Kingdom of Cambodia

Nation-Religion-King

Health Information System Master Plan 2016-2020

Department of Planning and Health Information
November 2017

FOREWORD

A good HIS brings together all relevant partners to ensure that users of health information have access to reliable, authoritative, useable, understandable, comparative data. The long term vision of the Ministry of Health for HIS in Cambodia has hence been appropriately articulated as "all people in Cambodia will have better health and wellbeing through effective use of real-time health and health related information by all key stakeholders". The long-term vision for HIS development is envisaged to be achieved in 3 phases with the first period being 2016-2020, the second extending from 2021 to 2025 and the third phase lasting up to 2030.

The development of the HIS Master Plan comes at an important time when the health sector is implementing far reaching reforms to achieve Universal Health Coverage in line with the Cambodia Sustainable Development Goals. This Master Plan is fully aligned with the third Health Strategic Plan which outlines a clear development framework for the health sector, and includes strategic objectives supported by potential priority areas at both supply- and demand-sides. It is therefore very appropriate that the strategic objective 6 of the HSP3 has been adopted as the goal for the HIS Master Plan.

In order to have in place a Master Plan that is holistic and inclusive, the HIS Master Plan is developed through participatory process, led by HIS Bureau. The process benefitted greatly from expert inputs received from the inter-ministerial HIS-TWG chaired by the Director, Department of Planning and Health Information (DPHI) which has been re-vitalized during the development of the Master Plan and assumed the most important role of a think tank.

On behalf of the Ministry of Health, I call for active participation and strong support of all health staff, all departments and national health programs, relevant ministries and agencies, sub-national level administrations, Development Partners, NGOs, private sector and community for the successful implementation of the HIS Master Plan, in order to ensure that high quality, accurate and timely health and health–related data and information are available and used together with results of sound health research. I also expect that DPHI plays the role of an effective gatekeeper and ensures that all health sector players follow and implement the Master Plan.

Phnom Penh, 6 November, 2017

Prof. ENG HUOT
SECRETARY OF STATE

ACKNOWLEDGEMENTS

This Health Information System (HIS) Master Plan is a product of a concerted effort by the Health Information System Bureau of the Department of Planning and Health Information who worked tirelessly alongside the International Consultant hired through the Global Fund supported Health Systems Strengthening (HSS) Grant to develop it, under the stewardship and guidance of the Director of DPHI in constant consultation with the HIS Technical Working Group (TWG).

The Ministry of Health would like to gratefully acknowledge the significant contribution of a number of people, without whose efforts the development of this HIS Master Plan 2016-2020 would not have been possible. At the outset, we would like to express our sincere gratitude to the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) for supporting all key activities related to the development of this Master Plan and to the Principal Recipient office, MOH for enabling this support through the Health Systems Strengthening (HSS) Grant.

We would like to express our deep sense of gratitude to Dr. Lo Veasnakiry, Director of DPHI who provided the overall direction and guidance during the entire process of the Master Plan development. We are greatly indebted to Dr. Ly Vichea Ravouth, Dr. Sok Kanha, Mr. Ros ChhunEang, Dr. Buth Saben, Dr. Chev Mony, Dr. York Dararith, Mr. Sek Sokna, for pro-actively and comprehensively participating in the entire exercise from reviewing the previous HIS Strategic Plan, facilitating a SWOT analysis, organising and participating in one-on-one meetings with key partners, coordinating and conducting two consultative workshops and rigorously reviewing and improving every draft of the Master Plan until its finalisation. We are also highly thankful to Dr. Seshu Babu Vinjamuri, International Consultant, who closely supported DPHI and HIS TWG at every stage of the NSP development with preparatory work, technical guidance and facilitation. All the HIS TWG members need a special mention for their commitment, involvement and valuable contributions to the Master Plan development. All the staff of DPHI, the PR-MOH office, MOH Departments of Communicable Diseases Control, Hospital Services, Preventive Medicine, Human Resources, Personnel and the National Programmes for Maternal and Child Health, HI/AIDS, TB and Malaria, Referral Hospitals, Provincial Health Departments and Operational Districts have all provided their valuable inputs in the development of this document and hence deserve our whole-hearted thanks.

We would like to thank Dr. Jun Gao, Dr. Momoe Takeuchi, Mr. Ieng Vanra, Ms. Rochelle Eng, Dr. Vanchinsuren Lkhagvadorj and Mr. Mai Mo all from WHO; Dr. Chantha Chak and Mr. Serey Rathanak Suon from USAID; Dr. Ly Vanthy and Dr. Lori Newman from US-CDC; Dr. Kelvin Hui from GIZ; Dr. Alvin Marcelo from AeHIN; Mr. Michael Stahl, Mr. Steve Mellor and Dr. Steeve Ebener, consultants from ADB; Dr. Dineke Venekamp, Mr. Im Chanry, Dr. Suon Bophea from the Palladium Group, Dr. Christophe Grundmann, Mr. Tapley Jordanwood and Mr. Hong Roith from URC, Dr. Mean Reatanak Sambath from PBH, Mr. Phan Chinda from MOI, Mr. Heng Sophat from NIS, Dr. Ir Por from NIPH, Dr. Ly Sovann and Mr. Sok Samnang from CDCD, Dr. Cheap Thonvuthy, Mr. Nhim Sothearith and Mr. Sohan Cheath from DDF, Dr. Sok Kong and team from DPM, Mr. Chhon Sopheak from Personnel Department, Dr. Prak Somaly from NMCHC, Mr. Mam Sovatha, Dr. Ieng Ou, Leng Chanratana, Chea Chamnan and Dr. Kim Rattana from NCHADS, Dr. Mao Tan Eang, Dr. Tieng Sivanna and Dr. Nou Chanly from CENAT, Dr. Siv Sovannaroth from CNM, International Consultants Dr. Vladimir Choi (US-CDC), Mr. John Hustedt (US-CDC), Mr. Eric Okimoto (USAID) and National Consultants Him Phannary and Soprach Tong for their valuable inputs during the different stages of the HIS Master Plan development.

Last, but not the least, Mr. Ouk Sophal, Mr. Ing Leng and Ms. Kol Sakrya need to be commended for their tireless and continuous coordination, administrative and logistical support during the Master Plan Development.

Minister of Health

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

4G	Fourth generation
ADB	Asia Development Bank
ADT	Admission, discharge and transfer
AeHIN	Asia e-Health Information Network
AI	Avian influenza
AOP	Annual operational plan
API	Application programming interface
APR	Annual performance review
ArcGIS	Integrated collection of GIS software products from the Esri company that provides a standards-based platform for spatial analysis, data management, and mapping.
ASEAN	Association of Southeast Asian Nations
BHS	Better Health Services (USAID supported)
BSP	Budget strategic plan
CamEWARN	Cambodia Early Warning System
CamHDD	Cambodia health data dictionary
CamLIS	Cambodia Laboratory Information System
CD	Chronic disease
CDC	Communicable disease control
CDCD	Communicable Disease Control Department
CDHS	Cambodia Demographic and Health Surveys
CDSS	Clinical decision support service
CENAT	National Center for Tuberculosis and Leprosy
CIES	Cambodia Inter-Censal of Economic Survey
CIPS	Cambodia Inter-Censal Population Surveys
CMDG	Cambodian millennium development goals
CMS	Central Medical Store
CNM	National Center for Parasitology, Entomology and Malaria Control
CPA	Complementary package of activities
CR	Client registries
CRVS	Civil Registration and Vital Statistics
CSDG	Cambodia sustainable development goals
CSES	Cambodia Socio Economic Survey
DB	Database
DDF	Department of Drug and Food
DFAT	Department of Foreign Affairs and Trade, Australia
D&D	Decentralization and de-concentration
DHIS	District Health Information System
DHS	Department of Hospital Services
DID	Drug Inventory Database
DM	Diabetes Mellitus
DMT	Data management tool (currently being used by Personnel department)
DP	Development partner
DOTS	Direct observed treatment short course
DPHI	Department of planning and health information
DPM	Department of Preventive Medicine
DQA	Data quality assessment
e-	electronic (for e.g. e-education, e-government, e-commerce, e-health and e-tourism)
EDB	Essential drugs bureau
EHR	Electronic health record
EBS	Event Based Surveillance
EMPI	Enterprise master patient index
EMR	Electronic medical record
ESCAP	Economic and Social Commission for Asia and the Pacific
ESS	Essential support services
FMIS	Finance management information system
GAVI	Global Alliance for Vaccines and Immunisation

GDI	General Department of Immigration
GDP	Gross domestic product
GFATM / GF	The Global Fund to Fight AIDS, Tuberculosis and Malaria (or the Global Fund)
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMS	Greater Mekong Sub-region
GNSS	Global Navigation Satellite System GIZ
HC1	Standardized form for health centers and former district hospitals
HCDID	Health Center Drug Inventory Database
HCMC	Health center management committee
HCP	Health coverage plan
HDG	Health Development Goals
HEF	Health Equity Fund
H-EQIP	Health Equity and Quality Improvement Project
HF	Health Facilities
HID	Health infrastructure development
HIE	Health Information Exchange
HIM	Health Information Mediator
HIS	Health Information System
HISC	Health Interoperability Standards Committee
HISF	Health Interoperability Standards Framework
HISSP	Health Information System Strategic Plan
HIV	Human immunodeficiency virus
HMIS	Health Management Information System
HO2	Standardized form for national, provincial and referral hospitals
HOSDID	Hospital Drug Inventory Database
HP	Health Post
HPC	Health professional councils
HQ	Headquarters
HR	Human resource(s)
HRD	Department of Human Resource
HRH	Human resources for health
HRIS	Human Resource Information System
HSD	Health service delivery
HSF	Health system financing
HSG	Health system governance
HSP2	Second Health Strategic Plan 2011-2015
HSP3	Third Health Strategic Plan 2016-2020
H-SPIS	Health – Social Protection Information System
HSS	Health Systems Strengthening.
HTN	Hypertension
HWD	Health workforce development
IBS	Indicator Based Surveillance
ICD	International Classification of Diseases
ICT	Information and Communication Technology
ID	Identity document
IDPoor	Identification of Poor (Program)
IEC	Information, education and communication
IHR	International health regulation
IIS	Insurance information system
ILI	Influenza like illness
IMCI	Integrated Management of Childhood Illness
InSTEDD	Innovative Support To Emergencies Diseases and Disasters (a non-profit organization)
IPC	Infection prevention and control
IPIS	Integrated population identification system
ITSSU	Information Technology, Systems and Services Unit (proposed)
JAPA	Joint annual plan appraisal
JAPR	Joint Annual Performance Review
KfW	Kreditanstalt für Wiederaufbau
KOICA	Korea International Cooperation Agency

KPI	Key performance indicator
KSNFH	Khmer-Soviet National Friendship Hospital
KIDC	Khmer Identification Code
LMIS	Logistics Management Information System
MA4Health	Measurement and Accountability for Results in Health
M&E	Monitoring and Evaluation
mHealth	Mobile health
MDG	Millennium development goal
MDP	Municipal department
MDR	Multi drug resistance
MEF	Ministry of Economy and Finance
MIS	Management Information System
MLMIS	Medicines Logistics Management Information System
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MOH	Ministry of Health
MOI	Ministry of Interior
MOL	Ministry of Labour
MOND	Ministry of National Defence
MOP	Ministry of Planning
MOU	Memorandum of Understanding
M/PHD	Municipal/Provincial Health Department
MPTC	Ministry of Post and Telecommunication
MPA	Minimum package of activities
MPSP	Ministry of Planning Strategic Plan
MRA	Mutual recognition agreement
MRS	Management Review System
MS	Microsoft
MySQL	A relational database management system
NATDID	National Drug Inventory Database
NCD	Non communicable disease
NCHADS	National Center for HIV/AIDS, Dermatology and STD
NGOs	Non-governmental organizations
NHA	National Health Accounts
NHID	National Health Identifiers
NiDA	National ICT Development Authority
NIPH	National Institute of Public Health
NIS	National Institute of Statistics
NMCHC	National Maternal and Child Health Cente
NPRD	National Program to rehabilitate and develop Cambodia
NSCI	National Steering Committee on CRVS and Identification
NSDP	National Strategic Development Plan
NSPI	National Strategic Plan for Identification
NSSF	National Social Security Fund
NTD	Neglected tropical disease
OD	Operational district
OD3	Standardized form for operational districts
ODDID	OD Drug Inventory Database
OOPE	Out-of-pocket expenditure
PAE	Public administrative enterprise
PBB	Performance based budgeting
PC	Personal computer
PDA	Personal digital assistant
PHP	A widely used, general-purpose scripting language
PIP	Public investment plan
PIX/ PDQ	Patient Identifier Cross Referencing / Patient Demographics Query
PMO	Program Management Office (proposed)
PMRS	Patient Medical Registration System
PMTCT	Prevention of mother-to-child transmission
PNC	Post-natal care
PRODID	Provincial Drug Inventory Database

QPR	Quarterly progress review
QWP	Quarterly work plan
RCVIS	Road Crash and Victim Information System
RGC	Royal Government of Cambodia
RMNCHN	Reproductive maternal neonatal child health and nutrition
R&D	Research and Development
RRT	Rapid Response Team
RS	Rectangular Strategy
SAPR	Sector annual performance review
SARI	Severe Acute Respiratory Infection
SARS	Severe Acute Respiratory Syndrome
SC	Steering Committee
SDG	Sustainable Development Goals
SDG	Service delivery grant
SEDP	Socio-Economic Development Plans
SHP	Social Health Protection
SHR	Shared health record
SIS	Sequenced information systems
SNOMED	Systematized Nomenclature of Medicine
SOA	Special operating agency
SRDPs	Socioeconomic Rehabilitation and Development Programs
STEPS	WHO STEPwise approach to surveillance
STI	Sexually transmitted infection
SWG	Stakeholders Working Group
SWOT	Strengths, weaknesses, opportunities, and threats
TA	Technical Assistance
TOR	Terms of reference
TPIT	National Technical Program Implementation Team
TRC	Telecom Regulator of Cambodia
TS	Terminology service
TT	Task team
TV	Television
TWGH	Technical working group for health
UHC	Universal Health Coverage
UIS	Unique Identifying System
UPI	Unique Patient Identifier
URC	University Research Co., LLC
USAID	United States Agency for International Development
USB	Universal Serial Bus
US CDC	United States Centers for Disease Control and Prevention
VHSG	Village health support group
WB	World Bank
WHO	World Health Organization
WRA	Women of reproductive age (15-49)

GLOSSARY OF TERMS

Cloud computing
A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Coding
A procedure that assigns a numeric code to diagnostic and procedural data based on a clinical classification system.

Dashboard
A data visualization tool that displays the current status of metrics and key performance indicators (KPIs) for specific program such HMIS to support decision making to improve program intervention and monitoring.

Data
Data may be defined as a representation of facts or concepts or instructions in a formalized manner, suitable for communication, interpretation or processing by manual or electronic means. An element of data is an item, idea, concept or raw fact[1].

Data dictionary
A set of core uniform definitions and data items relating to the full range of health services and a range of population parameters.

Data element
A unit of data, usually defined by a set of attributes specifying its definition, its identification, the way it is represented and its permitted values.

Data management
Data management is the development, execution and supervision of plans, policies, programs and practices that control, protect, deliver and enhance the value of data and information assets[2].

e-Health
The use of information and communication technologies for….improving the flow of information, through electronic means, to support the delivery of health services and the management of health systems. In practical terms, e-Health is the means of ensuring that the right health information is provided to the right person at the right place and time in a secure, electronic form to support the delivery of quality and efficient healthcare.

Electronic Health Record (EHR)
An electronic record of health related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed, and consulted by authorized clinicians and staff across more than one health care organization.

Electronic Medical Record (EMR)
An electronic record of health related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization.

Geo-enable
Apply geospa**ti**al capabilities to a business process in order to establish the authoritative spatial location of business data, and enable contextual spatial analysis[3].

Global Navigation Satellite System (GNSS)

[1] Abdelhak M, Grostick S, Hankin MA, Jacobs E. Health Information: Management of a Strategic Resource. Philadelphia, WB Saunders Company, 1996.
[2] DAMA International. Guide to Data Management Body of Knowledge (DAMA DMBOK ®) https://technicspub.com/dmbok/
[3] US Government. Modernization Roadmap for the Geospatial Platform (Version 4.0). US Department of the Interior & Federal Geographic Data Committee, March 2011, p. 12.

Standard generic term for satellite navigation systems that provide autonomous geo-spatial positioning with global coverage. This term includes e.g. the GPS, GLONASS, Galileo, Beidou and other regional systems.

Geographic Information System (GIS)

An integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships, and model spatial processes. A GIS provides a framework for gathering and organizing spatial data and related information so that it can be displayed and analyzed[4].

Health information

Health care data that have been organized into a meaningful format.

Health Information Exchange (HIE)

The electronic movement of health-related information among organizations according to nationally recognized standards[5].

Health Information System (HIS)

A system that integrates data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services[6]. HIS is a much broader term than HMIS and includes HMIS, Patient Management Registration System (PMRS), Logistics Management Information System (LMIS), Human Resources Information System (HRIS), Financial Management System (FMS), etc.

Health record

A single record of all data on an individual's health status, including birth records, immunizations, reports of all physical examinations as well as all illnesses and treatments given in any health care setting. Often used interchangeably with "medical record," but is a broader concept

Health Management Information System (HMIS)

An information system specially designed to assist in the management and planning of health programmes, as opposed to delivery of care[7]. A ***health management information system*** collects and reports program information, such as incidence of disease, client/patient information, and health services rendered. HMIS data can be used to determine disease patterns or to track health services use, as well as to monitor and evaluate health service delivery[8].

ICD-10

International Statistical Classification of Diseases and Related Health Problems (10th revision) published by WHO.

Information System

A system that provides information support to the decision-making process at each level of an organization[9]

Integration

Systems can share data with each other

Interoperability

Systems can share data with each other and understand it for appropriate use.

Laboratory Information System

---

[4] http://wiki.gis.com/wiki/index.php/GIS_Glossary

[5] The National Alliance for Health Information Technology. Report to the Office of the National Coordinator for Health Information Technology on *Defining Key Health Information Technology Terms.* April 28, 2008.

