralised architecture for digital health may be a viable option as the government and Ministry of Health develop their digital health strategy. Should this approach be pursued, Departments of Health will require in-depth technical skills to ensure interoperability. They will need to establish policies for health data standards and develop their own health information exchange platforms that are connected to the national digital health platform. This domain assessment evaluated the readiness of the Departments of Health in this context and found an overall score of 2.4. This score highlights a critical need to improve capacity and structures to facilitate interoperability within their regions.

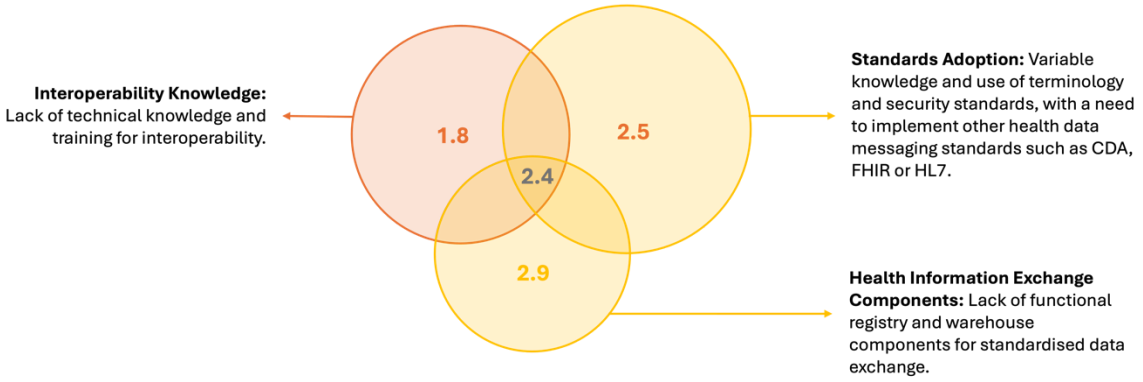


Figure 21. Management Dimension: Interoperability Score Summary.

Interoperability Knowledge

A significant portion of ICT staff lacks knowledge or ability regarding data interoperability, with 32% of respondents indicating that there is no knowledge or ability in this area. Additionally, 41% of IT staff have only heard about data interoperability but do not possess specific knowledge, requiring further training or assistance from external technology companies. While some regions report that there is ongoing training, only 14% of ICT staff have attended more than one training session on data interoperability. Only 14% of IT workers are reported to have sufficient knowledge and skills in this domain.

The availability of interoperability training for ICT staff was also found to be insufficient. A staggering 77% of regions reported that no regular training is available, with training sessions, if any, being held occasionally and on an ad hoc basis. In some instances, training is organised with the help of Mongolian or foreign experts, but these sessions are infrequent and lack a systematic approach. Only 5% of Aimags have plans to include ICT staff in interoperability training courses, with funding already decided. In a limited number of cases, data interoperability training is a part of the performance evaluation for ICT staff, with 18% reporting occasional training organised at least once a year.

Standards Adoption

The adoption of various health data standards to facilitate interoperability was variable across Departments of Health varied in the assessment.

Table 4: Adoption of Health Data Standards across Departments of Health.

Type of Standard	Adoption
Terminology	The adoption of terminology standards such as ICD-10/11, LOINC, and SNOMED-CT varies widely. Approximately 23% of regions have fully implemented at least one standard, while 27% have plans to use a standard. However, 18% of regions report no knowledge or plans to use these standards, indicating a need for increased awareness and training.
Content	Content standards such as HL7 CDA, CCD, and FHIR are less commonly adopted. Only 14% of regions report full implementation, while 27% have at least one standard planned for use. A significant 32% of regions have no knowledge or plans to adopt these standards.
Messaging	Data exchange standards like HL7, DICOM, and IHE are also not widely adopted. About 18% of regions have fully implemented at least one standard, and 23% plan to adopt at least one. However, 23% have no knowledge or plans to use these standards.
Security	Privacy and security standards such as HIPAA, GDPR, and ISO/IEC 27001 show higher levels of adoption. Around 27% of regions have fully implemented at least one standard, and another 27% have plans for adoption. Still, 18% of regions report no knowledge or plans to use these standards.

The assessment also examined the frequency of updating standards. Approximately 18% of regions update standards annually, while 23% update them every few years or on an ad hoc basis. About 18% of regions have a government-approved process to review and revise standards adoption regularly, while 23% report they never update their standards.

Health Information Exchange Components

Health information exchange readiness across the Departments of Health in Mongolia highlights several areas of progress and ongoing challenges. The use of unique registration numbers for patients is inconsistent across regions. Approximately 24% of respondents indicated that no unique registration system exists, while 33% reported the use of multiple IDs across systems. About 14% of regions have a single unique ID available but not fully implemented in all systems. A

promising 24% have a patient registry with unique IDs, and 5% reported that all systems connect to the patient registry, allowing access to all patient records.

In assessing the existence and implementation of various health information exchange components present, the results were unreliable and demonstrated a limited understanding of the difference between exchange registries and warehouses versus database lists in isolated systems. This suggests that there is a need for greater education and standardisation around the use of comprehensive, integrated exchange systems rather than relying on disparate, isolated databases. By enhancing knowledge and implementation strategies, health departments can better leverage these components to improve data consistency, accessibility, and overall health system interoperability.

Table 5: Existence of Health Information Exchange Components across Aimags.

HIE Component	Assessment Findings
Terminology Registries	Around 14% of Aimags have fully institutionalised and regularly maintained terminology registries. However, 33% reported that such registries do not exist, and 29% indicated the existence of manual/digital lists that are not consistent or up to date.
Facility Registry or MFL	Fully institutionalised facility registries are present in 24% of regions. In contrast, 29% of regions lack such registries, and 29% have inconsistent and outdated manual/digital lists.
Health Worker Registry	Fully maintained health worker registries exist in 24% of regions. However, 38% reported no existence of such registries, and 24% have inconsistent and outdated lists.
Logistics Management System	Fully institutionalised logistics management systems are present in 24% of regions. About 38% of regions lack such systems, and 24% have inconsistent and outdated lists.
Medical Product and Drug Catalogue	Fully maintained catalogues are found in 24% of regions. Around 38% reported the non-existence of such systems, and 24% have inconsistent and outdated lists.
Shared Health Record	Institutionalised shared health records exist in 24% of regions, whereas 38% lack these records, and 24% have inconsistent and outdated lists.
Health Management Information System	Institutionalised HMIS are present in 24% of regions, while 38% lack such systems, and 24% have outdated systems.
Health Financing and Insurance Information System	Fully maintained health financing and insurance information systems are reported by 24% of regions. About 29% lack these systems, and 24% have inconsistent and outdated lists.

Recommendations

- Enforce mandatory training and capacity development for interoperability across Department of Health ICT staff and teams.
- Offer national leadership for interoperable architectures by developing a national digital health blueprint to guide Departments of Health.

Business Processes

Assessing the current business processes is a crucial step in supporting business process reengineering within the health system. This assessment helps identify the availability and use of 21 business processes, as recommended by the “Building a Digital Information Infrastructure (Infostructure) for Health” handbook. The overall score for this domain was 3.5, indicating that business processes exist but are sometimes used inconsistently.

Table 6: Management Dimension: Business Processes Scores.

#	Business Process		Score
		Overall	**3.5**
A	Related to facility-based care and services	Patient health record management	3.7
B		Patient care tracking	3.5
C		Referrals within health facility	3.4
D		Referrals outside the health facility	3.3
E		Laboratory and diagnostic management	3.6
F		Specimen tracking	3.6
G		Prescription management	3.5
H	Related to communication	Public health event response	3.3
I		Targeted and untargeted alerts and communications	3.3
J		Peer-to-peer communication between physicians	3.3
K		Patient to provider communication	3.3
L		Public health event notification	3.4
M		Patient-based reporting	3.9
N	Related to identity management	Civil registration and vital statistics (births and deaths)	3.9
O		Patient identity verification	3.2
P		Patient enrolment in health services	3.5
Q	Related to data management	Data collection and management	3.6
R		Data storage and aggregation	3.9
S		Data coding and transformation	3.5
T		Data analysis and visualisation	3.6
U		Data quality and improvement	3.5

While several provinces have established and consistently use business processes, there are still significant gaps in certain areas, particularly in Aimags like Uvs, Khuvsgul, and Darkhan-Uul. Improving these workflows and ensuring consistency is crucial for enhancing the efficiency and effectiveness of health services, as well as informing the design and implementation of digital health solutions in Mongolia.