[6] WHO (2000) Regional Office for the Western Pacific. *A selection of important health indicators.* Manila, Philippines. 2000.

[7] WHO (1993) Regional Office for the Western Pacific. *Guidelines for the development of Health Management Information Systems*. Manila, Philippines. 1993.

[8] World Health Organization Regional Office for the Western Pacific. 2004. *Developing Health Management Information Systems: A Practical Guide for Developing Countries*. World Health Organization 2004. Manila, Philippines: World Health Organization. http://www.wpro.who.int/publications/docs/Health_manage.pdf

[9] Hurtubise, R. Managing information systems: concepts and tools. West Hartford, CT, Kumarian Press, 1984.

A system that facilitates the collection, management, storage, analysis and reporting of data at laboratories.

Personal Health Record (PHR)

An electronic record of health related information on an individual that conforms to nationally recognized interoperability standards and that can be drawn from multiple sources while being managed, shared, and controlled by the individual

Primary data

Obtained from the original data source. That is, documentation in the patient's medical/health record collected by staff at either a hospital, health centre or in the community. Daily ward census reports collected in hospitals are also primary data.

Register

Also referred to as master list, official, complete, up-to-date and uniquely coded list of all the active records for a given object.

Registry

IT solution that allows storing, managing, validating, updating and sharing a register/master list

Secondary data

Data sets derived from primary data. Secondary data are individual or aggregate health care data found in reports that are summarized from the source. At the hospital or health centre level, secondary data include the master patients' index, disease and procedure indexes, health care statistics and disease registries. At primary care level, they also include such aspects a as the patients' name index and statistics.

Standards

Best practice principles and guidelines for collection and storage of health care data.

System

A collection of components that work together to achieve a common objective[10]

Web Portal

The Health Information dissemination platform of officially published data by MOH for use by various stakeholders and will support MOH staff at subnational level in better analysis and control of health information.

[10] WHO (2000) Regional Office for the Western Pacific. *A selection of important health indicators.* Manila, Philippines. 2000.

EXECUTIVE SUMMARY

INTRODUCTION

DEMOGRAPHIC AND HEALTH BACKGROUND

1. Cambodia's total estimated population in 2016 is 15.2 million. The country is currently going through a demographic as well as an epidemiological transition and as a consequence, the health system is facing the dual challenge of on-going burden of communicable diseases and a growing epidemic of non-communicable diseases (NCDs). The existing structures of the health system will need to be strengthened, modified and expanded in different ways, while consolidating the gains made in the health status of the population which has remarkably improved over the last decade.

HEALTH SYSTEM ORGANIZATION

2. Cambodia has a pluralistic health system in which the main health infrastructure and public health care are delivered through the Ministry of Health (MOH), while the disparate private sector provides most outpatient curative care. Currently the Cambodian health system is organized into three levels: central, provincial and operational district level with clearly defined roles and functions at each level.

BRIEF HISTORY OF HEALTH INFORMATION SYSTEMS (HIS) IN CAMBODIA

3. Cambodia's Health Management Information System (HMIS) was formally launched in 1993 and complete coverage across the country achieved in February, 1995. Since its inception, the HMIS has undergone a number of revisions and the system was upgraded and migrated over to a web based database in 2010. Subsequently, the web based HMIS application has had many enhancements with the current HIS 3.0 version in use since 2015. Health Equity Fund (HEF) database, a patient level database was developed in 2004 at individual referral hospitals. By July 2012, all HEF Operators had successfully transitioned their activities into the Patient Medical Registration System (PMRS) as the core HEF patient management tool.

RATIONALE AND APPROACH FOR THE MASTER PLAN

4. There are several reasons why the DPHI, Ministry of Health, Cambodia decided to develop a Master Plan for 2016-2020. These include harmonization with national and sector policies and plans such as National Strategic Development Plan (NSDP) 2014-2018, National Strategic Plan of Identification (NSPI) 2017-2026, Ministry of Planning Strategic Plan (MPSP) 2014-2018, Statistical Law (2015), Cambodia Socio Economic Surveys, Cambodian ICT Masterplan 2020 and National Social Protection Policy Framework 2016-

2025; harmonization with national health needs and plans such as health information needs, Health Strategic Plan (HSP 3) 2016-2020, Health Information System Strategic Plan (HISSP) 2008-2015, need for integration of information systems, introduction of harmonized unique identifier system, data quality (PARIS 21 Initiative) and coordination of multiple sector stakeholders and plans.

5. The main purpose is to formulate a Master Plan for the HIS of the MOH under the leadership of the DPHI in accordance with the objectives of the Health Strategic Plan (2016-2020) and provide directions for formulation of roadmaps for different MOH departments, related line ministries and other implementation partners. A participatory approach involving multiple stakeholders was adopted with two consultative workshops being organized in February and March 2017 respectively. A situational analysis was presented along with suggested strategic priorities, strategic direction, vision, mission, objectives and key activities. Detailed feedback received from key stakeholders has been incorporated into the Master Plan.

SITUATION ANALYSIS

6. A situational analysis based on desk review of currently available documentation and applicable regional/ international best practices, regular team meetings within DPHI, one-to-one meetings with key stakeholders in their offices or in the field, rapid assessment through field site visits and two consultative stakeholder workshops was undertaken. The outputs from this analysis are presented sequentially as current status of overall HIS and selected sub-systems, use of ICT in the health sector, SWOT analysis and key recommendations.

7. Key organisational strengths to be harnessed during the Master Plan period include RGC's political will, improved HIS governance, availability of competent health training institutions, key systems (HMIS & PMRS) being web-based, institutionalization of data collection as well as data validation and report generation, nationwide coverage of HMIS, a very high 100% completeness of reports, recent increasing integration efforts among some MOH Departments and programs, standardization within HMIS, previous high reliability & quality of data, data management using computers, staff commitment at different levels, custom built systems, use of selected open-source technologies, richness of data and local resource mobilization. Organisational weaknesses persist such as a lack of a proper governance structure to guide the development of HIS and eHealth, lack of interdepartmental coordination at different levels with stakeholders continuing to build separate systems, disparate systems operating in silos due to verticalization/ fragmentation of programs, lack of a clear, visible and readily-available landscape. timeline & evolution of systems not being available for several systems, slow expansion of PMRS at health centre level, poor reporting compliance of private providers, slow progress in penetration of digital devices at health center level, quantitative and qualitative gaps, low levels of ICT capability

within MOH, lack of updated policy and guidance in specific areas, financial constraints, inadequate capacity building, delayed communication of information to sub national levels, low staff motivation, lack of regular supportive supervision, recording and reporting burden, lack of standards, unavailability of a single health unique identifier, lack of data quality checks at sub-national levels, inadequate national capacity in data analysis, limited use of data for decision making and relative lack of feedback to sub-national levels.

8. Environmental opportunities to be fully capitalized upon include political commitment to SDGs, RGC's D&D policy, recent economic growth, rapid expansion of infrastructure and communications, projected ICT expansion in the country, high penetration of internet, availability of web and cloud based platforms, RGC's commitment to national identification, consistent engagement of specific development partners, Cambodia's integration into ASEAN, expansion of the AeHIN, public engagement, participation and demand generation, availability of regional best practices, and participation of related ministries and departments. Environmental threats to be overcome during the Master Plan period include absence of legal frameworks/legislation to support eHealth, low investment in medical technology and ICT, unstable funding, donors' continued interest in vertical programme funding, lack of a central repository for survey and research data and results, inadequate intersectoral collaboration, slow progress by related ministries, limited support from local authority, inadequate community involvement in registration of vital events, inability to keep pace with global and regional technological trends, inadequate capacity for software development and maintenance, inadequate financial resources to maintain internet connectivity, interruptions to real time data entry due to frequent electricity and internet breakdowns, and inadequate application of information security standards on shared networks.

9. The priority list of recommendations includes focusing on developing and strengthening country-owned and sustainable HIS for improved decision making, need to bestow the Director of DPHI with the leadership role and sufficient authority to ensure proper coordination with the stakeholders, entrusting DPHI with the gatekeeper role for HIS in Cambodia, need for appropriate leadership to lead Master Plan implementation, establishment of a high level Steering Committee chaired by Minister or Secretary of State, current HIS TWG continuing with its remit, the need to set up a Program Management Office for day to day coordination, drafting new legislations and regulations concerning storage, privacy, confidentiality, security, retrieval and use of patient medical records, ensuring the development and sharing of policy, SOP and guidelines related to HIS, developing a consolidated HIS transitional plan for DPHI to take over HMIS and PMRS responsibilities from partners, preparation of costing of implementation of Master Plan at all levels, mobilizing required resources with incremental increase and ownership of Government, establishing an MOH Information Technology, Systems and Services Unit (ITSSU) within MOH, ensuring no further proliferation of systems that are used at the

service delivery level, channeling efforts towards data integration and interoperability across all systems, establishing standards for integration and interoperability through the setting up of a Standards Committee, use of a health sector specific unique identifier until the nation-wide adoption of the National ID, establishing necessary linkages between different systems, evolve PMRS into EMR which could be leveraged by all programs to access data, establish linkages between HRD- DMT- HMIS and HCP as well as PMRS - HMIS, review and revision of HMIS forms, introduction of a clear policy and law enforcement for private sector reporting (for e.g. linking of licenses to practice to submission of regular reports), improving compliance by private sector health facilities through education, advocacy and legal measures, follow up of private providers by PHDs and ODs, expansion of PMRS to all health facilities including health centers in a phased manner, implementation of the simplified version of the ICD 10 within PMRS, signing of an MOU between MOH and MOI regarding CRVS and IPIS integration with MOH systems and processes, instituting a mechanism to verify the HMIS data on a 6 monthly basis, review and modification of existing Data Quality Assessment methods and tools, establishing mechanisms for providing period feedback to HIS health workforce and encouragement of health managers on effective data use, strengthening NIPH as a central repository for all health survey and research data, continuing collaboration with NIS on all periodic surveys. collection of NHA data on an annual basis, institutional strengthening of HIS at different levels, formulation of a HR capacity development plan, and organizing training workshops for doctors, coders and other health staff for recording diagnosis of disease conditions and cause of death as per ICD 10 simplified version.

STRATEGIC FRAMEWORK

10. **Strategic Direction** - The strategic direction sets a long-term broad policy direction for the entire range of health information systems. The HIS Master Plan, with clearly defined goal and objectives, and clearly laid-out strategies, interventions and time bound targets, is developed as a means moving towards achieving the strategic intent of its development, in order to improve health outcome of the Cambodian population through better information, better decision making, better service delivery and better utilization of health services.

11. **Vision** - All people in Cambodia will have better health and wellbeing through effective use of real-time health and health related information by all key stakeholders. The long-term vision for HIS development is envisaged to be achieved in 3 phases. During Phase I (2016-2020), coverage, quality, management and use of current systems will be prioritized, Health Interoperability Standards Committee (HISC) will be established and convened, development, testing and implementation of Client Registry, Facility Registry and Interoperability Layer will be accelerated, health sector specific unique identifier will be used across all health information systems and deployment of telemedicine systems will be piloted in selected hospitals in Phnom Penh. During Phase II (2021-2025), there would be nationwide deployment of HMIS / EMR in the public health sector, all registered private

health facilities report to HMIS, Khmer ID is used across all HIS and medical platforms and telemedicine platforms established in selected provinces and municipalities. During Phase III (2026-2030), there would be nationwide deployment of HMIS / EMR in both public & private health sectors, nationwide implementation of a full-fledged eHealth strategy, and establishment of national health service and national telemedicine platforms established.

12. **Mission -***Provide timely, relevant, accurate and complete health information through well trained and highly motivated staff with necessary resources and appropriate technology*. Increased and regular investment in the health information system, including communication and technology is a critical need for the health system strengthening as a whole. One example is the expansion of the use of health sector specific Unique Patient Identifier to all HIS in the country until an interface with national ID is developed.

13. **Goal** -*High quality, accurate and timely health and health–related data and information are available and used together with results of sound health research*. (Strategic Objective 6 of HSP 3). DPHI is expected to play the role of the gatekeeper and ensure that all health sector players follow the Master Plan.

14. **HIS Strategic Objectives** –Strategies 26 to 30 of the HSP3 have been adopted as the five key HIS strategic objectives for the period 2016-2020:
    1. Develop and implement legal tools and protocols for health information management.
    2. Increase the quality, reliability and validity of health and health related data and information.
    3. Improve institutional capacity on data management, especially at facilities and district level on data compilation, analysis, interpretation, reporting, dissemination and use.
    4. Enhance the national disease surveillance and response systems, including public health emergency and disease reporting system.
    5. Strengthen monitoring and evaluation system and promote health research.

15. **HIS Strategies -** the strategic interventions articulated for each of the strategies 26 to 30 of the HSP3 have been adopted as the key HIS strategies for the period 2016-2020:

Strategies for Objective 1

1.1 Develop and enforce legislations and regulations concerning storage, confidentiality, retrieval and use of patient medical records.

1.2 Develop and implement national protocols for operations and management of the health information system, including flow of information, reporting, storage, data security and privacy.

1.3 Develop and use data kits such as dashboards and web-portal within HMIS to facilitate the use of health data and information.
1.4 Develop data quality assessment tools and institutionalize the tools in routine data quality monitoring.
1.5 Strengthen information systems on human resources/staffing, infrastructure, health services, population, laboratory (including biosafety/security/bio-risk management) and drug management support system.

Strategies for Objective 2

2.1 Promote data integration between different health information databases, focusing on standardization and interoperability.
2.2 Expand electronic medical record system, including patient registration, patient medical profiles, International Classification of Diseases, births, and deaths with medically defined causes accompanied by medical death certificates, as well as National Patient Unique Identifier system.
2.3 Use International Classification of Disease (ICD) based morbidity and mortality diagnosis and integrate ICD10/11 in HMIS and patient management registration system.
2.4 Increase coverage of reporting through the MoH web-based HMIS and national disease surveillance and response system, with compliance from the private health sector.
2.5 Conduct supportive supervision, spot checks, routine and follow-up monitoring of information systems, with timely feedback mechanism to ensure completeness, accuracy and quality of reporting.

Strategies for Objective 3

3.1 Develop common information standards and compatible platform to enable information sharing, including security architecture and regulations for privacy protection.
3.2 Expand IC application with appropriate training provision for health managers and health personnel who are responsible for data management including collection, compilation, analysis and interpretation, reporting dissemination and use.
3.3 Promote dissemination and use of quality health information among health personnel and the public to enhance health literacy among health personnel and the public.
3.4 Strengthen collaboration and coordination amongst relevant ministries and institutions and Development Partners for data collection for and analysis of population-based surveys from which the health sector can benefit.
3.5 Support the development of the national Civil Registration and system to collect vital statistics and promote their use in planning and health service delivery.

Strategies for Objective 4

4.1 Strengthen the existing routine early warning system on communicable diseases, known as Cam-Warn, and further integrate disease surveillance and response systems to reduce workload at facilities, district and provincial level.

4.2 Strengthen capacity of Rapid Response Team at facility, district and provincial level in detecting potential threats to public health, timely reporting accurate data, and responding to disease outbreak.

4.3 Develop the reporting of non-communicable diseases in the overall surveillance and case reporting and response system, including accident and injuries, with compliance for both public and private health sectors.

4.4 Perform routine and continuous monitoring of disease surveillance and response system to ensure accuracy, timeliness and completeness of reporting and other attributing factors.

4.5 Strengthen collaboration on communicable disease surveillance and response system through information sharing on potential threat and disease outbreak, knowledge sharing, and joint simulation exercises, etc. with other relevant ministries and institutions and neighbouring countries.

Strategies for Objective 5

5.1 Perform routine and continuous monitoring of plan implementation at required intervals by using the HSP3 Indicators Framework for M&E at different level of the health system.

5.2 Strengthen the use of the national M&E system, processes and tools to reduce multiple monitoring systems in the health sector, especially at operational level.

5.3 Enhance mutual accountability by the Ministry of Health and Development Partners to track progress of development cooperation towards the development results.

5.4 Establish governance structures with clearly defined roles and functions to advice oversee and coordinate health research system, while promoting the use of research findings for policy dialogue and formulation.

5.5 Develop and regularly update a health research agenda to coordinate and complement research activities.

16. **HIS Strategic Interventions -** Strategic interventions have been identified for each of the HIS strategies for the period 2016-2020. These include strengthening governance mechanisms, establishing legal framework, developing and using national protocols and guidelines, developing and using data kits and data quality assessment tools, establishing and maintaining robust HRIS, LMIS and FMIS (for objective 1); establishing Health Interoperability Standards and developing Client Registry, Facility Registry, and Interoperability Layer, evolution of PMRS as a full-fledged EMR, implementation of a unique health identifier aligned with the IPIS, implementation of the ICD-10 simplified version, improving the coverage of HMIS and IBS reporting, strengthening supportive

supervision, ensuring efficient and effective use of data for decision making and geo-enabling the HIS (for objective 2); implementing standards and data sharing arrangements, implementing a consolidated transition plan, costing the Master Plan and mobilizing required resources, developing MOH ICT Strategy, designing and implement long-term HIS professional development and training plan, developing and implementing a Benefits Realization Plan; promoting effective use of data for decision making, collaboration and coordination with related ministries and partners including Civil Registration and National Identification Systems (for objective 3); strengthening Indicator based surveillance (IBS), Event based Surveillance (EBS) and response systems, establishing an integrated disease surveillance and response system, strengthening capacity of sub-national Rapid Response teams, strengthening surveillance of non-communicable diseases and conditions, monitoring Surveillance and Response Systems, and strengthening collaboration among partners for effective Surveillance and Response Systems (for objective 4); undertaking routine and continuous monitoring of HSP3, strengthening the use of national M&E system, strengthening mutual accountability between MOH and its clients, establishing governance structures for health research and implementation of a health research agenda (for objective 5).

17. **Priority Strategic Areas -** The top ten priority strategic areas identified are Leadership & Governance; Legislation, Policy & Compliance; Stakeholder Engagement; Services, Applications & Tools; Standards & Interoperability; Capacity and Workforce; Investment, Affordability & Sustainability; Infrastructure; Benefits realization; and M&E.

18. **Key Strategic Priority Actions and Milestones -** Key strategic priority actions and milestones for implementing the Master Plan are summarized below in a chronological order.
    - Establish a high level Steering Committee (SC) for HIS by 30 September 2017
    - Convene quarterly stakeholder meetings - first meeting by 30 September 2017.
    - Establish Health Interoperability Standards Committee (HISC) nested within HIS TWG by 30 September 2017.
    - Develop & institutionalize DQA tools by 30 September 2017.
    - Cost the Master Plan & mobilize resources through a convergence workshop by 30 September 2017.
    - Develop HIS M&E Strategy aligned to overarching health M&E Strategy by 30 September 2017.
    - Organize ICD 10 (simplified version) National TOT workshop by 30 September 2017 and Sub-national workshops completed by 31 Dec 2018
    - Set up a Program Management Office by 1 October 2017.
    - Introduce health sector specific Unique Patient Identifier to all health information systems through completion of one time configuration set-up by 31 Dec 2017.

- Develop and sign a MOU between MOH and MOI regarding CRVS and IPIS integration with MOH systems and processes by 31 Dec 2017
- SOPs for outbreak investigation and response endorsed and implemented by 31 Dec 2017
- Strengthen EBS by integrating all events into single online database by 31 Dec 2017
- Integrate diabetes and hypertension databases into one single data base hosted by Preventive Medicine Department by 31 Dec 2017
- Integrated national HRH database in place and use by 1 January 2018
- Upgrade DPHI to assume M&E role for the entire health sector by 30 June 2018.
- Finalize & implement a consolidated transition plan for complete take-over of HMIS and PMRS by DPHI by 30 June 2018.
- Procure, install and maintain the ICT infrastructure by 30 June 2018
- A central repository for all survey and research data set up in NIPH by 30 June 2018.
- Develop and use data kits such as dashboards and web-portal within HMIS by 31 October 2018.
- Establish an MOH Information Technology, Systems and Services Unit (ITSSU) by 31 December 2018
- 100% coverage of provinces with master lists and registries developed under the GIS project by 31 December 2018
- HMIS linked to MLMIS in place by 31 December 2018.
- Develop a benefits realization plan by 31 December 2018
- Draft new legislations and regulations & obtain government clearance by 31 Dec 2018
- Establish data sharing arrangements between HMIS, PMRS and national program databases by using Client Registry (CR) and Open Health Information Exchange (OpenHIE) (by 31 Dec 2018 for TB HIS and Malaria-MIS, by 31 Dec 2019 for HIV/AIDS databases)
- Full scale up of PMRS in all hospitals by 31 Dec 2018 and scale up to cover 50% of all HCs by 31 Dec 2020.
- An Interoperability Layer in place and communicating reliably with a Client Registry, a common geo-registry for administrative districts and villages, health facilities and operational districts master lists, PMRS and CamLIS by 31 December 2020.
- Develop PMRS as a full-fledged electronic medical record (EMR) by 31 December 2020.

19. **Values and Working Principles** - A value-based commitment of the MOH is: “Rights to health for all Cambodians and Equity”. All those dealing with and use HIS are guided by a set of ethical working principles which include being client-centric, equitable, standards based, interoperable, innovative, cost-effective, scalable and phased, sustainable, collaborative and accountable.

IMPLEMENTATION FRAMEWORK FOR HIS

20. The framework is constructed on the basis of a logical approach to implementation with Vision, Mission and Overall Goal statements at the top of the matrix. Each of the five identified strategies are then listed with strategic interventions following thereafter. For each of the strategic interventions, key activities are identified and the timeline (up to end of 2020) for their implementation is plotted. Against each of these activities, one or more OVIs are described along with means of verification, responsible entities and resources required such as TA, government and donor support, etc.

COSTING AND FINANCING OF HIS

21. **Costing of HIS**. As part of the HSP3, the MOH with support from WHO undertook a costing of all the strategic objectives including strategic objective 6 (HIS), using the OneHealth Tool. An amount of US$ 14.2 million is projected to be the total cost for HIS over the five year period. However, since work on the HIS Master Plan was yet to begin whilst the HSP 3 was being developed, it is essential to undertake a detailed costing of the HIS based on the strategic interventions included in the HIS Master Plan using an activity-based costing approach.
22. **Financing of HIS**. The budgetary commitments of different development partners for HIS related activities in 2018 are estimated to be US$ 1.6 million. The financial allocations for 2019 and 2020 are estimated to be much lower at around US$ 783,175 per year with the ending of USAID support through Palladium (only up to mid-2018) and URC (only up to end of 2019)
23. **Financial Gap Analysis**. A preliminary analysis based on HSP3 cost estimates for HIS and financial commitments from development partners shows that there is a substantial financial gap that needs to be bridged if HIS is to be implemented successfully during the period up to 2020. For e.g. the financial gap for 2018 works out to US$ 794,629 and the gap goes up to US$ 1,690,429 in 2020. When the HIS Master Plan is fully costed using an activity-based costing approach, the financial gap is likely to be much higher than currently estimated.
24. **Resource Mobilization.** To successfully implement the HIS Master Plan, the Ministry of Health and DPHI will undertake a detailed costing exercise and financial gap analysis through the adoption of a participatory approach and utilising required technical assistance in order to provide a robust estimate of the resources required to achieve the 5 strategic objectives of the plan. The findings from this exercise will be presented to the Government and development partners to mobilize required resources for HIS with incremental increase and ownership of Government.

MONITORING AND EVALUATION

25. The M&E approach focuses on measuring the execution of the Master Plan and is central in answering the question of whether the Ministry of Health is on track in terms of its

implementation of the Master Plan. The M&E Framework presents the list of outcome, process and output indicators to be used for monitoring the implementation and outputs of the HIS Master Plan 2016-2020. All HIS related indicators in Annex 3 of the HSP3 have also been included in the Indicator Matrix for the HIS Master Plan (in Annex 3).

PRE-REQUISITES AND CRITICAL SUCCESS FACTORS

26. There is clear recognition that the successful implementation of the Master Plan impinges on a series of assumptions and potential risks which need to be kept in mind and carefully and diligently handled such as political commitment, financial support, legal environment, coordination and communication with multiple stakeholder, policy and legal Framework, management of the technical landscape, common understanding, standardized approach, enabling environment and robust implementation.

1. INTRODUCTION

1.1 DEMOGRAPHIC AND HEALTH BACKGROUND

1.1.1 Demographic profile of the country

Cambodia's total estimated population in 2016 is 15.2 million[11] with a population density of 87 per sq.km and a sex ratio of 96.2 males to 100 females[12]. The country is currently going through a demographic transition. The expected changes in demographic compositions will have an impact on the social and economic sectors. The demographic dynamic not only creates opportunities for a young population entering the labour workforce, but also indicates the potential changes in the health services needs of the population. It is estimated that by 2020, the total population will be 16.5 million, of which 9.8%, 6.5%, and 27% are children aged less than 5 years, people aged over 60 years, and women of reproductive age (WRA, 15-49) respectively. Health care demands for these groups are much higher than for other population groups. For instance, a significant increase in young adults will increase the demand for adolescent and youth reproductive health services[13].

The Cambodian population is aging and increasingly urban (an average annual increase of 5%). An increase in the elderly population will imply more need for treatment of non-communicable diseases coupled to long-term care services. Cambodia is also witnessing an epidemiological transition. The health system is facing the dual challenge of on-going burden of communicable diseases and a growing epidemic of non-communicable diseases (NCDs). NCDs are already the largest cause of mortality in Cambodia: 32% in 2000 versus 52% in 2013. To cope with the rising burden of NCDs, the existing structures of the health system will need to be strengthened, modified and expanded in different ways, while consolidating the gains made in other areas such as maternal and child health, and communicable diseases control.

1.1.2 Health profile of the country

The health status of the Cambodian population has remarkably improved over the last decade. Life expectancy at birth increased from 65.6 years in 2000 to 71.4 in 2012. The total fertility rate decreased from 3.8 in 2005 to 2.7 in 2014. The maternal mortality ratio dramatically decreased from 472 per 100,000 live births in 2005 to 170 in 2014. Neo-natal mortality declined slowly from 28 per 1,000 live births in 2005 to 18 in 2014 and accounts for 50% of under 5 years- mortalities. Infant mortality rate decreased from 66 per 1000 live births in 2008 to 45 and 28 in 2014. Stunting decreased from 43% of children under five in 2005 to 32% in 2014 while wasting decreased from 17% in 2000 to 10% in 2014. The adult HIV prevalence has declined by nearly 60%. The country has achieved the universal access target for treatment, with approximately 80% of adults and children estimated to be in need receiving antiretroviral

[11] National Institute of Statistics, Ministry of Panning. Population Projection of Cambodia 2013-2023, February 2017.
[12] Royal Government of Cambodia. National Strategic Development Plan 2014-2018 (http://cdc-crdb.gov.kh/cdc/documents/NSDP_2014-2018.pdf)
[13] Department of Planning & Health Information. Ministry of Health. Cambodia.The Third Health Strategic Plan 2016-2020. June 2016

treatment. Malaria mortality fell rapidly from 219 deaths in 2008 to 10 in 2015 and the malaria mortality rate reported by public health facilities is approaching zero (0.06 per 100,000 populations in 2015). Tuberculosis prevalence more than halved between 1990 and 2015 from 1,670 reported cases per 100,000 populations to 668 respectively. Tuberculosis death rate decreased from 155 per 100,000 populations in 1990 to 58 per 100,000 populations in 2014[14].

These improvements have largely resulted from the strong political commitment of the Royal Government of Cambodia (RGC) which implemented a wide range of reform programs with a strong potential impact on health, notably in the socioeconomic sector (including financing, education, agriculture, rural development), and governance (Public Administrative Reform). These reforms together with a stronger health system, together with effective development cooperation, contributed considerably to improved health outcomes. Nevertheless, equitable distribution of health outcome across the population remains a key challenge to the health service delivery[15].

1.1.3 Health System Organization

Cambodia has a pluralistic health system in which the main health infrastructure and public health care are delivered through the Ministry of Health (MOH), while the disparate private sector provides most outpatient curative care[16]. Currently the Cambodian health system is organized into *three levels*: *central, provincial and operational district level* with clearly defined roles and functions at each level.

The central MOH has three General Directorates: Health, Administration and Finance, and Inspection. These Directorates are responsible for ensuring that the government's health objectives – defined in the National Strategic Development Plan and the Cambodian Government's overall plan for national development called the Rectangular Strategy – are translated into policies, strategies and guidelines in order to reach their targets. The role of the General Directorate for Health is the formulation and implementation of MOH policies through its eight departments (Planning and Health Information; Human Resource Development; Preventive Medicine; Communicable Disease Control; Drug and Food; Medical Equipment and Cosmetics; Hospital Services; and International Cooperation) and to oversee the 25 Provincial Health Departments (PHDs) and their 94 health Operational Districts (ODs). The affiliated institutes of the MOH include the University of Health Sciences (including Technical School for Medical Care), the National Institute of Public Health (NIPH), four regional Secondary Technical Medical Schools, as well as specialized national centres (the National Center for HIV/AIDS, Dermatology and Sexual Transmitted Diseases (NCHADS); Tuberculosis and Leprosy Control (CENAT); Maternal and Child Health (NCMCH); Traditional Medicine; Medical Laboratory; Blood Transfusion; Health Promotion; and Parasitology, Entomology and Malaria Control- CNM), and the Central Medical Store (CMS).

[14] CDHS 2005 & 2014. The Health Sector Progress Report 2008 & 2015 (MoH) Health Sector Analysis Report January 2015.
[15] NSP3 (2016-2020) for 2013-2018
[16] Asia Pacific Observatory on Health Systems and Policies. The Kingdom of Cambodia health system review (Health Systems in Transition, Vol. 5 No. 2 2015). World Health Organization Regional Office for the Western Pacific.

As of December 2015, there are 25 Municipal/Provincial Health Departments (M/PHD) and 25 Municipal /Provincial Referral Hospitals that are under direct administration of the M/PHDs. The municipal/provincial level is the interface between the central and operational district level. The M/PHDs operate a provincial hospital and cover from one to 10 Operational Districts (OD), formed on a geographic and population basis. The main role of the M/PHDs is to link the MOH and ODs.

There are 94 OD offices covering 197 administrative districts/khans/cities as of December 2015. The OD is the most peripheral subunit within the health system, closest to the population, and composed of HCs/HPs and RHs. Its main role is to implement the OD health objectives. Each OD covers 100,000–200,000 people with a Referral Hospital delivering a Complementary Package of Activities (CPA), mainly secondary care, and a number of Health Centres.

As of December 2015, there are 102 referral hospitals, including 9 National Hospitals, 25 Municipal and Provincial Referral Hospitals and 68 district-based Referral Hospitals. Referral hospital services are distinct and complementary to those delivered by health centers. The type of health services delivered by RHs is defined by the MOH's Guidelines for Development Complementary Package of Activities (CPA).

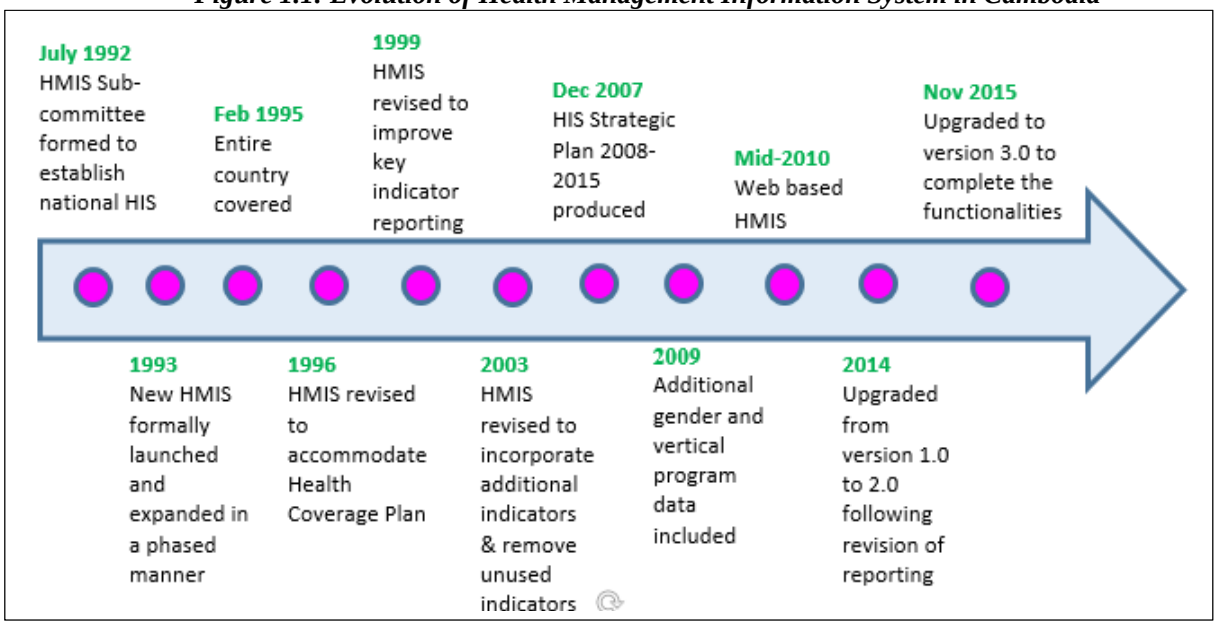
There are 1,141 HCs and 107 Health Posts for 1,633 communes/sangkats as of December 2015. Health Centres cover 10,000–20,000 people and deliver a Minimum Package of Activities (MPA) which consists mainly of promotive, preventive and basic curative services, supplemented by specific activities for vertical programmes as defined in the MOH's Guidelines for MPA. Less formal Health Posts are located in remote areas, more than 15 km from the nearest Health Centre, and cover 2000–3000 people.

1.2 BRIEF HISTORY OF HMIS IN CAMBODIA

The Ministry of Health formed the HIS sub-committee with a remit to create a nationwide HIS in July 1992. HMIS was formally launched in 1993 and complete coverage across the country achieved in February, 1995. Since its inception, the HMIS has undergone a number of separate revisions (see Figure 1.1 for evolution of HMIS in Cambodia). In 1996, the system was revised to accommodate modifications resulting from the introduction of the Health Coverage Plan, which defined the services to be delivered by each health facility. In 1999, minor changes were made to the system to improve key indicator reporting. In 2003, additional indicators required for the monitoring and evaluation by health facilities and national programs were incorporated, and unused indicators were eliminated. In 2009, additional gender and vertical program data were included. In mid-2010, the existing Access HMIS database was upgraded and migrated over to a web based (PHP/MySQL) database in order to reduce the administrative workload and reporting timeline while at the same time capturing accurate and timely data from all health facilities. The web based HIS application has seen many enhancements and was further

developed alongside the feedback from the users resulting in the current HIS 3.0 version since 2015.

Figure 1.1: Evolution of Health Management Information System in Cambodia



"HEF Operational Database", a patient level database was developed to support the management of the Health Equity Fund (HEF) in 2004 at individual referral hospitals. By 2010 this was expanded to a point that the software platform on which it was built (Microsoft FoxPro) began limiting further development. Development of the Patient Medical Registration System (PMRS) which provided the next generation platform for the HEF began in 2010 in Siem Reap Provincial Hospital and through multiple iterations has been extensively tested and continues to be refined. By July 2012, all HEF Operators had successfully completed an initial training and transitioned their HEF information management activities into the PMRS as the core HEF patient management tool.

1.3 RATIONALE FOR THE MASTER PLAN

There are a number of reasons why the DPHI, Ministry of Health of Cambodia decided to formulate and develop a Master Plan for 2018-2022. Some of the key considerations behind the development of the Master Plan are described below.

1.3.1 Harmonization with national and sector policies and plans

A number of policy initiatives of the Royal Government of Cambodia (RGC) and related line ministries with immediate bearing on HIS have been kept in mind when considering the development of the HIS Master Plan for 2016-2020 and are summarised below.