Table 7: Availability and use of Business Process by Aimag

Location	Total Score	Analysis
Ulaanbaatar	**3.5**	Consistent existence and use of workflows in all areas except for peer-to-peer communication, patient to provider communication, and data collection and management which are used inconsistently. Data quality and improvement processes are planned for updates.
Arkhangai	**4.0**	High scores across all categories suggest consistent and well-documented workflows.
Bayan-Ulgi	**3.4**	Mixed results with moderate consistency in most areas but needing improvement in some.
Bayankhongor	**4.0**	High consistency and documentation across all areas, indicating robust workflow processes.
Bulgan	**4.4**	Consistent and high scores, suggesting well-documented and established workflows. Nine processes are planned for review and update.
Govi-Altai	**4.0**	Consistently high scores across all areas, indicating well-documented workflows.
Darkhan-Uul	**2.9**	Mixed results with low scores in many areas, indicating significant gaps in workflow documentation and consistency.
Dornogovi	**4.0**	Consistently high scores across all areas, indicating well-documented workflows.
Dornod	**4.0**	All workflow processes are consistently used and established, scoring 4 across all categories.
Dundgovi	**1.8**	Many processes are not documented or inconsistently used. Only laboratory and diagnostic management and specimen tracking show moderate consistency.
Zavkhan	**4.0**	Processes indicate consistency and proper documentation. Some workflows are under revision or planned for update, particularly for patient health records, patient care tracking, and data coding and transformation.
Orkhon	**4.0**	All workflow processes are consistently used and established, scoring 4 across all categories.
Uvurkhangai	**4.0**	High consistency and documentation in most areas, with some categories under revision. Patient to provider communication and identity verification are used inconsistently.
Umnugovi	**3.3**	Generally consistent usage and documentation, although some areas like public health event response and patient to provider communication need improvement.
Sukhbaatar	**3.9**	Workflows established across all business processes. Some workflows such as specimen tracking, prescription management, public health event response, targeted communication, patient to provider communication and data analysis and visualisation are used inconsistently.
Tuv	**3.9**	Consistent usage and documentation across all areas with scores of 4, except for specimen tracking which needs improvement.
Uvs	**2.0**	Inconsistent or non-existent workflows in most areas, indicating significant gaps in documentation and implementation.
Khuvsgul	**1.4**	Very low scores with many processes not existing or used inconsistently, highlighting major gaps.
Khentii	**3.0**	Mixed scores with some workflows well-documented and others needing improvement, especially in patient to provider communication and data quality and improvement.

Recommendations

- Include key health system business processes in the business process reengineering efforts under the Digital Mongolia project.
- Conduct a detailed analysis of business processes that are targeted for digital health transformation to identify bottlenecks in existing processes.
- Establish standards and performance metrics for key business processes.

Assessment Outcomes: Operational Dimension

The operational dimension encompasses a variety of health facilities and health workforce that are essential for delivering health services. The effectiveness of digital health in enhancing service delivery, supporting health workers and improving health outcomes hinges on the readiness of health facilities to adopt and maintain digital technologies and the capability of health workers to utilise these systems effectively. Four domains were scored in this dimension:

- Infrastructure: do facilities have adequate infrastructure to support and maintain digital technologies?
- Human capacity: is there sufficient knowledge and skills to use and manage digital technologies?
- Data ecosystem: are facilities collecting essential health data? And how is data used and managed at facilities?
- Business processes: are there established business processes to coordinate health operations and inform the development of digital systems?

Additionally, the assessment investigated the existing applications environment, including user perceptions and challenges to adoption. Although this was not included in the overall score, it provided critical insights for further digital transformation in the health sector.

Participants

The assessment survey was distributed to 364 facilities and achieved an 80% response rate, with 291 facilities responding after a five-week data collection period (three duplicate responses were removed). The types of health facilities included in the assessments are detailed below.

Table 8: Distribution of participating facility types and provinces in the operational assessment.

Location	Aimag general hospital	District general hospital	District health center	Family health center	Other (governed by MoH)	Other (not governed by MoH)	Pharmacy	Private clinic	Private hospital	Regional diagnostic and treatment center	Rural general hospital	Soum health center grade A	Soum health center grade B	Soum health center grade C	Specialized center	Specialized hospital	Grand Total
1. Ulaanbaatar		1	5	31	4	1		13	10						6	17	88
10. Dornod				1	2		1	2		1		2	2	2		2	15
11. Dundgovi	1											1	1	1			4
12. Zavkhan	1			1				1				3	4	3			13
13. Orkhon				2				2		1						1	6
14. Uvurkhangai				1	3		1		1	1		3	1	2			13
15. Umnugovi				1			1	4		1			3	1			11
16. Sukhbaatar				1										2			3
17. Selenge				1	1	1		1	1			2	1	1	1		10
18. Tuv	1												2	4			7
19. Uvs	1			1			1					2	2	1			8
2. Arkhangai	1			1			1		1			6	1		1		12
20. Khovd	1			1			1	2	1		1	2					9
21. Khuvsgul	1				1		2		1			3	3	3			14
22. Khentii	2			1			1	1				1	1	4			11
3. Bayan-Ulgii	1			1	2		1	2	1			4		2			14
4. Bayankhongor				1			1	2				1	1	2			8
5. Bulgan	1											1	3	3			8
6. Govi-Altai	1				1		1	3				2	2	6			16
7. Govisumber	1							1									2
8. Darkhan-Uul	1			1		1	1	2	1				1				8
9. Dornogovi				3	3		1	2			1		2	1		1	14
Grand Total	**14**	**1**	**5**	**49**	**17**	**3**	**14**	**38**	**17**	**4**	**2**	**33**	**30**	**38**	**8**	**21**	**294**

Because the assessment did not receive a balanced number and type of facilities across the Aimags, an OLS regression analysis was used to determine the effect that this facility distribution had on the overall provincial scores. The R-squared value (0.886) indicated that the model explained 88.6% of the variance in the provincial total scores. The Adjusted R-squared value (0.521) adjusts for the number of predictors and provides a more realistic measure of model fit, suggesting that when accounting for the number of predictors, the model explains about 52.1% of the variance. The result of the OLS showed that an increase in the number of specialised hospitals (coefficient of 0.4235 is significant with p=0.025) may be associated with a higher provincial total score (without considering the performance of the assessment domains). Although not highly significant, it also showed a positive trend for Soum Health Centre B (p=0.087), indicating a potential positive impact on the provincial score. The presence of other facility types, including general hospitals, district health centres, and various clinics, did not show significant effects on the provincial scores. However, the high condition number suggests potential multicollinearity, meaning that the predictor variables may be correlated, complicating the interpretation of individual coefficients. Further analysis, possibly with a refined model including additional data such as population catchments and health services offered, might have further defined the relationships.

Pre-assessment

The pre-assessment questions administered to participants aimed to establish a baseline understanding of the current digital health activities. The questions explored key challenges at the facility, plans to implement digital health technologies, past investments in digital health activities, reasons for investing in digital health, funding pathways, and planning processes for digital health activities.

What are the key challenges at health facilities?

Participants were asked to describe five key issues they faced at the facility level. This was non-specific to either health or digital issues and could include both. Four primary themes emerged across the responses:

- Infrastructure Limitations (270 responses)
- Human Capacity Challenges (184 responses)
- Financial Constraints (129 responses)
- System Issues (114 responses)

The primary infrastructure challenge reported was the lack of equipment, including both ICT and clinical equipment, particularly for diagnostic purposes. While most facilities (96%) reported having computer hardware, 49% of these were either non-functional or more than five years old, making them incompatible with current digital health software. Many facilities also noted an insufficient number of computers. The second most reported issue was the physical condition of the facilities; many buildings were old, poorly maintained, and did not meet required quality standards. Common problems included inadequate water, sanitation, heating, and insufficient space for services and ICT equipment. Remote facilities further highlighted shortages in vehicles for patient transport and referral, as well as poor road infrastructure. Despite having internet connectivity, many facilities raised concerns about the speed and stability of the connection.

Challenges related to human capacity included a shortage of both clinical and ICT-skilled staff. Access to technical support for troubleshooting ICT issues is critical, especially in rural and remote facilities where digital literacy is also a concern. Poor technical support affects users' willingness to adopt digital health systems. The assessment identified an opportunity for telemedicine interventions to address gaps in clinical and ICT knowledge, provided there is sufficient infrastructure to implement them. Participants also emphasised the need for more training opportunities.

As in other dimensions, financial constraints posed significant barriers. Health insurance reimbursements, which contribute over 90% of facility budgets, were reported as insufficient to cover operational costs and did not adequately account for geographic differences in the cost of delivering care. This impact was felt more severely in rural and remote facilities, which serve smaller populations and receive less funding. This affects their ability to meet quality standards and purchase clinical and ICT equipment, compounded by the high cost and logistical challenges of acquiring such equipment in remote areas. Some participants noted that the discontinuation of discount medicines from health insurance reimbursements added additional financial strain. Other financial concerns included salary payments for non-civil servants and the inability to pay for overtime work.

Facilities that had already implemented digital health systems expressed a need for more integration across systems to reduce the burden of entering data multiple times. Participants mentioned missing functions and the low suitability of some systems for smaller facilities. Many commented that it was difficult to access and view data once it had been submitted. The assessment found that frequent changes in systems (almost annually in some cases) led to data loss or the need for manual re-entry.

Other issues included poor communication between smaller facilities and referral-level facilities, difficulties in getting appointments at referral facilities, and poor feedback on referred patients. Changes in regulations, often due to shifts in

authority or leadership, also posed challenges for the coordination of policies and activities.

What are recent and planned digital health activities at facilities?
When asked about their investments in digital health activities, the assessment discovered that participants are actively working to adopt ICT into health facilities and have been doing so for many years. In the last three years, facilities have invested in improving internet connectivity and adopting national systems such as Health.gov.mn, H-Info, ERP systems, hospital management systems, and more. Over one-third of participants indicated plans to implement digital health activities in the next year in response to government orders. Common activities reported included improvements to infrastructure for ICT adoption, investments in mHealth and portable devices, updates to existing systems such as PACS, adding new modules to systems, and installing new systems. This indicates a high motivation for digital transformation despite the challenges.

The most commonly reported reason for making such investments in digital health was to improve efficiency and information availability, demonstrating an awareness of the benefits of digital health. Others noted that this was the direction required by the government to receive national health insurance funding. A few highlighted that digital health could help improve patient satisfaction.

However, despite their aspirations for ICT adoption, funding pathways seem limited. Most facilities reported that their funding is primarily provided by the state and national insurance fund. Few facilities, specifically larger hospitals and specialist centres reported being able to generate funds through grants and external donor agencies. However, these funds were often limited to specific disease areas. Comparably, smaller facilities have little opportunity to generate or access other funding to support digital health activities.