1.3.1.1 NSDP 2014-2018

The Royal Government of Cambodia (RGC) has evolved a 'Rectangular Strategy' (RS), which has been the hallmark of development since 2004. The Third Five-year Development Plan for

2006-2010 was formulated as an overarching national policy document for pursuing prioritized goals, targets and actions for the next five years. The new plan was renamed as National Strategic Development Plan (NSDP) 2006-2010. The NSDP 2006-2010 carried forward the agenda laid out in the first Rectangular Strategy, and the NSDP Update 2009-2013 on the RS Phase II. The NSDP 2014-2018 carries forward the agenda laid out in RS Phase III, which was unfolded in September 2013. RS provides a development framework, which will be implemented through the next five-year period. The National Strategic Development Plan (NSDP) is a 5-Year national development plan which coordinates the government strategies/policies and spending towards the attainment of overall development goals of Cambodia.

1.3.1.2 National Strategic Plan of Identification (NSPI) 2017-2026

This National Strategic Plan developed by the Ministry of Interior (MOI) aims to achieve a long-term vision for Cambodia — every person is to have an identity. This will require building a modern, permanent, universal civil registration system (CRVS) that will generate reliable vital statistics and an integrated population identification system (IPIS) that will ensure that the country has a single reliable source of information about individuals and population. Building these systems will eliminate the necessity to develop parallel systems for population identification, thus ensuring the efficient use of resources. The NSPI foresees that by 2019 each individual will be assigned a personal Khmer Identification Code (KIDC) at the moment of birth registration and will carry this code throughout his or her life. The awareness of its importance and the need for registration and identification will be continuously raised throughout the implementation of the NSPI (2017-2026)[17]. The Master Plan has incorporated system strengthening actions to ensure linkages with the national strategic planning in the area of civil registration and vital statistics.

1.3.1.3 Ministry of Planning Strategic Plan (MPSP) 2014-2018

To contribute to the implementation of NSDP 2014-2018 and the RGC's prioritized policies; the Ministry of Planning (MoP) has formulated its plan, Ministry of Planning Strategic Plan (MPSP) 2014-2018, which continues the previous mandate plan of MoP, MPSP Update 2009-2013. This plan will be the roadmap for the implementation of the two General Directorates and departments in MoP as well as the roadmap for the development partners, who intend to cooperate and provide technical and financial support to MoP[18]. Objectives 6 and 7 spell out the key collaborative activities in close partnership with other line ministries that the National Institute of Statistics (NIS), MOP intends to carry out under the MPSP 2014-208 such as the General Population Census of Cambodia, Cambodia Inter-Censal Population Surveys (CIPS), Cambodia Demographic and Health Surveys (CDHS), Cambodia Inter-Censal of Economic Survey (CIES), Annual Cambodia Socio Economic Survey (CSES), production of Vital Statistics, etc.

[17] Royal Government of Cambodia. National Strategic Plan of Identification 2017-2026. Phnom Penh. June 2016
[18] Ministry of Planning. Strategic Plan Update 2014-2018. Unofficial Translation. January 2014.

1.3.1.4 Statistical Law (2015)

The Statistical Law (2015) governs all matters relating to collection, processing, compilation, analysis, publication and dissemination of statistical data and pertains to the whole Kingdom of Cambodia. It emphasizes the importance the country places on development sound and quality data for tracking and policy development and stipulates that all line ministries establish statistical units within their organizations for statistical purposes and submit the statistical data they produce to the National Institute of Statistics of the Ministry of Planning and also publish and disseminate the statistical data they produce to all users[19].

1.3.1.5 Cambodia Socio Economic Surveys

Cambodia Socio-Economic Surveys (CSES) have been carried out since 1993 with the purpose of contributing to the development of the living standards of people in Cambodia. The survey provides a comprehensive set of indicators on living conditions in Cambodia, covering the main socio-economic areas such as health, education, housing conditions, economic activities, victimization, vulnerability and others. The Royal Government of Cambodia (RGC) uses the data to monitor the National Strategic Development Plan (NSDP) and to develop effective policies for reducing poverty in Cambodia. From 2007 and onwards the CSES has been conducted annually[20]. Since the CSES assists in collecting data on indicators related to disability, illness/injury in the last 30 days and health care seeking, it is important that this vital source of health information is included in the HIS Master Plan.

1.3.1.6 Cambodian ICT Masterplan 2020

The Cambodian ICT Master Plan[21] formulated in 2013 by the Ministry of Posts and Telecommunications (MPTC) with support from KOICA set up a vision of an 'ICTopia Cambodia'. This means a society or community possessing highly desirable and perfect qualities geared by ICT and implies building Cambodia as an intelligent and comfortable nation with intelligent people, intelligent society and intelligent government by ICT. The plan comes on the back of the ASEAN ICT Masterplan 2015, and the Connect Asia-Pacific Summit with the vision of 'Smartly Digital', and NSDP 2014-2018. Cambodia's ICT Master Plan 2020, which would be the guiding document for the ICT component of the HIS Master Plan; has the following objectives:

- *Empowering People*: become Top-tier country of ICT Human Resource Development in Southeast Asia and 70% of Cambodian people are able to access the Internet by 2020
- *Ensuring Connectivity*: Improve service accessibility of telecom and broadcasting for all the people; expand ICT infrastructure through government assistance and activating private investment and set base environment for diverse ICT convergence
- *Enhancing Capabilities*: Cambodian's own ICT ecosystem have to be integrated into the global ICT ecosystem; Standardization is top priority; need to increasing the number of participation; enhancing ICT technological capacity through R&D and to help reinforce national competitiveness

[19] National Institute of Statistics, Ministry of Planning. Statistics Law 2015. Unofficial Translation. February 2016.
[20] National Institute of Statistics, Ministry of Planning. Cambodia Socio-Economic Survey 2014. October 2015
[21] Ministry of Posts and Telecommunications. The Cambodian ICT Master Plan 2020.

- *Enriching e-Services*: has 5 priority actions including development of an e-government framework, strengthening of cyber-security, e-education, e-commerce and e-tourism

In September 2012, the government established Telecom Regulator of Cambodia (TRC). The Cambodian Law on Telecom 2015[22] was promulgated by the Royal Decree No.NS/RKM/1215/017 dated 17 December 2015 to become the most comprehensive legal instrument supervising the telecom sector in Cambodia.

1.3.1.7 National Social Protection Policy Framework 2016-2025

The National Social Protection Policy Framework 2016-2025 is a long term roadmap focusing on two main pillars: Social Assistance and Social Insurance. Social assistance is divided into four components: (1) emergency responses, (2) human capital development, (3) vocational training, and (4) social welfare for vulnerable people. Social Insurance is divided into five components: (1) pension, (2) health insurance, (3) employment injury, (4) unemployment, and (5) disability. The Royal Government's long-term vision for social protection system development is to build an effective and financially sustainable social protection system which serves as a policy tool for reducing and preventing poverty, vulnerability and inequality. It also contributes to the strengthening and broadening of human resource development as well as boosting national economic growth. The main goal of this Policy Framework is to harmonize, concentrate and strengthen existing schemes or programs in order to increase the effectiveness, transparency and consistency of the whole social protection system.

Citizens save money (contribution) in pension schemes in order to prevent themselves from falling into poverty when they reach old age. Additionally, they are required to make contribution to health insurance schemes so that they can receive healthcare services for free. For the poor and vulnerable who cannot afford to contribute, the Government will consider the possibility of contributing for them. Contribution in Social Insurance systems can be used to invest in Government bonds, and enables the Royal Government to use this source of financing for public investment. This contributory mechanism helps reduce the dependency on foreign financing and promote the development of domestic security market.

1.3.2 Harmonization with national health needs and plans (including HSP 3)

1.3.2.1 Cambodia's Health information needs

Correct and up-to-date information is critical, not only for the provision of high-quality clinical care, but also for continuing health care, maintaining health care at an optimal level, clinical and health service research, and planning and management of health systems. Sound and reliable information is the foundation of decision-making across all health system building blocks, and is essential for health system policy development and implementation, governance and regulation, health research, human resources development, health education and training, service delivery and financing.[23] A well-functioning health information system (HIS) is an integrated effort to collect, process, report and use health information and knowledge to

[22] https://www.linkedin.com/pulse/cambodia-telecom-law-2015-brd-law-office
[23] WHO. Health Information System. Toolkit on monitoring health systems strengthening. June 2008.

influence policy and decision-making, programme action, individual and public health outcomes, and research.

Health information is crucial for monitoring health sector performance and for improved health care management decision making at all levels of the health system. Since the development of the national Health Management Information System of the MOH in 1993, the demand for new information has grown rapidly. This is due mainly to the expansion of health services and disease prevention and control programs across the country, the emergence of new public health concerns, such as severe acute respiratory syndrome (SARS) and Avian Influenza, and multiple donor needs for information for monitoring their respective projects. As a consequence, a high burden has been placed on health information officers at all levels of the health system for the production of timely, high quality, and relevant information.

1.3.2.2 Health Strategic Plan 2016-2020

This Master Plan for Health Information Systems is based on the vision, mission, values and working principles of Ministry of Health's new Health Strategic Plan 2016-2020[24]. HIS is one of the seven strategic areas of the HSP3 (see Figure 1.2) and supported by five key HIS strategies.

Figure 1.2: Strategic areas for health system interventions

Source: Health Strategic Plan 2016-2020, Ministry of Health, Cambodia

Source: Health Strategic Plan 2016-2020, Ministry of Health

According to HSP3; by 2020 HMIS will ensure availability of high quality health and health related information for policy decision making, planning and budgeting, performance monitoring, evaluation and research. Therefore, the Master Plan will cover the envisaged expansion of coverage of HMIS to both public and private sectors, expand the use of ICT/ EMR

[24] Department of Planning & Health Information. Health Strategic Plan 2016-2020. June 2016

(electronic medical record) and introduce National Health Identification, strengthen ICD based morbidity and mortality diagnosis and strengthen disease surveillance system.

1.3.2.3 The Health Information System Strategic Plan (HISSP), 2008-2015

The Health Information System Strategic Plan (HISSP), 2008-2015 was the first strategic plan for the health information systems ever produced in Cambodia, and intended as a compass to guide all activities pertaining to the further development of the HIS in the country over the eight year period. It was deliberately crafted with a view to providing objectives, strategies, targets, and interventions that specifically address the weaknesses and shortcomings revealed through the multi-sectoral joint assessment of the HIS. Its purpose was to define how health information management from all sources could help achieve the health sector goals and objectives over the medium term period.

HISSP was only partially successful in achieving its objectives and implementing the agreed strategies and interventions. Notable achievements include integration of HIS strategy and implementation plan into the health strategic plan (HSP) 2008-2015 and health sector AOPs; regular revision of HMIS data collection forms and instruments, and development of a web-based HMIS; revision and strengthening of patient record management in all public health facilities; periodic update of the core set of health-related indicators and the multiple sources of data for monitoring them; strengthening of HMIS supervision; quality assessments carried out with WHO support in 2012 and 2014; improvements made in the national disease surveillance system, diagnosis, case notification and timely outbreak response; a STEPS survey in 2010 to estimate prevalence of hypertension and diabetes; strengthening the system for tracking budgets and expenditure from all sources of finance and linking with the first ever National Health Accounts (NHA) in 2012; and use of HMIS as the major source of data for assessing sector performance in the National Health Congress, Joint Annual Performance Review and other health sector reviews. However, there are a number of strategies and interventions that were either not initiated or only weakly implemented such as the envisaged review and strengthening of existing legislation, regulations and administrative procedures related to health data governing both public and private sector; expansion of the participation private sector in the national HMIS; provision of incentives and benefits for staff involved in the HIS at all levels; strengthening and maintaining the continuing authority and responsibility of the HIS Stakeholders Working Group (SWG); development, use, and maintenance of ICT systems for health data management and communications; strengthening the capacity of staff involved in the HIS through in-service training and degree programs; development and deployment of service performance assessment and improvement for HIS teams at different levels; expansion of Civil Registration system at health facilities and within communities; training and application of ICD-10 coding and verbal autopsy; strengthening the case reporting, monitoring and response to NCDs, strengthening of human resources, facilities and drug information management systems.

1.3.2.4 Need for integration (including establishment of national health data repository)

The Ministry of Health recognizes the great potential of information and communication technology (ICT) in transforming healthcare services by enabling information access and supporting healthcare operations, management, and evidence based decision making. However, the Cambodian health sector is characterized by a fragmented landscape of ICT pilot projects and a wide array of data and health information system (HIS) silos with significant barriers to the effective sharing of information between the various MOH departments and national programmes. The collection and use of information should not impose a burden on the health system. It should be collected as a routine by-product of the health care process. Although the government, development partners, NGOs and the private sector are continuing to invest in various health information system initiatives, without some form of a national plan and coordination, there is a real risk of continued duplication, ineffective expenditure, and the creation of new solutions that cannot be integrated or scaled across the continuum of care.

1.3.2.5 Introduction of harmonized unique identifier system(s)

Within the health system, unique ID is key to ensuring information about any one person can be shared securely and confidentially, both internally and beyond. Being able to identify an individual uniquely is essential in both the delivery and administration of health care. This has far-reaching implications for health service provision, so much so that arguably the goal of UHC cannot be fully achieved without it. Analysis of available health identifiers in Cambodia showed a significant need to harmonize existing, multiple identifiers in the health sector. Overcoming fragmentation can help resolve issues related to continuity of care, accurate record keeping, and proper claims reimbursement by health insurance funds, and prompt payment and detection of fraud, waste, and abuse[25]. The Unique Identifying System (UIS) in health can be the common thread and platform that has a potential to link the multiple health systems and bring them into a common HMIS repository while maintaining consistency and uniqueness of data[26]. Development of this Master Plan therefore took into careful consideration the adoption of a unique health identifier system for all health data to enhance data use for programming and decision making. Adoption of a single unique patient identifier as a "golden key" for eventual interoperability between the systems that are being developed and used presently has been recognized by all key stakeholders to play a central role in the implementation of the Master Plan.

1.3.2.6 Data quality (PARIS 21 Initiative)

This Master Plan is aligned with the strategies of sensitizing policy and decision makers, co-ordination, platform for debate and information sharing, developing sequenced information Systems (SISs) advocated by the PARIS 21 initiative.

[25] Michael Stahl. *Identification numbers within the Cambodian health system and beyond*. Summary Report. Asian Development Bank. November 2016
[26] Palladium. *UIS Assessment*. Consultation Workshop for UIS Assessment. 25 November 2016

1.3.2.7 Coordination of multiple sector stakeholders (Interior, Planning, etc. and including private providers within health sector) and plans

The concept of HIS is not limited only to the health sector since health statistics are generated and used by a variety of different organizations and institutions. These include the vertical health programs, other sectoral ministries, the private sector and many development agencies. However, data collection efforts are fragmented with limited coordination both within and outside the health sector. A HIS Master Plan is a coordination mechanism to streamline and develop a coordinated health information platform. Technical and financial support was provided by the Global Fund (GF) Health Systems Strengthening (HSS) grant.

1.4 APPROACH TO MASTER PLAN DEVELOPMENT

The development of the HIS Master Plan has been strategically guided by two driven-contexts. Firstly, an internal context that comprised of *strengths and weaknesses* of the health information system's performance. More importantly, the plan is fundamentally built upon the successes of the sector policies, strategies and planned interventions over the last decades by taking *health information problems and challenges to the health information system* into account. Secondly, external context that covers *opportunities and implications* of politics, legislations, national policy, strategy and plan, and the on-going national reform programs that effect choices of health information strategy and its successful implementation.

1.4.1 Purpose

The Master Plan for the national Health Information Systems of the Ministry of Health has been formulated under the leadership of the Department of Planning and Health Information (DPHI) in accordance with the objectives of the Health Strategic Plan (2016-2020) in order to provide directions for formulation of roadmaps and Annual Operation Plans for different MOH departments, related line ministries (particularly the Ministries of Interior and Planning) and other implementation partners. This has been in line with the Strategic Objective #6 of the Health Strategic Plan (2016-2020) which envisages "availability and use of high quality, accurate and timely health and health-related data/information, and promote health research".

The main intent is to have a holistic roadmap for DPHI/MOH as a whole that can be a guide to all health departments when they do their respective program activities planning to ensure that all the activities and information needs are aligned to the DPHI/MOH vision and objectives. As part of the Master Plan all the initiatives being undertaken by the various health departments/vertical programs along with their information needs were analysed and way forward developed that is aligned to the MOH goals and objectives. DPHI, by definition of their role, should at some point become a single repository (albeit virtual) of overall health information even as each department of the ministry / national program owns and manages their own data and this Master Plan is one step closer to achieving that objective. The interim objective for DPHI is to coordinate fully interoperable systems of health information, set standards and guide the dissemination of one set of data and strategic use of information for

planning, decision making and monitoring and evaluation. The Master Plan has also been aimed at reviewing the actual work processes at the DPHI/MOH, national programs and relevant health agencies and recommending appropriate information & communication technologies (ICT) solutions in terms of information, technology and solution architectures for a more efficient and effective use of ICT.

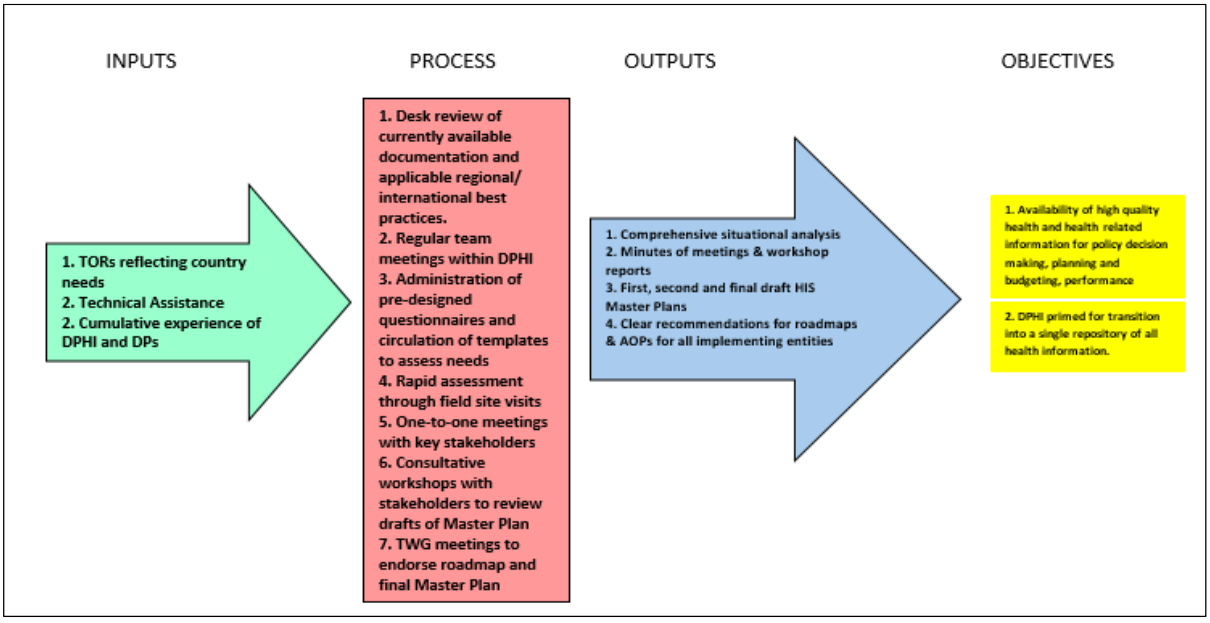
1.4.2 Structure

The formulation process (road map) for the Master Plan was under leadership of the DPHI/MOH and guided by the Technical Working Group for HIS (TWG-HIS) while the implementation of the process was led, managed, coordinated and facilitated by the Director of DPHI, with technical support from a short-term international consultant embedded within the DPHI and hired through the GF HSS Grant.

1.4.3 Process

Similar to the previous HIS Strategic Plan (2008-2015) formulation, DPHI, MoH adopted a participatory and consultative approach to HIS Master Plan development. A participatory approach involving multiple stakeholders in developing the Master Plan was adopted. The methodology and steps adopted for developing the Master Plan is depicted schematically in Figure 1.3.

Figure 1.3: Road Map for Development of HMIS Master Plan



The process basically involved a number of main activities, including desk reviews, rapid assessment in field implementation sites, one-to-one meetings, HIS TWG and sub-group meetings and two multi-stakeholder Consultative Workshops. The consultative workshops were in particular organized to generate inputs from the HIS TWG, concerned Ministries, Provincial Health Departments, Operational District offices, development partners and health

partners including NGOs. The HIS Master Plan was developed in three phases comprising of Master Plan Initiation (the key step here being the endorsement of the Road Map and Outline of the Master Plan by the Inter-Ministerial Technical Working Group for HMIS), Situational Analysis (with a focus on the review of current functions and activities, databases, needs assessment and inventory of existing hardware and access to electricity/internet at various levels, field visits to assess data quality and quality of services) and Master Plan Development (through DPHI team meetings, one-to-one meetings and 2 major participatory workshops with key stakeholders).

1.4.4 Outcome and Timeline

The whole process lasted 7 months, starting January 2017 till July 2017, resulting in the development of a comprehensive Master Plan for HIS in Cambodia.

2. SITUATION ANALYSIS

A situational analysis based on desk review of currently available documentation and applicable regional/ international best practices, regular team meetings within DPHI, one-to-one meetings with key stakeholders in their offices or in the field, rapid assessment through field site visits and two consultative workshops with stakeholders is presented below.

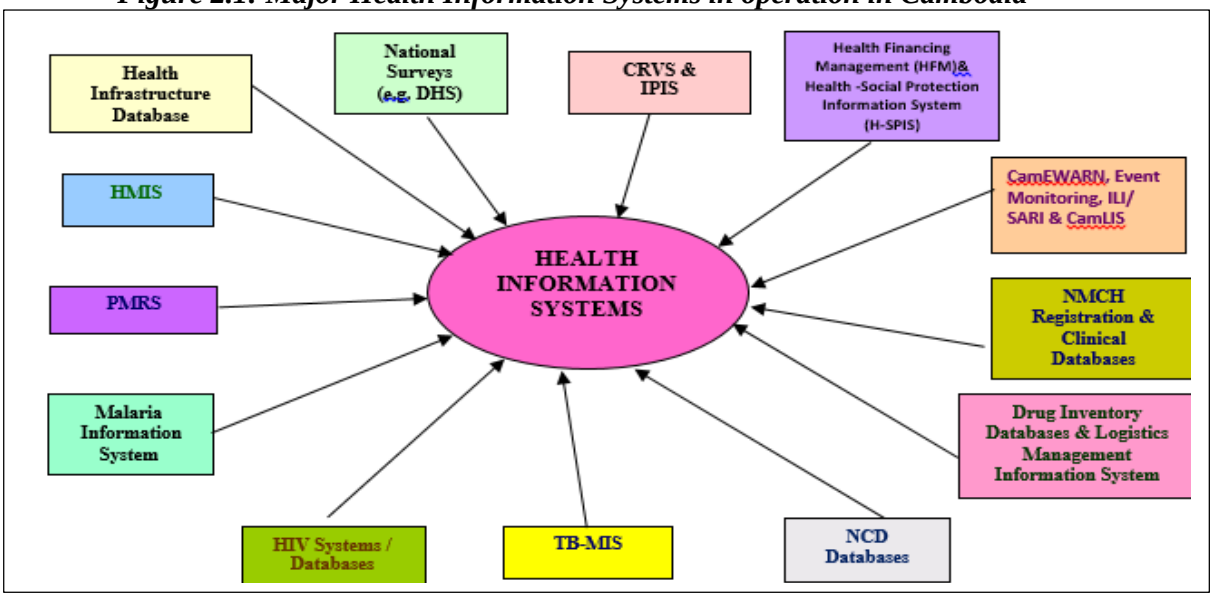
2.1 CURRENT STATUS OF OVERALL HEALTH INFORMATION SYSTEMS IN CAMBODIA

Cambodia's Ministry of Health (MOH) aims at ensuring availability of high quality health and health related information for policy, decision-making, planning and budgeting, performance monitoring, evaluation and research. In order to fulfil this purpose, a number of health information systems have been set up within the various departments and programme areas of the MOH. The Health Information System (HIS) Bureau of the Department of Planning and Health Information (DPHI), Ministry of Health is mandated to develop systems and related capacities of the Ministry of Health concerning Health Information Management to support the implementation of National Health Strategic Plan (2016-2020). In accordance with this mandate, the HIS Bureau is currently developing and managing Health Management Information System (HMIS) and Patient Management Registration System (PMRS) databases for monitoring health service delivery outputs and health situation of the Cambodian population. Apart from these two databases, several other database systems have been developed and managed by other departments and vertical programs of the Ministry of Health and of other sectors. Some of the entities which are hosting health information systems and databases are listed below.

- DPHI: HMIS, PMRS
- Other MOH Departments: Department of Preventive Medicine (DPM), Communicable Disease Control Department (CDCD), Department of Hospital Services (DHS), Department of Drug and Food (DDF), Department of Human Resource (HRD), etc.
- National Centers/Programs: CNM, NCHADS, CENAT, NMCHC…
- National Social Security Fund (NSSF): Health – Social Protection Information System (H-SPIS)
- Other Ministries: MOI, MOP, MOND, etc.
- Private Sector/NGOs

Figure 2.1 depicts some of the major health information systems and databases currently being implemented in the country; although the list appears comprehensive, it is by no means exhaustive. All these multiple systems are operating in silos due to verticalization/ fragmentation of health services and programs.

Figure 2.1: Major Health Information Systems in operation in Cambodia



The ability and capacity to consolidate and comprehensively analyse the multiple systems and databases related to health is limited due to a variety of reasons, including unavailability of unique identifiers for health facilities, patient identification code, lack of guiding principles for development and implementation of database systems. No entity or group has authority to properly coordinate and monitor the implementation of HIS electronic development and deployment. There has also been a lack of coordination between DPHI and national programmes which has resulted in inconsistency in regard to definitions of common indicators, number of reporting sites, etc. A lack of a clear, visible, consensus-driven, and readily-available landscape has been found. The consultant for development of the HIS Master Plan along with the consultant to Develop HIS Standards & Guidelines developed a template for a landscape of HIS and populated it through one to one meetings with various key stakeholders and also during the group discussions organised as part of the consultative workshops held in February and March 2017 respectively. Although the landscape is still relatively sparse, it is presented in Annex 2 to provide an idea on some of the similarities and differences shared by different health information systems in Cambodia.

2.2 CURRENT STATUS OF SELECTED SUB-SYSTEMS IN CAMBODIA

2.2.1 Health Management Information System (HMIS)

2.2.1.1 Introduction

The national Health Management Information System (HMIS) is regarded as one of the Ministry of Health's (MOH) priority areas of work in Cambodia. The system covers information on routine health service activities and health problems presented at all levels of the health facilities in the national health care system, including Health Centres, Referral

Hospitals and National Hospitals. Its main objective is to provide the MOH and its constituent parts, including referral hospitals and health centers, with valid, reliable, relevant, up-to-date, adequate, timely, and reasonably complete information on health needs, delivery of services, availability and use of resources, and effectiveness of services to serve evidence based decision making, health management and planning needs. Accurate health information is expected to be used as reference to create guidelines, protocols or policies which lead to effective management of health programs and to improve the development of the health sector. Information plays a central role in supporting strategic goals and in underpinning the principles of the country's Health Strategic Plan (2016-2020). The HIS Bureau of DPHI manages HMIS as well as the Inventory of Health Facilities (Health Coverage Plan) which is updated twice a year.

2.2.1.2 Information Flow

A schematic representation of the flow of information[27] upwards, along with the approved schedule for public health facilities, is presented in Figure 2.2 for ease of understanding. Data collection starts at the health center level through the use of daily registers for curative outpatient consultation, antenatal care, immunization, birth spacing, deliveries, etc. Data from both on-site facilities and outreach activities are recorded in these daily registers. Similarly, in hospitals, there is one register for each health service ward – such as general medicine, paediatrics, obstetrics, gynaecology, surgery, tuberculosis, pharmacy, laboratory, etc. In both health centers and hospitals, the date, patient's name, sex, age, address, diagnosis, date of admission and date of discharge from hospital, etc. are recorded in these registers. The reporting period covers the entire month from the first to the last day of the month. At the end of each month, data is entered into reporting templates at health facility levels via tally sheets. Previously, monthly reports generated by health centers (form HC1) and referral hospitals (form HO2) were required to be sent by hard copy to operational district health offices (OD) and provincial health departments (PHD) and later sent using email and/or USB using Access. Now however, HIS data is entered directly on to the HIS web-based database with OD and PHDs able to access the data directly from the HIS web based database. Currently available HMIS Guidelines contain instructions on recording in registers, filling in monthly reports, reporting, quality checking and use of health information for planning, program implementation, monitoring and evaluation, etc.

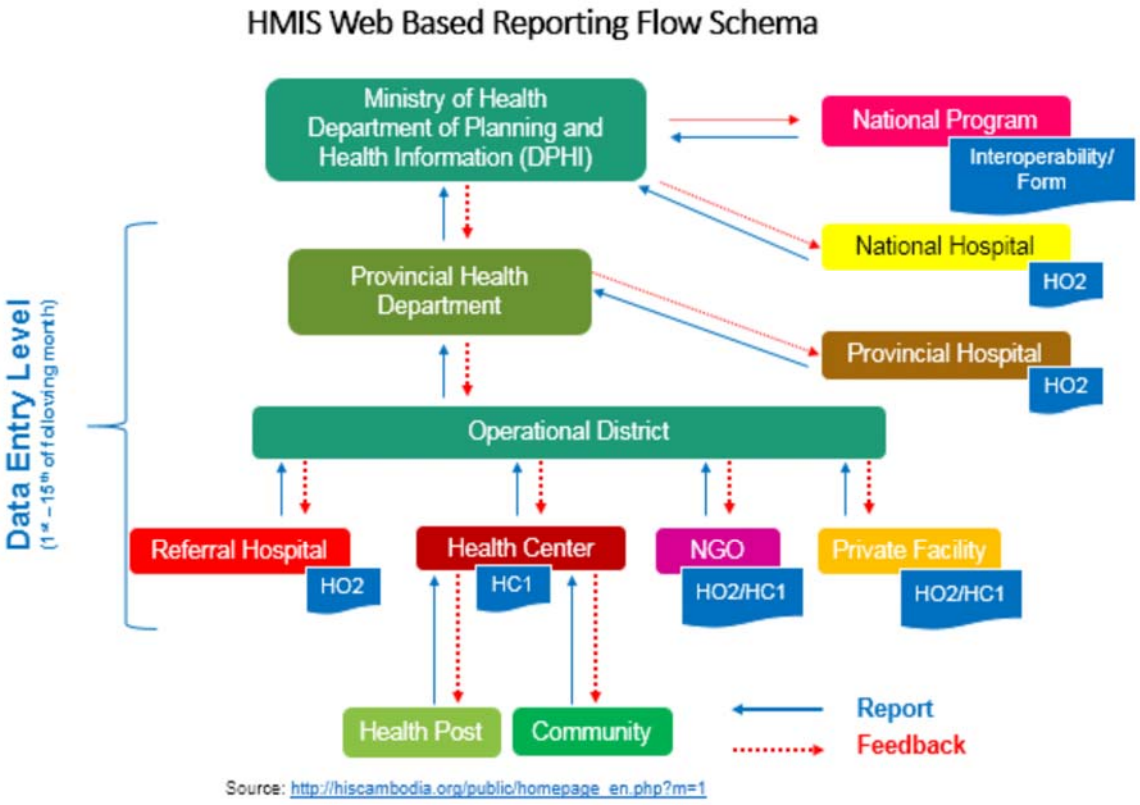
2.2.1.3 Key features

- *Information domains*: outpatient care, inpatient care, laboratory, maternal & child health, immunization, communicable diseases, dental care, blood bank, imaging and physiotherapy
- *Level of data*: aggregated system
- *Functions*: Health centre (HC1) and hospital (HO2) reporting, health system planning and management, and GIS.
- *Deployment*: HCs, RHs, PHs, NHs, ODs, PHDs, private clinics (limited)
- *Technology*: Software: Web-based and Hardware: desktop/laptop

[27] http://hiscambodia.org/public/homepage_en.php?m=1

- *Components*: Front-end web application- mySQL DB and DB Tables- HC1, HO2, HCP, PMTCT and TB-MIS
- *Data capture method*: with internet- transcription from paper-based register or intermediary Excel spreadsheet and without internet- submission of HC1/HO2 paper form to OD.

Figure 2.2: A schematic representation of the flow of information in HMIS



2.2.1.4 Summary of achievements and progress:

- *Coverage*: Currently, the HMIS web-based database collects monthly health data (HC1 and HO2) nationwide from a total of 1,303 public health facilities (not counting health posts) including 33 (2.5%) Provincial/National Hospitals, 83 (6.4%) Referral Hospitals, 71 (5.5%) Health centers with beds which are in fact former district hospitals and 1,116 (85.7%) Health centers without beds. Web-based HMIS application reached national coverage across the national, provincial and referral hospitals, except at HCs level; only 47% of HCs (557 out of a total of 1187 HCs in April 2017) are able to capture and submit data electronically through HMIS[28].
- *Reporting:* In 2016, 100% completeness (before deadline of 15th of following month) was just over 74% for the whole year while the corresponding percentage for the first 4 months of 2017 is around 58%. Although 100% completeness increased to 83% in April

[28] Personal communication received from Palladium on 17 May 2017.

2017, the fact that it was 0% in January 2017 brought down the first 4 month average to just over 58%. Owing to change in the reporting format, the January 2017 reports were complete at around 96% but none was100% complete before the deadline of 15th February 2017.

- *Data quality:* Overall data quality index (in fact this measures data consistency and will be renamed accordingly) in 2016 was around 93% and the tentative value for the first 4 months of 2017 stands at 92%[29]. Routine data quality assessments in 2011, 2012 and 2013 by using WHO data quality score cards indicated a generally high consistency rate between source documents and monthly HMIS reported values. For many key indicators, the data from the HMIS are reported to be within about 5% of the results from household surveys, suggesting that the validity and reliability data are both high. An initiative to institutionalize data quality assessment in routine data quality monitoring is under way within DPHI.
- *Data management:* The current HIS 3.0 web-based system allows health staff at Health Centre (HC), Hospitals and Operational Districts (OD) (which have computers and can access internet) to enter their monthly activity data directly into the web-based system. In facilities where there are no computers, data are recorded into reporting templates (paper-based formats) at health facility level at the end of each month and then sent to OD level for entering into the HIS application. These data are synchronized with the central level data just minutes after they are entered and all health staff are able to access the HIS data within a few minutes following data entry.
- *Data use:* The MOH and HMIS stakeholders have made extensive use of the HMIS database to monitor and record health services performance, to provide data for research and to prepare a wide range of official and public reports on Cambodia's health system. At subnational level, HMIS information is used for quarterly and annual reviews, SOA performance reviews, disease-specific program progress reviews, Provincial Technical Working Group meetings, District and Provincial Health Financing Steering Committee meetings, and for annual planning and budgeting by facilities. The historical data is available in HMIS to a range of international institutes and universities, and researchers as well as investigators from development partners seeking information on health system performance in Cambodia.

2.2.1.5 Key Weaknesses and Challenges:

1. Dependence on external support:

A key challenge is that the HMIS is not currently managed and maintained directly by the MoH but by Palladium, a firm commissioned by USAID to provide direct support to DPHI for managing and maintaining the HMIS up to 2018. Although a transitional plan has been developed, the key challenge for DPHI would be to take over and run the HMIS from the latter half of 2018 in a seamless manner.

2. System coverage:

Although registration of private health facilities has shown a significant increase from 201 in October 2016 to 1,258 on 12 May 2017 (as against an estimated 4,000 private

[29] Ibid.

health facilities in the country), eight provinces have not registered any private facility and only less than a third of the registered facilities (31.3% or 382 out of 1,220 submitted their April 2017 report) through the MoH web-based HMIS[30], resulting in incomplete data sets of access to and utilization of health services by the population as a whole. Since the HMIS predominantly captures data from the public health facilities, while more than half of the patients sought care for their last illness/injury episode from the private sector first (NIS, 2011), indicating that its coverage and timelines are limited, especially for instituting any rapid response mechanisms. The on-going engagement with private health providers in this respect will further increase reporting coverage from this sector. There is also a need to verify data submitted by the private providers. It is therefore important that PHDs/ODs closely follow up their respective private health facilities both routinely and specially in order to improve reporting performance.