Operational dimension score

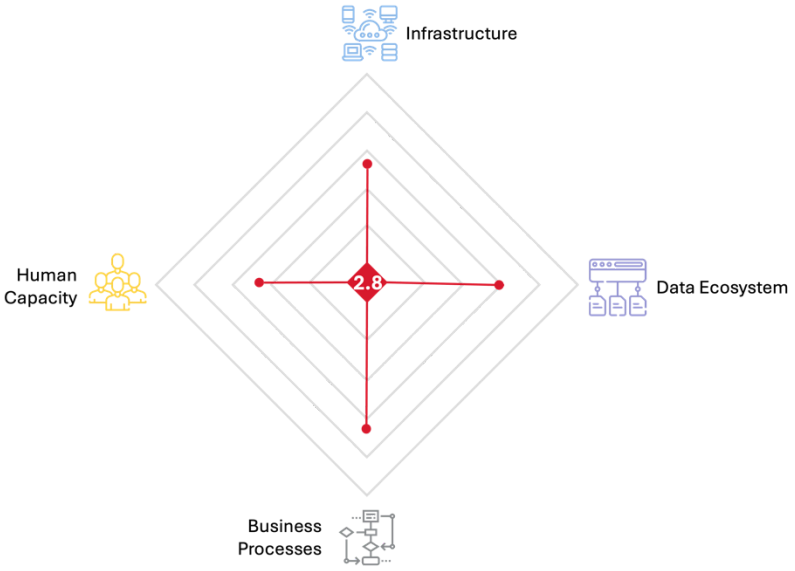


Figure 22. Overall Score for the Operational Dimension.

The overall score at the operational level was 2.8, which is below the midpoint (3) of the assessment scale, indicating challenges for implementing and adopting digital health technologies. The human capacity domain received the lowest score, 2.4, across this layer of the assessment. This consistently low score across all three dimensions of the assessment highlights a critical area where substantial investment is needed for digital transformation in the health sector, requiring a multi-faceted approach.

The digital infrastructure domain scored the second lowest, with a 2.6. This domain presents a significant barrier to adopting and maintaining digital health technologies and risks increasing the digital divide if not addressed. The business process domain scored the highest with 3.3. The tables below provide detailed scores for provinces and facility types.

Table 9: Digital readiness scores across Aimags

Location	Digital infrastructure	Human capacity	Data ecosystem	Business processes	Total Score
Mongolia	**2.6**	**2.4**	**3.0**	**3.3**	**2.8**
Ulaanbaatar	2.9	2.8	3.1	3.4	**3.1**
Arkhangai	2.4	2.0	2.6	3.0	**2.5**
Bayan-Ulgi	2.5	2.3	2.7	3.1	**2.6**
Bayankhongor	2.5	2.1	2.5	3.1	**2.5**
Bulgan	2.6	2.2	3.3	3.6	**2.9**
Govi-Altai	2.3	2.0	2.9	3.4	**2.6**
Govisumber	2.4	2.2	2.9	3.7	**2.8**
Darkhan-Uul	2.8	2.8	3.0	3.3	**3.0**
Dornogovi	2.7	2.4	2.9	3.5	**2.9**
Dornod	2.7	2.5	3.2	3.8	**3.0**
Dundgovi	2.7	2.2	3.1	3.3	**2.8**
Zavkhan	2.6	2.2	3.3	3.6	**2.9**
Orkhon	2.9	2.7	3.3	3.5	**3.1**
Uvurkhangai	2.1	2.1	2.8	3.3	**2.6**
Umnugovi	2.6	2.3	3.2	2.7	**2.7**
Sukhbaatar	2.4	1.9	2.6	2.9	**2.4**
Selenge	2.5	2.6	2.9	3.3	**2.8**
Tuv	2.4	2.4	3.0	3.5	**2.8**
Uvs	2.8	2.4	3.2	3.5	**3.0**
Khovd	2.6	2.4	3.0	3.4	**2.9**
Khuvsgul	2.7	2.1	3.0	3.3	**2.8**
Khentii	2.3	2.0	2.6	2.6	**2.4**

These results disprove a common assumption that the further an Aimag is from the capital, Ulaanbaatar, the less developed it may be and the more challenging it is to carry out digital health activities. Figure X below illustrates the scoring across Aimags, showing that some Aimags, such as Uvs, Khovd, Zavkhan, Dornod, and Dornogovi, performed better than the overall score for the operational dimension. These Aimags demonstrated better readiness in digital infrastructure and human capacity.

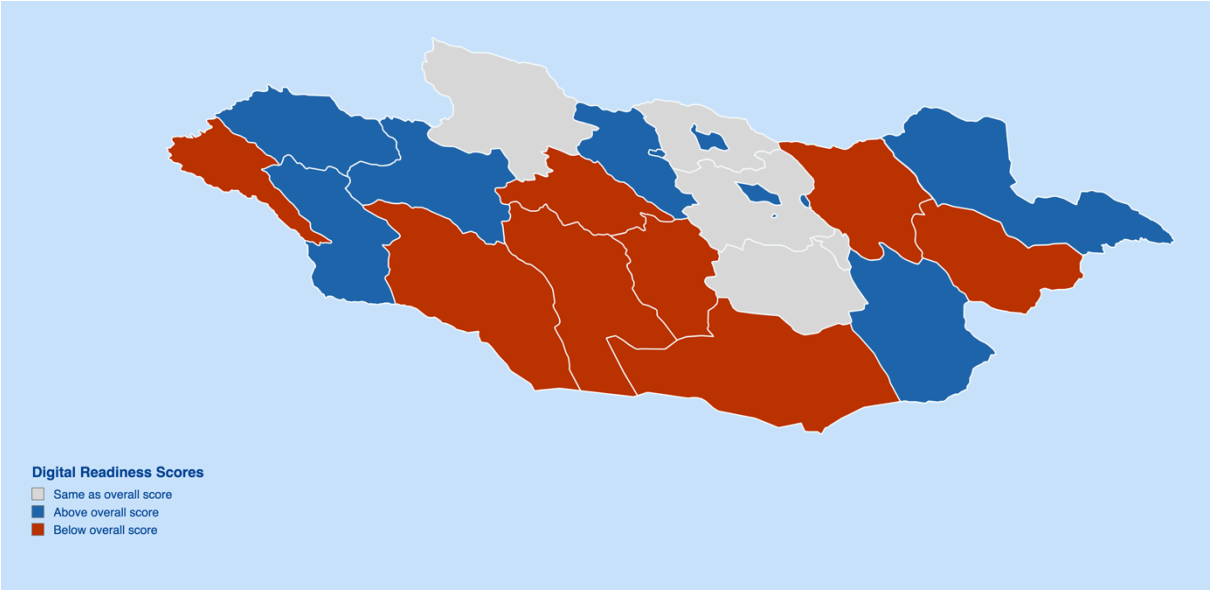


Figure 23. Operational readiness compared across Aimags

Although the presence of specialised hospitals in UB, Arkhangai and Selenge may have contributed to more positive scores (as per the OLS analysis), the overall scores in Selenge (2.8) and Arkhangai (2.5) were on par or poorer than the overall country score of 2.8, suggesting that the variability in digital infrastructure, human capacity, data ecosystem and business processes were more significant.

Eight Aimags and the capital, Ulaanbaatar, scored above the overall score for the operational layer, five scored the same, and eight scored below the overall score. Those that scored above were strong in two or more assessed domains, compared to Aimags that scored below the overall score. Notably, three Aimags—Arkhangai, Sukhbaatar, and Khentii—consistently scored lower than the overall scores in each of the four domains, indicating that these Aimags are in greatest need of investment to participate in digital transformation and benefit from digital health technologies.

Table 10: Digital readiness scores across type of facility

Facility Type	Digital infrastructure	Human capacity	Data ecosystem	Business processes	Total Score
All	**2.6**	**2.4**	**3.0**	**3.3**	**2.8**
Regional Diagnostic and Treatment Centres	3.1	3.0	3.3	3.5	**3.2**
Specialised Centre	2.8	2.8	2.9	2.9	**2.8**
Specialised Hospital	3.3	3.1	3.5	3.8	**3.4**
Aimag General Hospital	2.8	2.9	3.4	3.4	**3.1**
District General Hospital	3.1	3.8	3.6	4.0	**3.6**
District Health Centre	3.0	3.6	3.2	4.0	**3.3**
Family Health Centre	2.7	2.6	3.0	3.5	**3.0**
Rural General Hospital	2.8	2.6	2.9	3.8	**3.0**
Soum Health Centre A	2.7	2.0	3.0	3.4	**2.8**
Soum Health Centre B	2.5	2.0	2.9	3.4	**2.7**
Soum Health Centre C	2.4	2.1	3.1	3.4	**2.7**
Other MoH	2.7	2.5	2.8	3.1	**2.8**
Other non-MoH	2.3	3.1	2.9	3.6	**3.0**
Private Clinic	3.5	2.2	2.6	3.0	**2.6**
Private Hospital	3.2	2.9	3.1	3.3	**3.1**
Pharmacy	2.5	2.3	2.4	2.6	**2.5**

In terms of facility-level score comparisons, smaller facilities generally performed lower than larger facilities. Contributing factors to these lower scores in smaller facilities included limited digital infrastructure and human capacity. Qualitative survey responses provided additional insight, indicating that smaller facilities often have smaller budgets to support the upfront and ongoing costs of digital health activities.

Although district general hospitals scored the highest, this finding is based on only one participating facility in the sample and therefore may not be representative. Similarly, specialised hospitals, which had the next highest scores, were predominantly from Ulaanbaatar, with only two or fewer from Dornod, Orkhon, and Dornogovi.