3. Data entry burden:

At the end of April 2017, 47% of the HC1 reports (557 out of a total of 1187 HCs registered) were being submitted by the HCs using their own user account while the remaining HC1 reports were being entered by HIS officers at the district level resulting in a data entry burden for the latter. However, this situation is expected to ease in the next few months since 530 laptops have been recently procured and distributed by PR-MOH to HCs without computers in June 2017.

4. Data accuracy:

A major challenge relates to accurate population denominators, particularly at OD level and below, due to seasonal migration, both internal and cross-border. Closer collaboration with commune council authorities and higher levels promises to ensure greater accuracy of the data.

5. Data quality:

Routine data quality check from different subnational levels, such as health facility, operational district and provinces has only been observed in some provinces.

6. Data analysis:

The ability and capacity to consolidate and comprehensively analyse the existing databases is limited due to a variety of reasons, including unavailability of unique identifiers for health facilities, patient identification code, lack of guiding principles for development and implementation of database system.

7. Policy implementation:

Palladium has supported HIS Bureau in developing a HIS user manual, HIS protocol, indicator definitions, and data quality supervision guidelines. The challenge is to disseminate these to the subnational level and ensure their effective use.

8. Other challenges: Other significant challenges in HIS reporting include frequent HIS staff turnover at the provincial, district, and facility levels, lack of internet coverage in certain areas hindering use of the web system, paper-based systems which are prone to errors in data transfer, incomplete recording in registers, and use of incorrect indicator

[30] Ibid.

definitions, infrequent cross check of data at subnational levels multiple recording sources, formal tally sheets not being used, lack of feedback on data reported[31].

2.2.2 Patient Management Registration System (PMRS)

2.2.2.1 Introduction

The Patient Management and Registration System (PMRS) is a national web-based application developed under the stewardship of DPHI and used by public health facilities in Cambodia for the management of individual patient data. Creating a system of unique patient identification numbers (in addition to storing other identifiers such as National ID, driving license ID, etc.), the system manages personal patient details (name, address, contact details, photo, etc.), service utilization, service fee accounting, and includes tools for the aggregate reporting of utilization and financial data by facilities. The use of unique patient identification numbers by the PMRS allows individual facilities to organize central patient dossier filing systems which are retrieved during each patient visit and support improvements in the quality of care by facilitating the maintenance of continuous patient records. In addition to the unique patient identification numbers assigned by the PMRS, the system can also record any other identification documents related to individual patients to facilitate easier patient identification and access and allow the PMRS to be linked with patient level data systems currently maintained by other MOH departments and vertical programs such as NCHADS, CENAT, and the LMIS etc. Beyond unique patient identification numbers, the system is a platform in which individual services (procedures, tests and medications) can be attributed to individual patients providing a path forward to eventual electronic medical records.

2.2.2.2 Information Flow

The current key functions of the PMRS system within a hospital setting ("Full PMRS") (see Figure 2.3) focus on patient registration, hard copy patient dossier management, management of user fees payments for specific services, collection of basic clinical information related to each patient (including diagnosis at discharge), and
tools and reports that support financial and statistical reporting to the MOH.

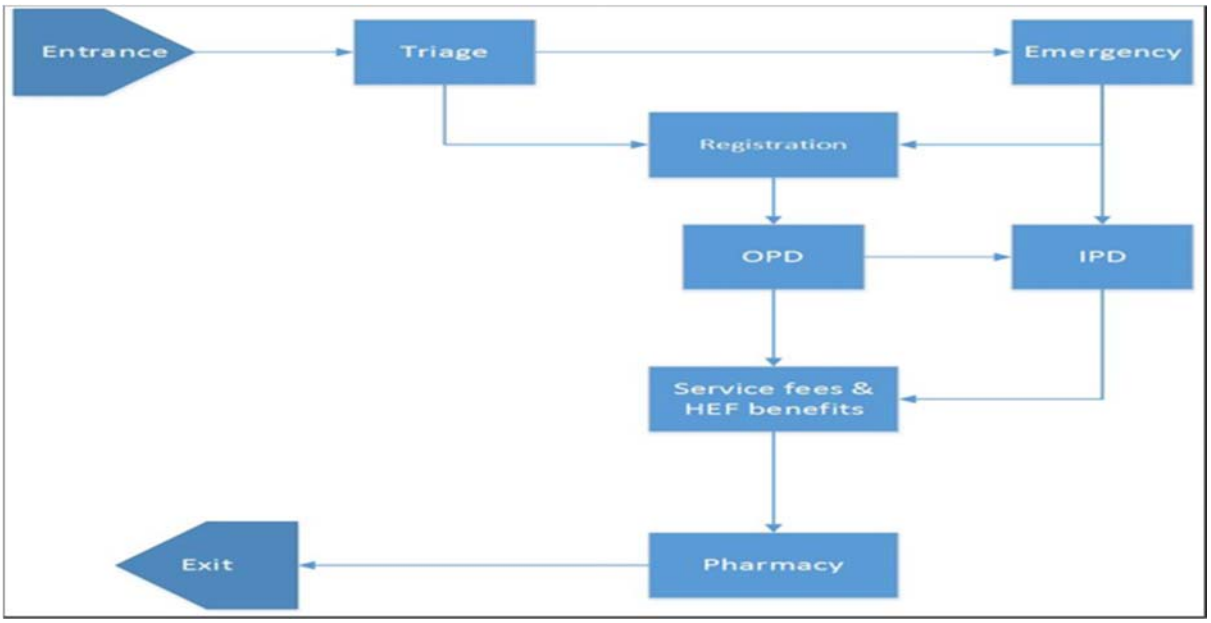
2.2.2.3 Key features

- *Information domains*: Inpatient care (Hospital), outpatient care (Hospital and HC), treatment from (HC), IMCI information (HC), Diabetic (HC), emergency information (Hospital and HC), maternal & child health (Hospital and HC), paediatric Care (Hospital and HC), partial- laboratory (HC – BT, malaria) and vital signs information (HC).
- *Level of data*: health facilities- point of care.
- *Functions*: Patient registration, patient ID assignment, patient dossier retrieval, health insurance (HEF), patient billing, referral tracking system and monitoring system

[31] National Maternal and Child Health Center (NMCHC). Assessing Maternal and Newborn Hospital Data in Cambodia. Draft Report. January 2017.

- *Deployment*: Hospitals and HCs (limited). Note: special workflows at Battambang PH and KSFH
- *Technology*: Software: Web-based (self-developed) and Hardware: desktop, tablet. Hosted on Amazon Web Services Singapore.
- *Components*: ADT, EHR, IIS, Gazetteer (province, district, commune, vile), standard diagnostics, client registry (OpenEMPI)# and interoperability layer (OpenHIM)#.
- *Data capture method*: direct entry during patient registration and billing.

Figure 2.3: Standard Flow of Recording Patients' information at Referral Hospital



2.2.2.4 Summary of achievements and progress:

- *Coverage*: PMRS system is presently installed and is working in 103 out of the total 116 hospitals for HEF. In 75 of the 103 hospitals, PMRS is being used to track both poor and non-poor patients (i.e. "full" implementations). Patients are being registered, admitted, cared for, discharged, and the accounting workflows that process HEF claims and transfer monies to hospitals are being accomplished. Where applicable, beneficiaries are receiving cash transfers to cover out-of-pocket fees and costs. Service claims are audited and fraud risk mitigation workflows are followed through. By end of April 2017, PMRS covered 103 RHs for HEF, 75 RHs and 26 HCs (out of a total of 1,187 HCs) for "Full Function".
- *Reporting:* PMRS includes tools for the aggregate reporting of utilization and financial data by facilities into other modules of the larger HMIS. 1,300,000 patient cards have been issued. Handled 4,700 patient admissions daily and 200,000 requests daily on an average.
- *Data quality:* No data quality issues have been reported during site visits.

- *Data management:* During site visits, it has been found that staff have the capacity to use the web-based PMRS and that patient dossiers are being established, used, and retrieved on subsequent visits. One area of current development activity is the development of reports and standardized analysis tools (dashboards) to inform facility and health system managers of hospital activities and results.
- *Data use:* Hospital directors and staff who have seen the PMRS at work first hand note that it makes their facilities more organized and efficient with a standardized patient flow, financial management tools, and automated reporting functions. They also recognize that it is a significant modernization of their facilities that improves the perceptions and experience of patients which they believe increases utilization[32]. One major incentive that public hospitals (and eventually health centers) stand to gain from the PMRS is the increased revenue that will come from greater utilization of the facility which is viewed by patients as more modern, organized, and an easier place to seek care. Since the software has been open source, this has made it accessible allowing contributions by other partners and integration of modules from other departments.

2.2.2.5 Key Weaknesses and Challenges:

1. Dependence on external support: Similar to HMIS, the key challenge is that the PMRS is not currently managed and maintained directly by the MoH but by URC, a firm commissioned by USAID to provide direct support to DPHI for managing and maintaining the PMRS up to 2018. Although a transitional plan has been developed, the key challenge for DPHI would be to take over and not just run the PMIS from the latter half of 2018 in a seamless manner but also expand coverage especially to health center level and evolve into a fully functioning Electronic Medical Record System.

2**. System coverage:** A conspicuous gap in the development of electronic patient level data systems exists at the health center level where all data is still recorded in the hard copy registers which are then summarized to create monthly aggregate reports (HC 1). Only 26 out of a total of 1,187 HCs are currently covered. Slow progress in the expansion of ICT infrastructure, security and privacy considerations limit rapid expansion.

2. Private Health Facilities Reporting: Difficult to envisage the enforcement of private health facilities to use PMRS in the immediate future. Issues of confidentiality of patient and practitioner information need to be addressed prior to a potential policy decision to ask the private sector to use PMRS. Currently there is no clear policy and legal instrument to force private practitioners to use PMRS and ICD 10 as currently this is seen to be only a pilot.

3. Informatics Standards: It may be noted that PMRS does not yet function as a full Electronic Medical Record system. PMRS does not employ health informatics standards in its application programming interfaces (APIs) or in its underlying data structures – with the notable exception of the demographic database (the test version uses OpenEMPI via standards-based PIX and PDQ transactions). The underlying software programs are "hard-coded" to its tasks. It is expected that this codebase may be difficult to support and

[32] URC. Sustainability Analysis and Scale-up Plan: The MOH Patient Management Registration System (PMRS). October 2015.

challenging to extend/evolve over time. It is also anticipated that it may be challenging for this version of PMRS to support new use cases (e.g. supporting new insurance schemes or Service Delivery Grants, SDGs)[33].

2.2.3 Disease Surveillance Systems in Cambodia

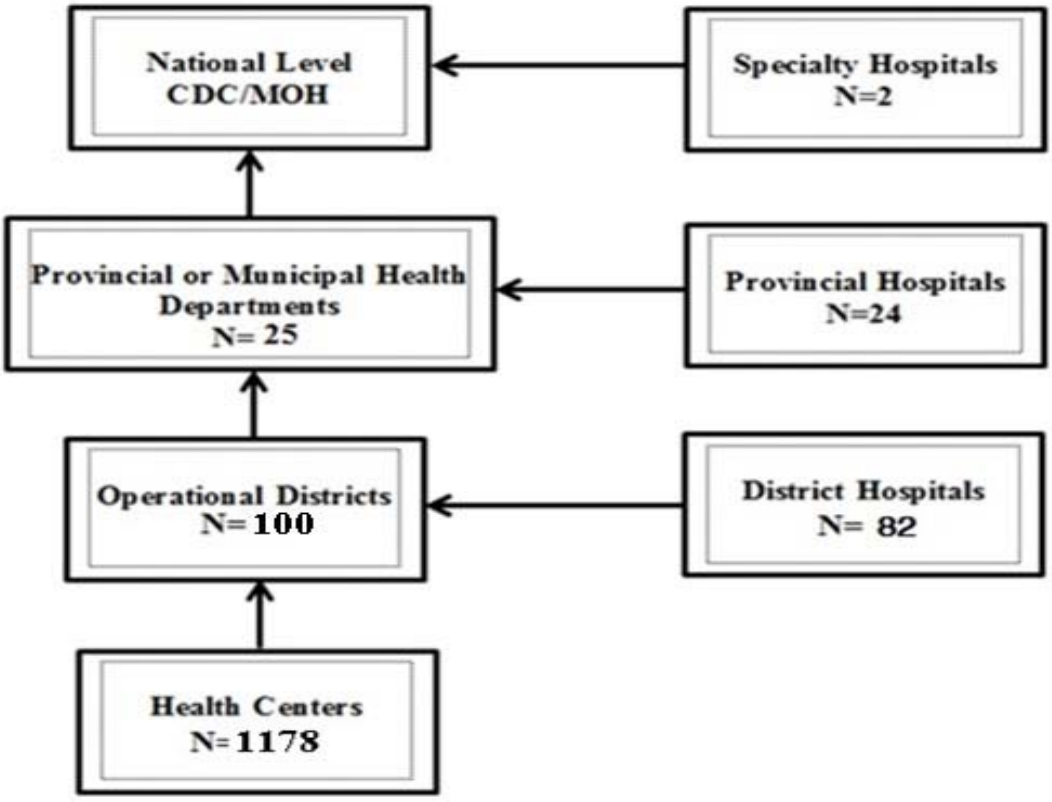
The Communicable Diseases Control Department (CDCD) in Cambodia has put in place an Early Outbreak Warning and Response System, known as CamEWARN (Cambodia Early Warning and Response Network). CamEWARN is a case-based surveillance system which covers 7 epidemic prone diseases and syndromes. It involves weekly zero reporting from health centres, referral hospitals and two paediatric specialty hospitals in Siem Reap to the CDCD, Ministry of Health. A web-based software has been created for reporting. All provinces have been trained in the use of the software. Data is available down to health centre level. The aim is to monitor disease trends and detect outbreaks early to enable timely response by Rapid Response Teams (RRTs). Data are collected weekly from health-care facilities. In addition, phone call from public health facilities is being used to report indicator based surveillance data. Currently there are 4 sub-systems of communicable disease surveillance in Cambodia which are described below.

2.2.3.1 Indicator based surveillance (IBS):

Weekly data transferred from Health Center to national level every Wednesday using web based CAMEWARN database. Data are collected weekly from health-care facilities (see Figure 2.4). In addition, government facilities that have internet access can report their data directly into web based database. Otherwise, they can use free phone call to hotline to r report indicator based surveillance data. Number of new cases and deaths of the 7 conditions (Acute watery diarrhea, Fever with rash, Acute flaccid paralysis, Severe respiratory infection, Suspected dengue fever, Meningitis / encephalitis and Acute jaundice) are usually tallied or added up each week as well as each month. The database is adapted from DHIS 2 and installed in 2013 by WHO HQ with technical support from University of Oslo. Currently being used at all public health facilities and different reports can be generated (Disease Trends, Pivot Table + Chart, GIS report and Aggregate report).

[33] Derek Ritz. PMRS Evaluation. ecGroup Inc. July 2016.

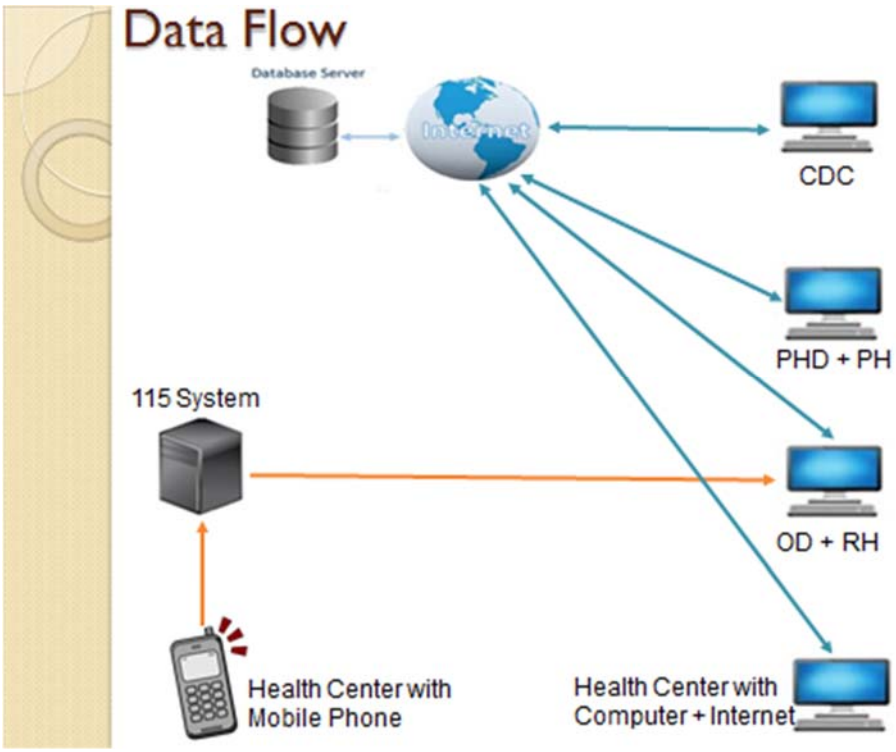
Figure 2.4: Flowchart of reports from the various health facilities for IBS



2.2.3.2 Event Based Surveillance (EBS):

Acute health events or disease outbreaks are reported, rather than case counts using strict case definitions. Events based surveillance is the organised and rapid capture of information about events that are a potential risk to public health. This information can be rumours and other ad-hoc reports transmitted through formal channels (less often) and informal channels (more often).

Figure 2.5: Data Flowchart of reports for EBS



One of the differences between event based reporting and disease indicator based surveillance is the fact that when an unusual event is seen by health facilities, it is reported straight away for EBS whereas for IBS, they tend to go through the data on a weekly basis and look for anomalies such as alert thresholds being exceeded and report/act on these then. Information received through EBS should be rapidly assessed for the risk posed to public health in order to inform action. EBS can sometimes provide a real head start for public health rapid response if the system works and people report unusual events that they observe (see Figure 2.5). The purpose of both of these systems is public health action. There are 3 hotlines (2 mobiles & 1 land line) to facilitate EBS. EBS will detect rare and new events that are not specifically included in case based surveillance and events that occur in populations which do not access health care through formal channels.

2.2.3.3 ILI/SARI web based system:

The surveillance and control of avian influenza among humans receives particular attention in Cambodia. The ILI/SARI web based system has been developed to provide background epidemiological data on influenza like illness (ILI) in Cambodia, identify circulating influenza viruses and to provide guidance for the public health interventions. The system also helps determine epidemiology and burden of influenza associated severe respiratory disease, and report proportion of influenza case and death among SARI and hospitalization cases timely, to establish sentinel surveillance for human cases of avian influenza and to provide circulating strains of influenza viruses for seasonal vaccine development.

The MOH, including Provincial and OD offices and the Department of Communicable Disease Control, manage surveillance and control in cooperation with the Ministry of Agriculture. Cambodia has been working with other countries of the greater Mekong sub region, namely China (Yunnan and Guangxi provinces), Lao PDR, Myanmar, Thailand and Viet Nam, to enhance early detection and effective response measures to communicable diseases; and to address the emergence of new diseases as part of the Mekong Basin Disease Surveillance Network established in 2001[34].

2.2.3.4 Laboratory Information System (CamLIS):

The Cambodia Laboratory Information System (CamLIS) is used for effective management of high volume laboratory data for diagnosis, treatment and disease surveillance. The first version was developed at the end of 2011 and piloted at National Padiatric Hospital (NPH) in January 2012. Successful outcomes of the pilot led to rolling out of the system to a total of 13 central (including NPH, Kossamak, Preah Angduong and MCH) and provincial laboratories in Cambodia till date. The system is able to generate different reports (with tables and graphs) such as summary reports by time period, report by hospital ward, microbiology report and an automatic report to CDCD for priority pathogens. The system uses Microsoft Office Access 2010 for desktop application, supports multi-users over computer network, has 5 main modules (Patient, Sample, Results, Reports and Administrator) and data can be analyzed by using Query Extractor, and exported to Excel format.

Key achievements till date include measurable improvements in the collection, management, and storage of data in referral laboratories, standardized reporting of laboratory data for clinical management of patients, improved storage and reporting of data about bacterial pathogens and antimicrobial resistance patterns, quality management of blood culture data to support supervision, detection of a nosocomial outbreak and improved laboratory practices. A number of challenges persist such as those related to hardware /software, incomplete forms, lack of unique identifier, lack of IT Staff, lack of standardization, infrequent data analysis and limited internet connectivity. Next steps include extension to other laboratories in the country, upgradation to an online web-based system and integration with PMRS.

2.2.3.5 Summary of achievements and progress of the Surveillance Systems:

- **Timeliness**: There is now faster data collection and more timely from lowest level up to national level. Faster response and provide feedback.
- **Completeness**: More complete data is being captured at each level and improvements in relationships among health staff involved in the exercise.
- **Data Analysis**: Faster data analysis and ease with which reports can be generated in various ways.

[34] Phommasack, Bounlay et al. "Mekong Basin Disease Surveillance (MBDS): A Trust-Based Network." *Emerging Health Threats Journal* 6 (2013): 10.3402/ehtj.v6i0.19944. *PMC*. Web. 27 July 2017.

2.2.3.6 Key Challenges:

These include hardware & software failure ((PCs & Phone), human resources with ICT capacity, data quality, behavior change and risk assessment.

2.2.4 Logistics Management Information System

2.2.4.1 Introduction

The Cambodian paper-based Logistics Management Information System (LMIS) for health products has been in place since the 1990's. The electronic system known as DID (Drug Inventory Database) was introduced in 2000 and contained an inventory control feature and key elements of an LMIS. The goal was to computerize and enhance the paper-based system at Referral Hospitals (RHs), ODs, PHDs and Central Medial Stores (CMS). The group of systems resulted in strengthening the supply chain system and increasing product availability in the country. The electronic system was first implemented at the district level and was scaled up between 2006-2008 to cover hospitals, PHDs, and the CMS.

2.2.4.2 Coverage and Gaps:

Although the current LMIS has many positive attributes, it also has several critical gaps described below.

- The supply chain uses multiple parallel LMIS systems of variable quality, causing inefficiencies.
- The current LMIS architecture depends on over 200 unique installations of the DID software which must manually transfer information by email or USB memory sticks creating bottlenecks and a significant risks of data security.
- Currently, MOH requires a paper-based approvals process for product distribution. This process parallels the electronic movement of requests between each level of the supply chain. The paper-based approvals introduce delays and need reconciliation when there are variances.
- DID's currently segmented architecture causes sub-optimal efficiency in terms of data visibility, system sustainability and underutilizes all the data in the DID system. Detailed information remains at lower level sites and is not generally visible or utilized centrally, while at the higher decision making levels of MOH, only aggregate data are available.
- The LMIS is not modular e.g. it does not have dispensing functionality nor an alternative simpler form of data entry for stock reports. The LMIS should include, but currently lacks, functionality for early warning management of impending stock outs or commodity expirations.
- DID's current lack of critical LMIS capabilities combined with poor of quality internet connectivity has perpetuated unnecessary and wasteful parallel electronic and paper based processes[35].

[35] Shiferaw G, Jones D and Krystall P. *Feasibility Study on Options to Strengthen Cambodia's Health Products Logistics Management Information System (LMIS)* submitted to MOH on 6 September, 2016. WHO, USAID, US-PEPFAR and US-CDC.

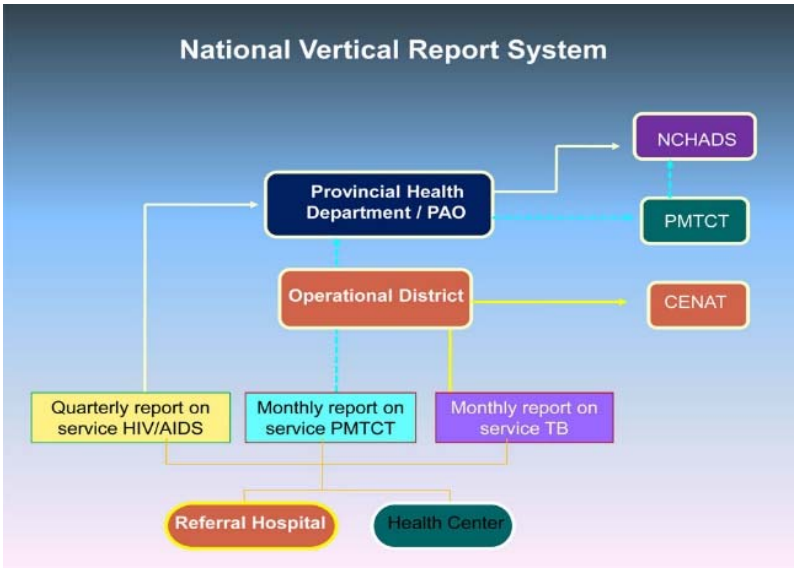
2.2.4.3 Strengthening Measures

MOH has taken a number of bold steps to improve the medicine supply management system and more recently, an MOH LMIS Technical Working Group was created in 2015 to strengthen the LMIS supported by the GFATM Health System Strengthening (HSS) grant. The TWG endorsed a plan which includes the enhancement and migration of the LMIS Software to an updated platform and deployment of the pilot in five (5) provinces, namely Phnom Penh (including DDF and CMS), Kampong Cham, Kampong Speu, Siem Reap and Battambang, commencing December 31, 2017. The LMIS initial release project is planned to be defined and piloted in parallel with the existing functionality of the NATDID, HOSDID and commencement of PRODID, and HCDID application on a newer technology platform with some enhancements[36].

2.2.5 Information Systems of departments and programmes within MOH

The role of the MOH National Centres, which receive funds from the Government, with financial and technical support from development partners and multi- and bilateral aid agencies, is to manage disease specific programmes from the central to the peripheral level. While each previously developed its own surveillance system (see Figure 2.6), some of these are supplying the data for the national indicators in the web-based HMIS and avoiding entering the same data into more than one system. However, there are vertical programs that are not yet directly linked to the HMIS to feed aggregate data. Vertical programs can only be integrated into the HMIS in terms of supplying the data for the national indictors and avoiding entering the same data into more than one system. Investments have been made to further integrate the existing different data bases systems, like in-service training database, personnel management database, drug information database, social health protection database, disease-specific databases, etc.

Figure 2.6: Data Flowchart for vertical health programs



[36] Ministry of health, Cambodia. *Draft pilot implementation plan and budget for strengthening the Logistics Management Information System*. Under the GFATM Health System Strengthening Grant. Updated 13 March 2017.

2.3 USE OF INFORMATION-COMMUNICATION AND TECHNOLOGY (ICT)

Use of technology for the HIS was limited until very recently. From 2006 to 2009, HIS computerization using Access software and developed by a local consultant, was available at central, provincial and district levels. At the health center, the chief of health center manually collected data from all the facility registers consolidating the data into a format for monthly reporting (HC1 form) and then sending it to the operational district office (OD). Referral hospitals also manually compiled all data on discharged patients into the HO2 form and then sent this to the operational district office while provincial hospitals would send data to the provincial health department (PHD). The operational district office then consolidated all the HC1 and HO2 data within the catchment area in form OD3 and entered this into the Access database, before sending this to the PHD. Some hospitals would also enter data in to the Access database by themselves. The PHD would then in turn consolidate all OD3 data from operational districts within its catchment areas and send this to the HIS Bureau, DPHI, where it would be uploaded finally onto the Access database. In April 2010, the MoH team worked with the USAID Better Health Services (BHS) team to upgrade and develop a new HIS scalable web-based database system, using the same data points as the previous MS Access HIS.

An inventory of computers, internet and electricity in the health centers (HCs) was collected by DPHI in May 2016 through questionnaire administration followed by telephone calls. Table 2.1 depicts a summary of the status of computer availability at HC level in different provinces in Cambodia in June 2017 while as Figure X shows the overall status of computer availability at HC level in the country in June 2017. More than two-thirds of the country's HCs (68.3% or 815 out of the total1193 HCs) have access to computers, internet and electricity. Just over a fifth of the HCs (21% or 250 out of 1193 HCs) have computers sourced through the RGC and DPs. HC staff in a small minority (2.9% or 35 out of 1193 HCs) use their own computers for reporting. As many as 530 HCs (44.4%) received computers through GF HSS grant in June 2017. While less than a third of the health centres (31.7% or 378 health centres) have no computers but have access to electricity and internet, 4 HCs have no or limited access to electricity and internet. Another 5 HCs have no staff in position for HMIS reporting. DPHI is currently validating the data received from the provinces.

The status of ICT in the health sector is also a reflection of the overall status of ICT in the country. The 2016 United Nations' E-Government report[37] (United Nations, 2016) assessed 4 dimensions of ICT and ranked Cambodia 158th out of 190 countries – a particular shortcoming was in ICT infrastructure. Cambodia's Information and communication technology sector includes postal services, telephones and telecommunications, and mass media. One of the strategic objectives of the RGC is to promote the development of a modern and high quality information and communication technology by strengthening the regulatory framework, building institutional capacity, modernizing technical equipment base, fostering competition,

[37] United Nations (2016). E-government survey 2016. New York: United Nations (https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/29-Cambodia)

strengthening the efficient use of ICT system and e-Government, and building and enhancing the efficiency of the backbone infrastructure of the information and communication technology sector[38]. Despite great progress observed in the past few years, ICT sector continues to face major challenges such as delay in promulgation of the Law on Telecommunications (on 17 February 2016), operation of illegal services at the border cutting into the government's revenues, limited cooperation between MPTC and service providers, private postal services being more competitive than public, limited ability of the government officials to respond to advances in technology, financial crunch faced by public media outlets (radio, TV and the news agency) and the technical facilities of the state media outlets, i.e. National Radio, National TV and National News Agency, requiring renovations and modernization, especially a shift from analogue to digital.

Table 2.1: Availability Status of Computers at HC level in different provinces in Cambodia in June 2017

#	Province	Total Health Centres	Computers sourced through RGC & DPs	Staff-owned personal computers	Computers sourced through GF	Total # of HCs with computers	Total # of HCs with no computers
1	Banteay Meanchey	65	31	7	27	65	0
2	Battambang	77	57	0	20	77	0
3	Kampong Cham	87	38	0	49	87	0
4	Kampong Chhnang	42	0	20	22	42	0
5	Kampong Speu	55	22	6	18	46	9
6	Kampong Thom	52	21	0	31	52	0
7	Kampot	64	0	0	35	35	29
8	Kandal	99	0	0	45	45	54
9	Koh Kong	13	8	0	5	13	0
10	Kratie	30	0	0	14	14	16
11	Mondolkiri	11	0	0	7	7	4
12	Phnom Penh	39	0	0	16	16	23
13	Preah Vihear	27	0	0	14	14	13
14	Prey Veng	113	0	0	56	56	57
15	Pursat	40	0	0	17	17	23
16	Ratanakiri	25	9	0	7	16	9
17	Siem Reap	90	48	0	32	80	10
18	Sihanouk	14	0	0	5	5	9
19	Stung Treng	12	0	0	6	6	6
20	Svay Rieng	43	0	0	25	25	18
21	Takeo	82	0	0	40	40	42
22	Oddar Meanchey	34	16	0	12	28	6
23	Kep	5	0	0	2	2	3
24	Pailin	6	0	2	4	6	0
25	Tbong Khmum	68	0	0	21	21	47
Total		**1193**	**250 (21.0%)**	**35 (2.9%)**	**530 (44.4%)**	**815 (68.3%)**	**378 (31.7%)**

[38] Royal Government of Cambodia. National Strategic Development Plan 2014-2018 (http://cdc-crdb.gov.kh/cdc/documents/NSDP_2014-2018.pdf)

2.4 M&E RELATED TO HIS

2.4.1 Role of HIS in M&E

Using the information supplied through the HIS for action-oriented performance monitoring, particularly where the information is generated, is the primary objective of the M&E process. This is the heart of decentralized, evidence-based decision making. Monitoring and Evaluation strengthens the linkage between resources and implementing strategic interventions/activities, and, ultimately with results. The HSP3 envisages that M&E promote the use of both qualitative and quantitative health and health-related data and information. The processes require real-time and high quality health and health-related data/information from reliable sources, and also institutional capacity at all levels to effectively carry out monitoring functions. These functions include data collection and compilation, analysis and interpretation and reporting, as well as using monitoring results to support decision-making and, most importantly, improve health service delivery[39].

In Cambodia, data from HIS is used for quarterly and annual reviews (including the Joint Annual Performance Review, disease-specific program progress reviews, standard operating agreement (SOA) performance reviews, provincial TWG meetings, OD and Provincial Health Financing Steering Committee meetings. Health information has been used for developing the Annual Operational Plan (AOP) and budgeting at subnational level since 2003.

2.4.2 Data Sources

Monitoring activities require health institutions at all levels to collect and compile, analyze and interpret the collected health and health-related data and information according to their monitoring purposes, for e.g. quarterly or annual review. Health and health-related data on different types of indicators can be collected through the existing data sources. Those sources include, but are not limited to:

2.4.2.1 Census

In 2008, the National Institute of Statistics (NIS), belonging to the Ministry of Planning, performed the last National Census. Mortality information was collected in the last census[40]. Inter-censal population estimates have been released in January 2016 by NIS and these have been posted on the HIS website for use at sub-national level. The projections are used for measuring coverage and for planning health services mainly at central and provincial levels, and in some districts since there are discrepancies between the real inhabitants and the projection.

2.4.2.2 Vital Statistics

The registration of births, marriages and deaths is under the responsibility of the Ministry of Interior. The percentage of registration of children under age five has steeply increased from

[39] Ministry of Health. The Third Health Strategic Plan 2016-2020. Department of Planning & Health Information. June 2016
[40] National Institute of Statistics, 2010. Report 1, Fertility and Mortality in Cambodia, General Population Census of Cambodia 2008, Analysis of Census Results, Phnom Penh.

22 % in 2000 to 66 % in 2006, and reached 73% in 2014. There are a few challenges for implementation of the civil registration including a limited understanding within the system and society at large about the importance of registration and identification; weak capacity, especially at the local level; the absence of the law on civil registration, vital statistics and identification complying with an international law/standard; moderate levels of ICT knowledge and availability of access to the Internet in some remote areas; etc.[41] Efforts are currently underway to implement the National Strategic Plan of Identification (NSPI 2017-2026) in such a manner that the country now can undertake the next step to develop a civil registration and identification system that would start filling existing gaps and move towards universal and integrated registration and identification.

2.4.2.3 Population based surveys

Demographic and Health Surveys (DHS), and Cambodian Socio Economic Surveys (CSES) conducted periodically at 3-5 years interval. These population-based surveys provide health and health related data/information, including demographics, access and coverage of health services, health and wellbeing, health related-expenditure, and social determinants of health.

2.4.2.4 HMIS and PMRS

Generated through routine facility-based reporting; providing most of data on health service coverage. Health facility data are a critical input into assessing progress and performance of the health system on a regular basis and they provide the basis for the national, provincial, district and facility performance assessment.

2.4.2.5 Other sources

These include Annual Health Financing Report and National Health Account Report, HCP, Annual Report on Human Resource Development, Administrative and financial records, programmatic assessments, research study findings, etc. Owing to the limitations associated with each source of data in relation to specific purposes, the MoH department(s), the national program(s), PHDs/ODs may collect additional information on key indicators for operational and service planning.

2.5 SWOT ANALYSIS

An analysis of the current strengths, weaknesses, opportunities, and threats (SWOT) in the Cambodian health sector in regard to Health Information Systems is summarised in Table 2.2 below.

Table 2.2: SWOT Analysis of HIS in Cambodia

STRENGTHS	WEAKNESSES
1. Political Will: Demonstrated by RGC to pursue health sector reforms and use ICT to improve the efficiency and efficacy of the health services	1. Governance: Lack of a proper governance structure to guide the development of HIS and eHealth across the health sector until 2016.