In other facility types with better distribution across all Aimags, district health centres performed the best. Family health centres also scored above the overall average. In contrast, soum health centres generally scored lower. Surprisingly, private clinics performed worse than soum health centres. This may be due to some private clinics not being registered with the General Authority of Health Insurance, which disburses health funding, thereby requiring them to rely on their own funds for operations. Pharmacies also performed lower than other facilities, likely because some survey questions were not relevant to their structure and functions.

Overall, these findings highlight the need for targeted investments and support to enhance digital infrastructure and human capacity, particularly in smaller and private facilities, to ensure a more equitable digital health transformation across Mongolia.

Detailed observations within each domain are discussed below.

Infrastructure

Modern, functional equipment and reliable internet connectivity are crucial for the efficient operation of digital health systems. Adequate infrastructure ensures the

sustainability and long-term viability of digital health initiatives, promoting continuous improvement in healthcare delivery and outcomes. This domain specifically evaluated whether facilities had access to basic utilities like electricity and internet connectivity, adequate communication platforms, essential ICT hardware, and the capacity to maintain ICT equipment.

The overall infrastructure score of 2.6 indicates a significant barrier to the adoption and sustainability of digital health initiatives. Access to basic utilities was the best-performing component in this domain, scoring 3.1, which reflects the government's commitment to improving infrastructure. However, the capacity to maintain ICT equipment scored the lowest at 2.2, highlighting a critical area needing improvement. The availability of adequate equipment for digital health also scored low, which, alongside maintenance capacity, underscores the human capacity and financial challenges faced by participants.

Notably, 50% of the provinces scored lower than the overall score, with mountainous terrain and poor road access in these Aimags being major contributing factors. These geographical challenges impede the development and maintenance of infrastructure, making it more difficult to support and sustain digital health technologies.

Table 11. Infrastructure scores across Aimags.

Location	Basic Utilities	Comm. Platforms	Equipment	Maintenance	Total Score
Mongolia	**3.1**	**2.7**	**2.3**	**2.2**	**2.6**
Ulaanbaatar	3.5	3.0	2.6	2.6	**2.9**
Arkhangai	3.5	2.5	2.1	1.8	**2.4**
Bayan-Ulgi	3.5	2.1	2.1	2.3	**2.5**
Bayankhongor	2.9	2.7	2.3	2.0	**2.5**
Bulgan	3.5	2.8	2.3	1.8	**2.6**
Govi-Altai	3.1	2.0	2.1	1.9	**2.3**
Govisumber	3.0	2.5	2.0	2.0	**2.4**
Darkhan-Uul	3.9	2.5	2.3	2.4	**2.8**
Dornogovi	3.4	2.8	2.4	2.3	**2.7**
Dornod	3.6	2.7	2.2	2.3	**2.7**
Dundgovi	3.8	2.8	2.0	2.3	**2.7**
Zavkhan	3.4	2.7	2.4	2.0	**2.6**
Orkhon	3.6	3.1	2.2	2.6	**2.9**
Uvurkhangai	2.7	2.0	1.9	1.9	**2.1**
Umnugovi	3.8	2.4	2.2	2.1	**2.6**
Sukhbaatar	3.4	2.7	1.9	1.4	**2.4**
Selenge	3.6	2.2	2.0	2.1	**2.5**
Tuv	3.4	2.4	1.8	1.9	**2.4**
Uvs	3.8	2.5	2.4	2.7	**2.8**
Khovd	3.5	2.7	2.2	2.1	**2.6**
Khuvsgul	3.7	2.9	2.1	2.1	**2.7**
Khentii	3.3	2.3	2.0	1.6	**2.3**

Across various facility types, five specific types scored lower than the overall score. These included Soum Health Centres type B and C, other non-MOH facilities (military and special purpose facilities), private clinics, and pharmacies. Soum health centres, particularly type B and C, are smaller facilities that face funding limitations, which affects their ability to purchase and maintain equipment. Private clinics, not

receiving government support, miss out on benefits from policies and programs aimed at improving public health infrastructure. As a result, these facilities struggle more with maintaining adequate infrastructure compared to those that receive government assistance.

Table 12: Infrastructure scores by facility type.

Facility Type	Basic Utilities	Comm. Platforms	Equipment	Maintenance	Total Score
All	**3.1**	**2.7**	**2.3**	**2.2**	**2.6**
Regional Diagnostic and Treatment Centres	4.0	3.4	2.5	2.7	**3.1**
Specialised Centre	3.2	3.0	2.6	2.3	**2.8**
Specialised Hospital	4.0	3.3	2.9	3.0	**3.3**
Aimag General Hospital	3.7	2.7	2.4	2.4	**2.8**
District General Hospital	3.7	3.0	2.6	3.2	**3.1**
District Health Centre	3.3	2.7	2.7	3.0	**3.0**
Family Health Centre	3.4	2.7	2.3	2.3	**2.7**
Rural General Hospital	4.0	3.0	2.4	2.0	**2.8**
Soum Health Centre A	3.7	2.6	2.3	2.0	**2.7**
Soum Health Centre B	3.4	2.6	1.9	1.9	**2.5**
Soum Health Centre C	3.2	2.5	1.9	1.8	**2.4**
Other MoH	3.5	2.6	2.4	2.2	**2.7**
Other non-MoH	3.4	1.8	1.7	2.4	**2.3**
Private Clinic	3.2	2.3	2.2	2.1	**2.5**
Private Hospital	3.7	3.3	2.7	3.0	**3.2**
Pharmacy	3.3	2.0	2.4	2.5	**2.5**

Access to Basic Utilities

Eighty percent of participants reported having electricity from the national grid to support all areas of their facilities. Additionally, 7% of facilities indicated the use of alternative energy sources, predominantly hydropower, with others including solar and diesel, highlighting the country's efforts to diversify its energy supply. The assessment also inquired about the availability of backup power, essential for maintaining the operation of critical ICT equipment like servers and networks during main electricity supply interruptions, thereby preventing disruptions in digital health systems. However, only 12% of facilities reported having one or more functional backup energy devices. Meanwhile, 38% reported that although they possessed backup equipment, it was no longer functional.

Regarding internet connectivity, 97% of facilities reported having an internet connection. Despite this high connectivity rate, participants reported significant challenges with internet speed, with 66% expressing concerns. To quantify these issues, facilities were asked to conduct speed tests. The results showed a discrepancy between test speeds and user experiences: 65% of facilities had download and upload speeds exceeding 25 Mbps (with some surpassing 500 Mbps), 9% had speeds between 11-25 Mbps, and 26% had speeds below 10 Mbps. Outdated equipment (such as routers and computer hardware), network congestion, service providers throttling speeds, and the distance from telecom infrastructure are factors that potentially influence internet speed. Additionally, from an application perspective, insufficient server capacity for digital systems might cause slow performance, which health workers could mistakenly attribute to internet speed

issues. Cost was another significant concern, with 40% of facilities paying more than 200,000 Tugriks per month to maintain their internet connection.

Secure Communication Platforms

By using secure systems, healthcare organisations can safeguard sensitive information, prevent data breaches, and maintain data integrity. As part of the e-Mongolia project aimed at providing modern technological solutions to support administrative processes and service delivery, the government has implemented a national ERP system for secure communication and document sharing. However, the assessment revealed that the uptake of this system has been low (13%), despite participants being aware of and having access to it.

It is common practice for facilities to use personal emails and platforms such as Google Drive to store and share health documents and data. Additionally, there is extensive use of social platforms like Viber, Facebook Messenger, and Telegram for I communication and coordination. This practice highlights a lack of understanding of the need to use secure platforms and suggests a need to revise communication policies to include safeguards for social platforms.

When asked why they do not use the national communication platforms, participants mentioned that they find the system complicated compared to existing platforms they have been using, such as Google. This insight is valuable for technology partners to improve their systems for users and for the government to provide more training support for national systems. Others cited cost and internet connectivity issues as barriers to using the platform.

Sufficient and Adequate ICT Equipment

Results of the assessment noted that the age of equipment posed a greater challenge than the availability of equipment, reflecting the financial constraints in renewing or updating technology to keep pace with advancements. While 93% of facilities reported having computer equipment, nearly half (49%) indicated that their equipment was older than five years. This ageing equipment hinders the adoption of new software solutions and affects the performance of newer software.

The assessment also evaluated the availability of other equipment, such as tablet devices and video conferencing tools, considering the increasing trend towards telemedicine and mHealth. Only 26% of facilities reported having tablet devices, and a quarter of these were older than five years. For video conferencing equipment essential for participating in the national telemedicine network, just over half of the facilities had the necessary tools. Specifically, 32% of facilities possessed robust video conferencing equipment, while 24% relied on the camera and audio capabilities of laptops and mobile phones.

Furthermore, the assessment explored the availability of on-site servers, which are valuable for data backup and supporting offline software use in remote and rural areas. On-site servers were available in 28% of facilities, but nearly half (46%) of this equipment was outdated and required updating. Additionally, 16% of facilities reported that their server storage rooms did not meet quality standards, potentially affecting the performance and longevity of the equipment.

Financial constraints are the largest factor in procuring equipment; however, the assessment uncovered several other noteworthy challenges, such as the tender law and budget savings law. The tender law requires facilities to tender for expensive equipment, and vendors on the tender system are reported to have higher prices than those outside the system. The quality of vendor services was also highlighted, with some participants noting that vendors often supplied different equipment (different specifications and poorer performance) than was purchased. Similarly, the budget savings law requires facilities to buy the most cost-efficient equipment, which may not always meet the necessary specifications.

Processes and Capacity to Maintain ICT Equipment

Structured maintenance processes ensure that healthcare facilities can leverage technology effectively to improve health outcomes and patient satisfaction. Over the past year, 53% of the assessed facilities have made efforts to improve internet connectivity, 9% have updated their equipment, and an additional 1% have focused on enhancing security measures by performing software updates and setting up VPNs. This indicates a growing recognition of the importance of participating in Mongolia's digital transformation.

Budget allocations towards ICT maintenance reflect these efforts. While the majority of facilities (56%) could only allocate up to 20% of their budget to ICT maintenance, larger facilities were able to contribute higher percentages. It was noted that most facilities allocated a significant portion of their ICT budgets to funding internet connectivity, with less than 7% directed towards other maintenance activities.

Even though ICT maintenance policies are available in 47% of facilities, funding remains the largest barrier to updating and replacing equipment, with only 13% of facilities managing to periodically replace computers and other hardware. Additionally, the assessment found that less than half of the facilities (45%) had established inventory systems to track and monitor equipment. This practice was mostly associated with larger facilities that have operational and financial management structures in place.

In terms of technical support for troubleshooting hardware and software issues, 43% of facilities noted that tech support was limited and significantly impacted by their distance from the capital. Only 19% of facilities reported having on-site support or support through their administrative department, resulting in long waiting times to resolve ICT equipment issues. Sixty-seven percent of facilities stated that it took two months or more to resolve issues, compared to those near or in the capital, who could resolve issues in under one month. Long waiting periods impact the facilities ability to then submit health data for reporting of service reimbursement. Participants commented that the availability of ICT equipment and parts for maintenance in the country might be a contributing factor.

Moreover, few facilities (20%) had established processes and plans for data backup and recovery in the event of a disaster, likely viewing it as the software vendor's responsibility to provide such measures.

Recommendations

- The recently launched Starlink services in Mongolia could be prioritised to support internet connectivity in mountainous and other challenging terrains. By providing wide coverage, quick deployment, consistent performance, and flexibility, satellite internet can support various digital health initiatives and enhance access to essential services in remote areas.
- Provide seminars and workshops on secure communications and use of secure government platforms through the relevant organisations and training channels.
- Partner with ICT vendors to support maintenance and updating of hardware and equipment.
- Require software vendors to provide hardware specifications for software's and their updates to help guide procurement and maintenance activities.
- Improve trade logistics with the international community to improve the availability and cost of ICT equipment.
- Review and revise laws concerning procurement of equipment to align with digital transformation goals.
- Improve the vetting process of ICT vendors to ensure quality services and equipment and supplies.
- Partner with banks and financial institutions to create credit schemes and establish microfinance programs that offer low-interest loans for purchasing ICT hardware.

Human Capacity

Digital transformation cannot succeed without a competent workforce equipped with the skills and capacity to utilise and maintain ICT equipment. Without relevant skills and capacity, digital health transformation efforts may face resistance and delays in adoption. This domain explored digital literacy among the existing workforce, the availability of technical staff, and the existence of training opportunities for health workers to acquire new skills and stay updated with digital health trends.

The overall score for human capacity in the operational dimension was 2.4. This low score was largely attributed to the scarcity of technical skills at the facility level and a low level of digital literacy (33-40%) among both clinical and non-clinical staff. Digital transformation entails significant changes, and the shortage of skilled staff in facilities adds an additional burden when developing the necessary skills for these changes. Moreover, there were challenges related to the availability and accessibility of training opportunities in the environment.

At the provincial level, only four Aimags and Ulaanbaatar scored above the domain average, while 13 Aimags scored below it. Sukhbaatar had the lowest score across the country, with a score of 1.9.

Table 13: Human capacity scores across Aimags.

Location	Workforce skills	Technical capacity	Training	Total Score
Mongolia	**3.2**	**1.6**	**2.5**	**2.4**
Ulaanbaatar	3.5	2.1	2.8	**2.8**
Arkhangai	2.8	1.1	2.1	**2.0**
Bayan-Ulgi	2.6	1.6	2.5	**2.3**
Bayankhongor	2.9	1.0	2.3	**2.1**
Bulgan	3.3	1.1	2.1	**2.2**
Govi-Altai	2.6	1.1	2.4	**2.0**
Govisumber	2.5	1.5	2.6	**2.2**
Darkhan-Uul	3.1	2.5	2.9	**2.8**
Dornogovi	3.6	1.4	2.4	**2.4**
Dornod	3.6	1.5	2.6	**2.5**
Dundgovi	3.3	1.5	1.9	**2.2**
Zavkhan	3.0	1.2	2.6	**2.2**
Orkhon	3.3	2.0	2.7	**2.7**
Uvurkhangai	2.6	1.2	2.4	**2.1**
Umnugovi	3.2	1.5	2.1	**2.3**
Sukhbaatar	2.2	1.0	2.4	**1.9**
Selenge	3.4	1.8	2.7	**2.6**
Tuv	3.4	1.6	2.4	**2.4**
Uvs	2.9	1.8	2.6	**2.4**
Khovd	3.1	1.6	2.6	**2.4**
Khuvsgul	2.8	1.3	2.2	**2.1**
Khentii	2.7	1.2	2.1	**2.0**

Among facility types, the scores followed an expected trend, with larger referral and specialist facilities performing better than primary health facilities. Primary facilities, both public and private, are also less likely to employ technical staff given the size and budget of the facility type. This emphasises the need for district and even bagh-level technical hubs to support smaller facilities and support them to participate in digital transformation activities. The lack of participation in digital transformation by primary health facilities has significant implications. It may result in a health system that lacks reliable and complete data at the primary care level, which is essential for informing and effectively implementing primary healthcare programs. Patients may also be less willing to attend primary facilities that are not keeping up with technological advancements, fearing that these facilities may not provide the same level of services as those that are more advanced.

Table 14: Human capacity scores by facility type.

Facility Type	Workforce skills	Technical capacity	Training	Total Score
All	**3.2**	**1.6**	**2.5**	**2.4**
Regional Diagnostic and Treatment Centres	3.4	2.5	3.0	**3.0**
Specialised Centre	3.1	2.0	3.1	**2.8**
Specialised Hospital	3.6	2.7	3.0	**3.1**
Aimag General Hospital	2.6	2.9	3.3	**2.9**
District General Hospital	3.5	4.0	3.8	**3.8**
District Health Centre	3.0	3.0	3.4	**3.1**
Family Health Centre	3.5	1.5	2.7	**2.6**
Rural General Hospital	3.5	1.5	2.8	**2.6**
Soum Health Centre A	2.9	1.1	2.2	**2.0**
Soum Health Centre B	2.8	1.1	1.9	**2.0**
Soum Health Centre C	2.9	1.1	2.3	**2.1**
Other MoH	3.5	1.6	2.4	**2.5**
Other non-MoH	3.8	2.3	3.1	**3.1**
Private Clinic	3.0	1.5	2.2	**2.2**
Private Hospital	3.9	1.9	2.9	**2.9**
Pharmacy	3.0	1.5	2.3	**2.3**

Training Opportunities for Health Facility Staff

Training is a crucial component for improving the digital literacy of health facility staff. Therefore, the assessment examined the training opportunities available to staff. In terms of basic digital and computer literacy training—covering tasks such as using computers, sending emails, conducting online searches, and operating software—the assessment found that 51% of facilities had no opportunities or few plans for training staff. While 9% of facilities offered such training, attendance was not mandatory for staff. In 35% of facilities, training was provided only as part of the staff onboarding process, and in just 5% of facilities, digital literacy training was mandatory.

For facilities that had implemented digital health software, the assessment inquired about the training received for using the software. It was found that 53% of facilities provided training at least once when the software was implemented, but in half of these cases, not all staff attended the training, leaving them to rely on learning from others or referring to user guides. Twenty percent of facilities admitted that no training was provided, and 18% only received user guides. In 9% of facilities, staff received refresher training when system updates were made, typically in larger or specialist facilities.

Regarding the incorporation of digital health topics into in-service training plans, 30% of facilities reported having done so already, 27% admitted that their in-service training plans did not yet include digital health topics, and 43% were still working on establishing such plans. The main challenges related to establishing training opportunities for health facility staff included the lack of available trainers, funding constraints, and poor infrastructure at the facilities to conduct training. Additionally, a small percentage of participants (less than 5%) mentioned the lack of time and motivation for health staff to attend training sessions. Language barriers were also cited as a significant obstacle for accessing training on open and online platforms.

Recommendations

- Prioritise the translation of globally available digital literacy programs to improve training effectiveness and coverage across facilities.
- The variability in resources across facility types, and even Aimags suggest that training programs should be tailored to the local context, language, and culture to increase relevance and effectiveness. Some strategies for improving training programs in low-resource contexts include:
    - For facilities accessible by road, use mobile training units equipped with necessary technology (computers, tablets, internet access) to visit remote or underserved areas. This brings training directly to communities, reducing the need for local infrastructure.
    - Partner with community centres, schools, libraries, or other local institutions that may have basic infrastructure. By leveraging existing resources, it reduces the need for additional investments in training infrastructure.
    - Develop and distribute offline training materials such as printed manuals, USB drives with preloaded content, or CDs/DVDs. This overcomes issues with internet connectivity and allows for self-paced learning.
    - Use local radio and television broadcasts to deliver training sessions on digital literacy. This reaches a wide audience and can be accessed without the internet.

Data Ecosystem

Data collected by health facilities is not only crucial for national health reporting but, at the facility level of the health system, is also vital for enhancing patient care, operational efficiency, quality assurance, compliance with standards, and identifying training needs. Digital health can significantly increase the accessibility and utility of this data for health facilities. However, the implementation of digital health solutions can have negative implications if the current data ecosystem is inefficient. Digitising flawed processes can lead to even greater inefficiencies. This domain evaluates the availability, collection, and management of data relevant to health facilities.

The overall score for this domain was 3.1, with the data collection theme contributing most positively (4.0) towards the score compared to data management practices contributing most poorly (2.2). Eleven Aimags performed better than the overall score compared to 9 Aimags that scored below the overall score.

Table 15: Data ecosystem scores across Aimags.

Location	Information availability	Data collect	Data mg	Total Score
Mongolia	**3.2**	**4.0**	**2.2**	**3.1**
Ulaanbaatar	2.8	4.2	2.5	**3.2**
Arkhangai	3.2	3.5	1.9	**2.9**
Bayan-Ulgi	2.9	3.5	2.1	**2.9**
Bayankhongor	2.9	3.6	1.5	**2.6**
Bulgan	3.9	4.3	2.2	**3.5**
Govi-Altai	3.5	3.8	1.7	**3.0**
Govisumber	3.3	3.3	2.8	**3.1**
Darkhan-Uul	2.9	4.3	2.3	**3.1**
Dornogovi	3.2	3.8	2.0	**3.0**
Dornod	3.7	4.3	2.0	**3.3**
Dundgovi	3.5	3.9	2.1	**3.2**
Zavkhan	3.6	4.3	2.5	**3.5**
Orkhon	3.3	4.3	2.4	**3.4**
Uvurkhangai	2.9	3.8	2.1	**2.9**
Umnugovi	4.0	4.2	2.3	**3.5**
Sukhbaatar	4.2	3.3	1.4	**3.0**
Selenge	3.2	3.6	2.2	**3.0**
Tuv	3.4	4.3	2.1	**3.3**
Uvs	3.3	4.7	2.2	**3.4**
Khovd	3.2	3.8	2.5	**3.2**
Khuvsgul	3.5	3.8	2.2	**3.2**
Khentii	3.0	3.5	1.9	**2.8**

Across facility types, only specialised centres, rural general hospitals, other MoH facilities, pharmacies, and non-MoH facilities (including private clinics) performed lower than the overall score. This may be attributed to the distinct management styles and healthcare focuses of these facility types. Notably, the availability of data, such as population data and feedback on reported data, was significantly lower in most of these facilities. Also observed, as the lower data management scores in other pharmacies, MoH and non-MoH facilities (including private facilities) suggest that different practices are employed in these settings. The disaggregation of scores by facility type suggests that standards for the data ecosystem must be tailored according to the type and function of the facilities.

Table 16: Data ecosystem scores by facility type.

Facility Type	Information availability	Data collect	Data mg	Total Score
All	**3.2**	**4.0**	**2.2**	**3.1**
Regional Diagnostic and Treatment Centres	3.6	4.9	2.3	**3.6**
Specialised Centre	2.8	3.4	2.6	**2.9**
Specialised Hospital	3.3	4.6	2.9	**3.6**
Aimag General Hospital	3.2	4.5	2.9	**3.5**
District General Hospital	3.5	5.0	2.3	**3.6**
District Health Centre	3.4	4.3	2.4	**3.4**
Family Health Centre	3.0	4.4	2.3	**3.2**
Rural General Hospital	2.8	3.8	2.5	**3.0**
Soum Health Centre A	3.4	4.0	2.1	**3.2**
Soum Health Centre B	3.6	4.0	1.9	**3.2**
Soum Health Centre C	3.7	4.2	2.0	**3.3**
Other MoH	3.3	3.4	2.0	**2.9**
Other non-MoH	2.7	4.3	2.1	**3.0**
Private Clinic	2.7	3.5	2.0	**2.7**
Private Hospital	2.6	4.4	2.5	**3.2**
Pharmacy	3.2	2.5	1.7	**2.5**

Availability of information for health facilities

The assessment identified two critical types of information for health facilities: population catchment data and feedback on their reported data. Population catchment data is essential for health facilities to understand community needs, plan resources and targeted health interventions, and provide equitable and effective healthcare services. Receiving feedback on reported health data and indicators is crucial for improving data quality, ensuring accurate performance monitoring, and fostering a data-driven approach to healthcare management.

According to the assessment, 45% of facilities indicated they receive regular updates on their population catchment, while 40% reported receiving this data only upon request. Notably, 15% of facilities indicated they do not receive population catchment data from the health department. While the challenges of estimating population catchment data were not investigated in this assessment, they may have contributed to the scores above.

In terms of feedback on reported data, 16% of facilities reported not receiving any feedback, and 36% received feedback only upon request. The remaining 48% received feedback either annually, quarterly, or monthly. This highlights the need for more consistent and proactive communication between health departments and facilities to ensure effective data utilisation.

Data collection at facilities

As Mongolia moves towards a more patient-centric health system, the assessment aimed to evaluate whether facilities collect patient-level data to enhance precision medicine and conduct patient satisfaction surveys to understand patient needs and challenges. Positively, 73% of facilities reported collecting patient-level data for all in-patient and out-patient services. However, 8% indicated that they only collect this data for in-patient services, while 20% of facilities reported only collecting aggregate data.

Regarding patient satisfaction surveys, only 5% of facilities, predominantly private clinics, other non-MoH facilities, two Soum Health Centres, and a specialised centre, reported not conducting any surveys. Additionally, 29% of facilities mentioned that they collect or receive patient satisfaction scores but do not monitor these regularly or use them to inform management and operational changes. The majority of facilities (66%), however, indicated active collection and use of patient satisfaction data, demonstrating a strong commitment to patient-centric services.

Data Management Practices

Good data management at the facility level of the health system is essential. It includes data quality checks, data analysis and use for planning, and methods to ensure the safe storage and protection of personalised data. These practices ensure the integrity of health data, making it useful at all levels of the health system. Conversely, poor data management practices create bottlenecks in analysing and using data at operational and strategic levels. When collecting patient-level data, there is a risk of duplicate records affecting health projections and insights at both facility and regional levels. Digital health solutions can help prevent duplicate records, but it remains essential for facilities to include record checks as part of their data management processes.

The assessment revealed that 29% of facilities have a process to remove duplicates, conducted either monthly or annually. Meanwhile, 40% reported conducting ad hoc duplicate record checks, and 31% did not conduct record checks at all. Given that health facilities may use different software for collecting patient data, it may be necessary for software vendors to inform users about the mechanisms in place (or the lack thereof) to manage duplicate records so that facilities can establish additional checks. The assessment also noted that multiple patient systems might be used within facilities, and conducting checks across all systems can be time-consuming, especially for those lacking the human capacity for such activities.

Regarding data storage and data protection, 45% of facilities admitted to not having any processes in place, possibly viewing this as the software providers' responsibility. Only 8% of facilities reported using regulations and policies established by the Ministry of Health (MoH) or the Aimag Department of Health. Meanwhile, 17% indicated they followed these regulations but also established their own internal policies. This reflects the need to create awareness about the different responsibilities that systems and people have in data storage and protection.

When asked about data analysis and use in facilities, the main challenge was the lack of capacity and skills: 25% reported having no capacity, 60% reported having limited capacity and knowledge, and only 15% said they have sufficient capacity and skills for robust data analysis and use.

Overall, the assessment observed high variability in data management practices, with only 16% of facilities having a data management and improvement plan.

Recommendations

- Make dashboards available to facilities to improve the availability of information and promote a data-driven culture for health management.
- Improve knowledge and skills around data management across facilities.
- Identify common data variables across the health system and establish data and metadata standards for common terminologies tracked entities (such as facilities and health workers).
- Publish and ensure compliance with data and metadata standards amongst software and technology vendors.

Business Processes

By implementing business processes, health facilities can identify bottlenecks in their day-to-day activities and determine where digital interventions are most needed. This enables them to prioritise investments in digital solutions that address multiple issues across the facility, thereby enhancing efficiency, quality of care, regulatory compliance, patient safety, and overall operational excellence.

The assessment evaluated 21 business processes, as recommended by the "Building a Digital Information Infrastructure (Infostructure) for Health" handbook, across various facilities. The overall score across all 21 business processes was 3.3, indicating inconsistent use of business processes and resulting in missed opportunities for improvement. Moreover, without the use of business processes to identify bottlenecks, digital health investments may be misdirected and fail to address the challenges faced by health facilities effectively.

Table 17: Operational Dimension: Business Processes Scores.

#	Business Process		Score
		Overall	**3.3**
A	Related to facility-based care and services	Patient health record management	3.6
B		Patient care tracking	3.5
C		Referrals within health facility	3.3
D		Referrals outside the health facility	3.4
E		Laboratory and diagnostic management	3.3
F		Specimen tracking	3.2
G		Prescription management	3.4
H	Related to communication	Public health event response	3.4
I		Targeted and untargeted alerts and communications	3.5
J		Peer-to-peer communication between physicians	3.4
K		Patient to provider communication	3.5
L		Public health event notification	3.4
M		Patient-based reporting	3.6
N	Related to identity management	Civil registration and vital statistics (births and deaths)	3.3
O		Patient identity verification	3.3
P		Patient enrolment in health services	3.5
Q	Related to data management	Data collection and management	3.4
R		Data storage and aggregation	3.3
S		Data coding and transformation	2.7
T		Data analysis and visualisation	2.9
U		Data quality and improvement	3.1

All scores except those for “data coding and transformation” and “data analysis and visualisation” fall within one standard deviation of the overall score. This may be due to the variability in systems used for these processes.
The total scores for Aimags were similar across 18 provinces that scored within one standard deviation of the total score. Arkhangai, Umnugovi, Sukhbaatar and Khentii demonstrated lower usage of business processes.

Table 18: Business processes scores across Aimags.

Location	Total Score
Mongolia	**3.3**
Ulaanbaatar	**3.4**
Arkhangai	**3.0**
Bayan-Ulgi	**3.1**
Bayankhongor	**3.1**
Bulgan	**3.6**
Govi-Altai	**3.4**
Govisumber	**3.7**
Darkhan-Uul	**3.3**
Dornogovi	**3.5**
Dornod	**3.8**
Dundgovi	**3.3**
Zavkhan	**3.3**
Orkhon	**3.5**
Uvurkhangai	**3.3**
Umnugovi	**2.7**
Sukhbaatar	**2.9**
Selenge	**3.3**
Tuv	**3.5**
Uvs	**3.5**
Khovd	**3.4**
Khuvsgul	**3.3**
Khentii	**2.6**

Across facilities, Specialized Hospitals and Pharmacies fell below one standard deviation of the overall score. This is likely due to their day-to-day activities differing significantly from other facility types, rendering many of the business processes irrelevant to these facilities. Three facility types—District General Hospitals, District Health Centres, and Rural General Hospitals—scored above one standard deviation of the total score, indicating greater consistency and use of business processes.

Table 19: Business processes scores by facility type.

Facility Type	Total Score
All	**3.3**
Regional Diagnostic and Treatment Centres	**3.5**
Specialised Centre	**2.9**
Specialised Hospital	**2.8**
Aimag General Hospital	**3.4**
District General Hospital	**4.0**
District Health Centre	**4.0**
Family Health Centre	**3.5**
Rural General Hospital	**3.8**
Soum Health Centre A	**3.4**
Soum Health Centre B	**3.4**
Soum Health Centre C	**3.4**
Other MoH	**3.1**
Other non-MoH	**3.6**
Private Clinic	**3.0**
Private Hospital	**3.3**
Pharmacy	**2.6**

Recommendations

- Conduct an assessment of established processes to determine their fit and suitability across health facilities. This may provide insights into business processes that need updating or training needs for staff to follow established processes.
- Use bottlenecks in existing business processes to guide the development of digital health products and solutions across the health system.

Applications & Interventions

Although the assessment did not score the application domain within this dimension, evaluating the existing applications was crucial. This evaluation aimed to identify the types of systems available, the software and technology they use, their implementation methods, and their user-friendliness. These insights are valuable for the MoH and MDDC in setting priorities for the digital strategies, governing systems and applications, and establishing necessary policies. Additionally, it can help software vendors enhance the design and usability of their systems and provide valuable information for designing and implementing future systems.

Types of Systems Used

Health facilities were asked to indicate the use of 19 application types identified in the “Classification of Digital Interventions, Services, and Applications in Health” guideline developed by WHO. These applications are considered relevant for addressing bottlenecks and challenges in the health system.

"Electronic medical records" were the most commonly available systems across facilities, with more than 70% of facilities reporting their use. However, in 10% of cases, these systems were either not used or non-functional at the time of the assessment. The availability of "Learning and Training Systems" was also around 70%, possibly reflecting the established national telemedicine network that supports

health worker training and expert assistance. However, telemedicine systems were only available in 28% of facilities.

Other widely used application categories included human resource management systems (66%), health management information systems (61%), laboratory information systems (47%), facility management information systems (46%), logistics management information systems (45%), pharmacy information systems (45%), health program monitoring systems (44%), and personal health records (44%). What wasn't clear from this assessment was whether these categories existed as distinct systems or as functions within a combined system.

A surprising observation was the use of social media across all system categories. While this may indicate a misunderstanding of the question, it nonetheless warrants further investigation.

Table 20: Category of applications available across health facilities.

Application Category	Not Available	Planned for use	Available, but not functional or used	Available and used	Face book/ social media are used
Communication systems (example for messaging patients)	70	25	15	80	101
Community-based information systems (for feldshers or outreach activities)	160	22	9	51	49
Decision support systems (example electronic diagnostic and treatment guidelines)	185	19	19	51	17
Diagnostic information systems (Example PACs or radiology information systems)	183	20	18	57	13
Electronic medical records	53	17	19	183	19
Laboratory information systems	123	20	19	117	12
Personal health records (patient accessible health record)	123	21	21	108	18
Pharmacy information systems	127	23	26	104	11
Telehealth and mHealth systems	174	21	30	51	15
Blood bank information systems	207	20	15	40	9
Health finance and insurance management systems	62	11	16	40	22
Health management information systems	71	17	22	154	27
Health program monitoring systems (Example TB/ HIV information systems)	120	23	21	106	21
Health resource information system (for managing health workers)	56	19	17	176	23
Learning and training systems	44	24	13	188	22
Logistics management information system (for drug or equipment distribution and stock management)	117	26	27	103	18
Patient administration systems (for registration and appointment management)	141	29	17	86	18
Facility management information systems (hospital management systems)	113	26	20	113	19

Types of technology and software used
Among the three types of technology platforms reported by facilities, mobile applications were the least common, while web-based and local systems were used similarly. A small percentage of respondents (less than 5%) were unsure of the technology platform, likely due to a lack of technical knowledge or the absence of technical staff during the assessment. The use of local systems highlights the need for offline capabilities in certain settings. Factors promoting the use of local systems included the cost of internet connectivity and the lack of internet stability, which hindered data capture activities. Some facilities also indicated that local systems did not require monthly or annual licence fees after purchase, making them more affordable.

Regarding the software technologies employed, a range of commercial, open-source, and custom-built (licensed) systems were used, with custom-developed systems being the most common. This underscores the need to establish clear development guidelines for health sector software to ensure alignment with interoperable standards in the health system architecture. The lower use of open-source systems was attributed to the lack of human capacity to manage these systems at the facility level. If Mongolia aims to increase the use of open-source software, it will be necessary to establish regional management teams to support facilities in managing updates and changes to the system.

System Usability
The user-friendliness of systems significantly impacts the willingness to use them. The assessment asked participants to comment on two aspects to gauge system user-friendliness: the ease or difficulty of using the system and whether the system's workflow was simpler than the previous paper-based system. More than half of the participants (53%) indicated that the available systems were easy to use. Almost a quarter (23%) found the systems difficult to use, and a further 25% reported experiencing some difficulties.

Regarding the system workflow, 48% of participants found it simpler than the paper-based process, 31% observed no difference between the digital and paper-based processes, and 21% found the digital systems more difficult to use than the paper-based ones. The perceived complexity and workflow of systems may have been influenced by the participant's level of digital literacy or infrastructure issues hindering system usage. Regardless, these insights highlight the need to adopt more human-centred design principles to improve health workers' willingness to adopt digital health systems.

Implementation practices
To ensure successful digital health adoption, it is crucial to provide comprehensive training and robust technical support. This not only enhances user confidence and competence but also maximises the benefits of digital health systems, ultimately leading to better patient care and more efficient health services. In the assessment, participants described several ways they received training on systems. Most participants (27%) received training via online platforms such as Zoom. In-person training at health facilities and user manuals (including video content) were also common (18%). Others indicated the availability of training through an online learning system (17%) and off-site training centres (6%). However, as much as 14%

reported not having received any training on systems. The range of training methods used reflects the need for flexibility and accessibility in training delivery to accommodate different learning preferences and environments.

When asked about the technical support offered to address software or hardware issues, on-site support through an ICT team was most common (30%), followed by online chat (15%). Email (13%), telephone (12%), and call-centre (12%) support were other user support methods. Notably, 18% had no user support or had to rely solely on the user manuals provided to troubleshoot issues. These results confirm the need for a variety of user support approaches. Failing to provide adequate user support will likely lead to user frustration and promote system switches. Some participants confirmed that they often switched systems due to usability and support issues.

Recommendations

- Require software and technology vendors to adopt human-centred design principles and include health facility staff in the design and development of systems.
- Establish clear guidelines and compliance mechanisms for custom software development.
- Conduct user-testing of system prototypes to gather feedback from health facility staff to improve the design and implementation of digital health products and solutions.
- Ensure multiple approaches to training and user support for digital health systems.
- Require system vendors to report on training conducted at facilities, as well as provide refresher training annually or following system updates.

Assessment Limitations

The DHLA, while comprehensive, faced several limitations that should be acknowledged to provide a clear context for interpreting the results and findings. These limitations include language barriers, abstract terminologies, response bias, limited access to remote areas and variability in digital literacy.

Language Barriers and Terminology Translation

In certain instances, global terminologies lack direct translations in the Mongolian language. To address this, adjustments were made in the assessment's wording to ensure clarity within the Mongolian context. Consequently, some concepts may deviate from the global terms originally employed. This variable understanding of specific terminology may have impacted the results. Additionally, the terminology used to describe digital health concepts was sometimes too abstract for respondents, resulting in less detailed responses than expected.

Response Bias in Self-Reporting

The assessment methodology included self-reporting, which is inherently subject to response bias. Respondents might have provided socially desirable answers rather than their true experiences or opinions, potentially skewing the data. This bias is

particularly relevant in contexts where digital health literacy varies significantly, and respondents might have felt compelled to provide positive feedback.

Access to Remote Areas
Conducting assessments in Mongolia's vast and sparsely populated rural areas posed logistical challenges. Limited access to some remote regions may have resulted in underrepresentation of these areas in the assessment. This geographical limitation could lead to a skewed understanding of the digital health landscape, disproportionately reflecting the experiences and resources available in more accessible urban areas.

Digital Literacy Variability
Despite the participant samples having a blend of managerial, clinical and ICT staff, the level of digital literacy may have influenced their ability to accurately understand and respond to the assessment questions. In regions with lower levels of digital literacy, respondents may have found it challenging to engage fully with the assessment, leading to incomplete or less accurate responses. This discrepancy can affect the assessment's overall representation of the digital health landscape.

Technological Infrastructure Disparities
Disparities in technological infrastructure between urban and rural areas also posed a limitation. Areas with inadequate internet connectivity or digital resources might have been underrepresented, as the ability to participate in the assessment could be hindered by these infrastructural constraints. This underrepresentation can lead to an incomplete picture of the digital health environment in Mongolia.

Overall, while this report provides valuable insights, these limitations must be considered when interpreting the findings. Acknowledging these constraints helps in understanding the context and in planning future assessments and interventions to address the gaps identified.

Discussion

The Digital Health Landscape Assessment (DHLA) of Mongolia provides a comprehensive evaluation of the nation's digital health ecosystem. The overall assessment score of 2.8 out of 5 indicates that Mongolia's digital health environment is active, with significant participation from various stakeholders and facilitated by working groups. However, several challenges and gaps need to be addressed to optimise the benefits of digital health initiatives.

While there is a significant drive from national leadership towards digital transformation, sub-national levels of the health system lack dedicated leadership and champions. This deficiency makes it challenging for these levels to implement national plans effectively. Additionally, a break in communication from the top-down and bottom-up further exacerbates these challenges, leading to inefficiencies and delays in implementation.

The roles of E-Government departments and the MoH are complementary but need clearer definition to avoid overlaps and enhance collaboration. Effective collaboration between these entities is essential to maximise the benefits of digital health

initiatives. The following table outlines specific focus areas where the MDDC may support the MoH with digital health transformation.

Table 21: The Role of eMongolia in Health Sector Digitization.

Area	Description
ICT infrastructure and services	Providing setup and implementation of government portals, essential operational platforms for email communication, document creation (e.g. Microsoft 365) and knowledge management (e.g. SharePoint).
	Facilitating access to and procurement of data storage and hardware through approved vendors (includes negotiating costs of hardware, internet and satellite devices in the public sector).
	Improving the coverage, bandwidth and costs of internet connectivity by establishing competitive environments for telecommunication vendors and advocating for more fibre-optic cables.
	Improving trade logistics for ICT equipment and parts.
Regulatory environment	Strengthen the regulatory environment for ICT through the development of relevant legislation and policy. Support and advise sectors in establishing relevant policies for digital transformation – example, expansion of HR policies to include digital health roles and competencies.
ICT capacity	Establishing infrastructure for in-service training centres/hubs (for use by all sectors).
	Collaborating with training institutes to provide or update ICT programs in line with digital transformation needs.
	Strengthening recruitment and retention initiatives for ICT cadres. (Example, establishing requirements for scholarship candidates or coordinating expatriate programs)
	Supporting the development of broad ICT skills at early stages of education (primary and secondary levels)
Donor Coordination	Establishing a platform for donor coordination and development finance.
Technology development	Implementing a unique ID system and maintaining a client or population registry for the health sector (and others) to verify and validate identity in the provision of services.
	Introducing platforms and technologies that facilitate digital payments for public services.
	Establishing platform for consent management of citizen data that needs to be shared across sectors systems

Strategic Dimension

In the strategic dimension, the assessment evaluates the alignment of Mongolia's digital health initiatives with national priorities and international commitments. The Ministry of Health (MoH) and other relevant ministries have made significant strides in securing funding and establishing essential policies and regulations. However, even though the government has secured funding, it is still not sufficient to achieve

the ambitions of the Vision 2050. Therefore, the digital health strategy must use a phased approach to implement digital health and prioritise activities in line with major health system bottlenecks. By costing the digital health projects the government is pursuing, they would be able to plan better for funding and lobby with investors for areas where they lack funding. An investment roadmap is essential to ensure they can secure the resources and funding needed to achieve the digital transformation goals. Tools like the Total Cost of Ownership tool from Digital Square are useful for developing costed plans and investment roadmaps.

Additionally, there is a pressing need to establish a full governance structure, as recommended in the assessment document. This structure should include forums to facilitate better communication with sub-national levels of the health system. Effective collaboration and clear communication channels are crucial for maximising the benefits of digital health initiatives and ensuring a cohesive approach to digital transformation.

Management Dimension

The management dimension of the assessment reveals a lack of champions and specialists to lead regional efforts for digital health. These stakeholders should play a more significant role in lobbying for reforms in health budget allocation to support the better implementation of national plans. The assessment also highlighted a significant need to bolster digital health knowledge, particularly to support facilities with digital health implementation. The absence of specialised knowledge and leadership at the regional level can lead to fragmented systems and inefficiencies. Strategic investments in human capacity development and targeted support for regional champions are essential for addressing these gaps and enhancing the management of digital health initiatives.

Additionally, Departments of Health need to establish relationships with the private sector, which is increasingly supporting digital health systems development in Mongolia. Through this collaboration, they would be able to strengthen the design of applications that will suit the regional context best. They also play a key role in ensuring interoperability across digital health systems is well-developed and scalable. Departments of Health must develop a deeper understanding of the data flows within the health system so that they can inform the development of health data standards and exchange platforms. They are crucial in supporting the national level with developing a seamless interoperability architecture across the health system. With this knowledge of the data ecosystem, they can also inform the development of digital systems from the private sector.

Operational Dimension

The operational dimension assessment underscores that health facilities are struggling to keep up with the transformation goals of the country due to significant challenges with infrastructure, knowledge, and skill capacity. National plans for digital health must be adapted to accommodate the different capabilities of various facilities and prioritise improving the enabling environment to help smaller facilities catch up with larger ones. Digital health cannot be implemented uniformly across all facilities because their functions, resources, and budgets differ significantly. Therefore, digital health plans must be contextualised for these different settings.

A key insight from this section is that applications developed for health facilities are largely designed for large facilities and are not practical or sustainable for smaller facilities. These applications often do not consider the different workflows and services provided by various facility types. Human-centred design plays an important role in the willingness of users to adopt digital health systems. Tailored solutions that meet the specific needs of different facility types are crucial for the successful implementation of digital health initiatives.

It is also important to note the frustration of health workers having to enter data multiple times across the health system. This redundancy in data entry is time-consuming and inefficient, detracting from patient care. Therefore, digital transformation should not only focus on adopting and implementing systems but also require system developers to work more collaboratively to reduce data entry redundancies. Creating integrated systems that communicate effectively with each other is essential to streamline workflows and improve data accuracy and efficiency.

Priority Areas

Strategic Dimension

- Governance and Coordination: Establish a centralised governance structure for digital health with clearly defined roles and responsibilities. Develop a comprehensive digital health strategy that aligns with national priorities and international commitments. Enhance collaboration between the Ministry of Health (MoH) and E-Government departments to streamline digital health initiatives. Establish forums to facilitate better communication with sub-national levels of the health system.
- Funding and Investment: Secure sustainable funding sources for digital health initiatives. Encourage private sector investment in ICT for rural areas through CSR initiatives. Implement strategic purchasing to ensure efficient use of resources. Develop costed plans for digital health projects and create an investment roadmap to secure necessary funding.
- Policy and Regulatory Environment: Develop and enforce policies and regulations specific to digital health, including data exchange, storage, and system development. Establish a centralised knowledge platform for digital health strategies and projects to enhance coordination and transparency.

Management Dimension

- Human Capacity Development: Invest in comprehensive workforce training and long-term capacity development. Update human resource plans to include digital health roles and competencies. Establish partnerships with global leaders to facilitate skills transfer and capacity building. Support the development of regional champions and specialists to lead digital health initiatives and lobby for necessary reforms.
- Private Sector Collaboration: Establish relationships with the private sector to support digital health systems development. Collaborate to design applications suited to regional contexts and ensure scalability and interoperability of digital health systems. Develop a deeper understanding of data infrastructure to inform the standardisation and exchange of data, supporting the development of a seamless interoperable architecture.

- Infrastructure Development: Address the disparities in technological infrastructure between urban and rural areas. Ensure equitable access to digital tools across all regions. Implement clear maintenance policies and guidelines for digital health infrastructure.
- Interoperability and Data Management: Enhance interoperability across health information systems. Develop national standards for data exchange and implement mandatory training for ICT staff. Establish robust data management practices to ensure data quality and accessibility.

Operational Dimension

- Facility Management and Operations: Provide targeted support and resources to smaller health facilities to enhance their capacity to adopt and maintain digital health technologies. Develop tailored solutions that meet the specific needs of different facility types.
- Patient-Centric Services: Foster a culture of patient-centric care by promoting the regular collection and use of patient satisfaction data. Implement systems that enhance patient engagement and improve the overall quality of care.
- Continuous Improvement and Innovation: Encourage innovation in digital health by supporting pilot projects and scaling successful initiatives. Establish mechanisms for regular review and improvement of digital health systems and practices.
- Integrated Data Systems: Reduce data entry redundancies by developing integrated systems that communicate effectively with each other. Work collaboratively with system developers to streamline workflows and improve data accuracy and efficiency.

Conclusion

The overall assessment score of 2.8 indicates that Mongolia is making significant strides in digitising its health sector. However, critical areas still need attention to achieve the goals outlined in the Vision 2050 document. Key barriers include fragmented systems and disparities in infrastructure, knowledge, and human capacity. By focusing on strategic governance, sustainable funding, comprehensive workforce training, and robust infrastructure development, Mongolia can continue its digital transformation journey, ensuring improved health outcomes for all its citizens. Strengthening collaboration across the levels of the health system (National, Aimags and facilities) and between the public and private sectors, as well as leveraging international partnerships will be vital in overcoming these challenges and achieving a resilient and efficient digital health ecosystem.

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