[41] Kingdom of Cambodia. National Strategic Plan of Identification 2017-2026. Phnom Penh , June 2016.

2. Improving Governance: Establishment of the re-vitalized inter-ministerial HIS TWG in early 2017. DPHI has competent and highly experienced staff. 3. Competent health training institutions : available at all levels 4. Web-based Systems: Key systems (HMIS & PMRS) are web-based and both HMIS & PMRS are hosted on the same cloud. 5. Institutionalization: Health information collection and submission has been institutionalized. Focal persons for collection and recording of health information exist at all levels of the public health system. Health facilities have a designated staff member responsible for collecting and reporting HMIS data. MOH-printed registers are being used for daily recording of patient information. Tally sheets are in use and monthly reporting forms are being filled up and submitted to the respective higher levels. 6. Data validation and generation of reports: HIS officers in ODs and PHDs review the reported data for discrepancies, using in-built validation functions of the HMIS web-based system, prior to submission to the HIS Bureau, DPHI. They are also able to generate on line reports and print them for circulation to the management teams within their own offices. 7. Coverage: Currently, HIS web-based database collects nationwide from a total of 1,303 public health facilities[42]. 8. Reporting: 100% completeness of HMIS reports was as high as 83% in April 2017. 9. Integration: There have been recent increasing integration efforts within some of the MOH Departments and programs and a recognition of the role for standards as well as a willingness to implement web-based APIs. 9. Standardization : Same set of forms applied across each level of HMIS; simplicity of design, retaining the look from past years yet incorporating new information. 10. Data Quality: PHD and OD HIS officers are conducting periodic visits to health facilities to verify data quality. Overall data quality index for HMIS in 2016 was around 93%. Routine DQAs in 2011, 2012 & 2013 using WHO data quality score cards indicated high consistency rate between source documents and monthly HMIS reported values. 11.Data management: The current HIS 3.0 web-based system allows health staff at sub-national levels with access to computers and internet to	2. Lack of coordination: No entity to properly coordinate and monitor the implementation of HIS electronic development and deployment. Also lack of coordination between DPHI and MOH departments /national programmes. 3. Lack of interdepartmental collaboration: Stakeholders are continuing to build separate systems resulting in duplication of effort and disparities in reporting. 4. Disparate Systems: There are multiple systems operating in silos due to verticalization/ fragmentation of programs and some stakeholders are pursuing separate integration activities without leveraging national architecture. As definitions are different, some databases cannot be linked together. It appears to be a waste of time to go through a number of databases but if definitions are not harmonized, integration cannot proceed. 5. Landscape of systems: Lack of a clear, visible, consensus-driven, and readily-available landscape. 6. Timeline & evolution of systems: Available for HMIS and PMRS, but not for HIV, Malaria, etc. 7. Coverage: PMRS coverage at HC level is still very low. Lack of ICT infrastructure, security and privacy considerations limit rapid expansion. 8. Compliance of private providers: Low for HMIS - less than a third are reporting among those registered (for e.g. 382 out of the 1,220 registered until 30 April 2017 reported among the 4000 across the country excluding private pharmacies). Lack of a clear policy and legal instrument to force private practitioners to report to MOH and follow ICD 10. Private health facilities consider reporting to be a waste of time. No staff made accountable to follow up on data from private health facilities. Difficult to envisage enforcing a compliance policy for private providers as two departments (DHS and DPHI) need to coordinate and some of them may already have their own systems. Key challenge in making the private sector use PMRS is to address the issues of confidentiality of patient and practitioner information. 9.Penetration of digital devices: Inadequate as around half the HCs lack computers, few lack electricity. 10.Human resources: Quantitative and qualitative gaps persist. Staff turnover,

[42] Personal communication from Palladium on 17 May 2017

enter their monthly activity data directly into system. In facilities where there are no computers, data are recorded into paper-based reporting templates (formats) and submitted to OD level for entering into the HIS application. 11.Staff commitment: Despite the lack of incentives, many of the HIS staff at all levels continue to be committed to their work and performance. 12. Custom built systems: Most of the current HIS are custom built with minimal legacy systems, technologies, standards and have used local expertise during the development, evolution, maintenance and expansion of the systems. 13. Technology: Open-source technologies such as PHP and mySQL are being used. 14. Richness of data: HMIS has a rich legacy of comprehensive data, an excellent source for making historical comparison of health and disease trends. 15. Resource mobilization: Local resource mobilization efforts in line with the decentralization and deconcentration are in process. Some ODs are using their own funding to procure and provide laptops to health centres. Some of the staff are using their own digital devices to log into the HMIS web based database and record information.	retirement, change in designations have all affected HIS in recent years. There is limited expertise in medical informatics. Difficulties in regard to training of new incumbents and slow progress in training in some provinces. 11. ICT Capability: Within MOH, there is no ICT department or unit or team in place yet. This would be a critical requirement as the MOH braces itself for developing and implementing a full-fledged eHealth Strategy in a few years' time but also represent the Ministry of Health when there are technical meetings between ministries to move on government-wide interoperability and e-governance. More IT staff required across MOH, not just in DPHI. 12. Policies & guidelines: Lack of updated policies or guidelines concerning data collection, information use and quality control. Lack of policy/guidance for some areas---patient dossier management, data privacy and security. 13. Financial constraints: Inadequate budget from government has led to dependency on donor support to expand and maintain key systems and databases. 14. Inadequate capacity building: due to limited budget, inadequate guidance, lack of trainers. HIS staff stated that they were not trained on the actual indicators. Insufficient knowledge of ICD-10 coding among hospital staff has been observed. 15. Low staff motivation: An overall low level of motivation of staff dealing HIS. 16. Lack of regular supportive supervision: Greater attention to collection of missing reports rather than on the job assessment, mentoring and coaching. 17. Recording and reporting burden: Too much data is recorded and contents of the reporting forms appear complicated. Reporting burden is high especially at HC level with same health staff required to submit reports (sometimes same data) to multiple departments/ programmes. Difficulties in understanding and computing some indicators especially MCH-related. 18. Lack of Standards. No standard terminology is currently in use for definitions, implementation of ICD10, SNOMET use, etc. Also a lack of consensus on priorities and a roadmap for standards adoption.

	19. Unavailability of unique identifiers: Non-adoption of a common unique identifier across health systems to allow for the rapid and accurate identification of patient records and their integration to provide high quality, patient-focused care. Lack of guiding principles for development and implementation of database system. 20. Lack of Data Quality Checks: particularly at subnational levels (PHD/OD/health facility). Also no regular DQAs carried out at subnational level by PHDs and ODs. 21. Data Analysis: Inadequate national capacity to consolidate and comprehensively analyse various databases. Inadequate data analysis skills have been observed at sub-national level. There appeared to be no trend analysis or comparison among facilities within the same district/province. Staff expressed their desire to analyse and use data to improve service delivery, but needed guidance on how to do so. Paper-based systems at health center level made it difficult to compile, compute and review data. 22. Data Use: This is still a major issue with limited use of data for decision making (timely response to public health threats), planning, management, problem solving and M&E at each level of the health system. Agenda for provincial and operational district management meetings did not appear to have included HIS-based reporting or presentations. 23. Data Feedback: HIS officers pointed out to the relative lack of feedback on the information they submitted.
OPPORTUNITIES	**THREATS**
1. Political commitment to SDGs: Realization of health related SDG targets to which the RGC is committed would definitely need stronger HIS to be put in place. 2. RGC's D&D Policy: Holds great promise if properly structured – health system becomes more accountable and responsive to local health needs which HIS helps to assess. 3. Economic growth: Allows the Government to increase public spending for health some of which could be on HIS. Salary reforms may improve productivity and motivation of health staff. 4. Rapid expansion of infrastructure and communications: such as electricity, roads and telecommunications. 5. ICT Expansion: Cambodian ICT Master Plan 2020 lays out the way forward for ICT expansion	1. Legal: Absence of legal frameworks/legislations to support eHealth/HIS development & compliance. 2 Low Investments: Low investment in medical technology and ICT with limited capacity at all levels to analyze, interpret and use data; limited use of health data and information in clinical and administrative areas, and multiple M&E frameworks, indicators and reporting systems. 3. Unstable funding: will lead to poor planning and commitment and uncertainties may lead to low motivation levels. 4. Donors' continued interest in vertical programme funding: Some donors may need data generated through vertical reporting in order to vertically track results from their resource support; while some vertical programs

in the country and the health sector should capitalize on this opportunity. Increasing investment in ICT (software and hardware, for e.g. 530 laptops being procured and distributed to HCs through GF grant) to support the current initiatives on integration and harmonization of different databases systems, including disease surveillance and response system. There is a need to harness the potential offered by mobile technologies to bring data capture to the point of care and thus improve accuracy, completeness and timeliness of data recording and reporting. 6. Internet connectivity: High penetration, nearly country-wide, 4G, inexpensive. 7. Availability of web and cloud based platforms: HMIS and PMRS have evolved as electronic record systems and as cloud based systems. Open-source technologies such as OpenEMPI and MEDIC CR (as patient/client registries) have now become available and willingness of DPHI and partners to explore these is timely and appropriate. 8. National Identification: RGC's commitment to building a modern, permanent, universal civil registration system (CRVS) that will generate reliable vital statistics and an integrated population identification system (IPIS) with a unique ID for the whole population that will be available for PMRS to uniquely identify each citizen. 9. Consistent engagement of specific development partners: Development partners such as WHO, USAID, US CDC, GIZ, ADB and GFTAM have been providing financial and technical support to the HIS during the past few years. HIS activities have been included in the quality of health care component of the H-EQIP project, the mechanism for sector-wide pooled funding in Cambodia. 10. Cambodia's integration into ASEAN due to which, many barriers between countries are coming down leading to free movement of skilled workers, of capital, and equalization of tax rates. This may have spin-off benefits for the health sector including HIS. 7. Expansion of the AeHIN: Since its inception in 2011, AeHIN has fostered relationship-building between its members aimed at effective capacity development, collaboration, and cooperation towards regional interoperability. 8. Public engagement, participation and demand generation: As these keep increasing in the country, the accountability on the part of the public health sector increases too, thus providing scope for the revitalization of HIS.	also want to maintain vertical reporting system which also becomes a challenge for promoting integration and makes it difficult for integrated HIS to attract funding and expand in a full-fledged manner. 5. Lack of a central repository for survey and research data and results: This not only limits the application of survey and research findings in policy and planning, but has resulted in several health and health related surveys being conducted in recent past without proper and coordinated planning, so as to avoid overlap of data collected and appropriate time intervals between such surveys. 6. Intersectoral collaboration: Persistence of the low degree of cooperation, collaboration and sharing across all sectors may prove to be an obstacle. 7. Slow progress by related ministries: Slow progress made on expansion of IPIS and CRVS have also affected HMIS and PMRS. 8. Decentralisation and Deconcentration: limited support from Local Authority (particularly in dealing with the Private Sector). 9. Community involvement: Communes are not able to capture all births and deaths for a number of reasons; unable to decipher cause of death recorded at health facilities and birth certificates are not valued by communities yet. Patient cards not being well retained and names not fully entered at the time of registration. 10. Pace of technology: HIS improvements have lagged behind because of the inability to keep up with global and regional technological trends. If Cambodia continues with its custom-built systems instead of deploying well established open-source systems such as DHIS2 and OpenMRS, it risks being further out of pace with the latest technological developments, and without an international community to leverage upon. 11. Software development and maintenance: Cambodia overall has an inadequate capacity for software development and maintenance and this has also affected the development and growth of HIS. 12. Internet connectivity: Not yet country wide and access slow and poor in some areas. Although internet connectivity is not a problem (as a result of good mobile coverage, not broadband coverage) consistent funding has

9. Availability of regional best practices: The increasing focus on discrete, patient-level data and hence the introduction and scaling up of electronic medical record systems in the neighbouring countries along with a trend towards formulation of robust and ambitious eHealth strategies has influenced the future directions that the DPHI would like to pursues during the life of the Master Plan.	been lacking. Some staff use hotspot through out of pocket expenditure (OOPE). 13. Interruptions to real time data entry: There are frequent breakdowns in both electricity supply and internet leading to difficulties in recording real time data entry. 14. Data Security Standards: Inadequate application of information security standards on shared networks. Privacy of patients with sensitive diseases (e.g. HIV/AIDS) is a potential issue.

2.6 KEY RECOMMENDATIONS

A consensus was reached on the following priority list of recommendations for inclusion in the Master Plan and Annual Operational Plans; following a detailed situation analysis, one-to-one meetings and two consultation workshops with key stakeholders and HIS TWG meetings.

Leadership & Governance:

- The focus during the Master Plan period should be on developing and strengthening country-owned and sustainable HIS for improved decision making leading to improved service delivery and utilization.
- There is a clear need to bestow the Director of DPHI with the leadership role and sufficient authority to ensure proper coordination with the stakeholders, and effectively lead the HIS master plan implementation.
- DPHI should be entrusted with the gatekeeper role for HIS in Cambodia- all departments and national programs and related ministries will need to consult and seek advice from DPHI while establishing new or upgrading existing health/health-related information systems.
- Establish structure and capability for MOH and relevant agencies to facilitate governance over the national HIS Master Plan:
  - ❖ Set up a high level Steering Committee chaired by Minister or Secretary of State with members from MOI, MOP, National ICT Development Authority (NiDA), Ministry of Posts and Telecommunications (MPTC), Ministry of Information, Ministry of Finance, and relevant departments and programs of MOH charged with the responsibility for setting directions (via the HIS Master Plan) and making decisions.
  - ❖ The current HIS TWG should continue to meet and provide technical guidance, facilitate decision making, and supervise and oversee the implementation the HIS Master Plan.
  - ❖ There is also a need to set up a Program Management Office for supporting Steering Committee and TWG, day to day coordination, convening and coordinating meetings, recording of minutes of meetings and agreements, track stakeholder commitments and keep stakeholders informed.

Legislations, Regulations, policies, guidelines, SOPs:

- Draft new legislations and regulations concerning storage, privacy, confidentiality, security, retrieval and use of patient medical records
- Ensure the development of policy, SOP and guidelines related to HIS are widely shared and closely monitored during implmentation by different stakeholders

Investment & sustainability:

- Develop a consolidated HIS transitional plan incorporating details of projects supported by DPs which are gradually and effectively taken over from 2018 and expanded by DPHI in the next 5 to 10 years.
- Prepare costing of implementation of Master Plan at all levels. Mobilize required resources with incremental increase and ownership of Government.

ICT & infrastructure:

- Establish an MOH Information Technology, Systems and Services Unit (ITSSU) within MOH to manage information systems (primarily HMIS and PMRS), human resources, projects and services, and associated technology for both Design/Build and Operate/Maintain capabilities.
- Emphasis should be placed on improving ICT infrastructure and capacity at all levels priming the health sector for launching a full-fledged e-Health Strategy in 2021.
- All health information systems should be made web-based or hosted on a Government-owned data center or cloud by 2020.

Linkages, integration and interoperability:

- There should be no further proliferation of systems that are used at the service delivery level in order to obviate the need to manage the various clinical and administrative data of patients in two separate unlinked systems. Use of a single unified system will make facilities more efficient at delivering care and managing patient data.
- Efforts should be made towards data integration and interoperability across all health information systems in the country over the life of the Master Plan.
- MOH will work with relevant stakeholders to establish standards for integration and interoperability of health information systems in the country through the setting up of a Standards Committee.
- All health information systems should use a health sector specific unique identifier until the nation-wide adoption of the National ID.

- Establish necessary linkages between the systems as quickly as possible in order to bring about efficiencies in terms of time and human resources. Decisions should be taken by the Steering Committee and implementation by DPHI and different programs based on a responsiblity matrix.

- Develop PMRS as a full-fledged electronic medical record (EMR). If an EMR is established that could be shared in the future (PMRS could become the EMR with

modifications), this could be leveraged by all programs to access data. Real time surveillance for CDC could become commonplace
- Explore and establish linkages between HRD- DMT- HMIS and HCP as well as PMRS - HIS after making sure that the systems work before connecting them including resolution of problems.

Coverage of HMIS reporting & private sector:
- There is a need for review and revision of HMIS forms and check if all current information is needed.
- Efforts should be made towards improving compliance by private sector health facilities through education, advocacy and legal measures.
- A clear policy and law enforcement are required in regard to private health facilities. This should include linking of licenses to practice to submission of regular reports.
- In the interim, PHDs and ODs should routinely as well as specially follow up with registered private health facilities to ensure better reporting.

Coverage of PMRS:
- MOH should expand PMRS to all health facilities including health centers in a phased manner. PMRS should be used in both public and private sector - in a voluntary manner for the latter. Suggested expansion:
  - Priority 1: Expand to all health centers beyond 2018 (MOH Master plan 2020). 2018 is the year for complete handover of partially expanded PMRS to DPHI.
  - Priority 2: Expansion to all wards - some hospitals can expand to all wards but will need technical assistance
  - Priority 3: Expansion from only HEF to full PMRS by end of 2018 in all public hospitals

ICD 10:
- Implement the simplified version of the ICD 10 within PMRS.

CRVS & IPIS:
- A joint plan or MOU between MOH and MOI regarding CRVS and IPIS integration with MOH systems and processes should be prepared and put into action. Higher ranking officials from the two ministries should be brought together to work on and agree on the contents of the MOU.

Data verification, quality, etc.
- There should be a mechanism in place to verify the HMIS data once every 6 months.
- Review and modify existing Data Quality Assessment methods and tools and establish a systematic framework for the assessment of HIS data quality in the health system.

- Establish mechanisms for providing period feedback to HIS health workforce and encouragement of health managers on effective data use during the Master Plan period.

Surveys, research and indicators:

- Strengthen NIPH as a central repository for all health survey and research data.
- Continue to collaborate with NIS on all periodic surveys that provide valuable information to the health sector such as DHS, CSES, etc.
- MOH should collect NHA data on an annual basis and build capacity and a system for routine collection of health expenditure and analysis to generate evidence for policy in Cambodia.

Capacity building:

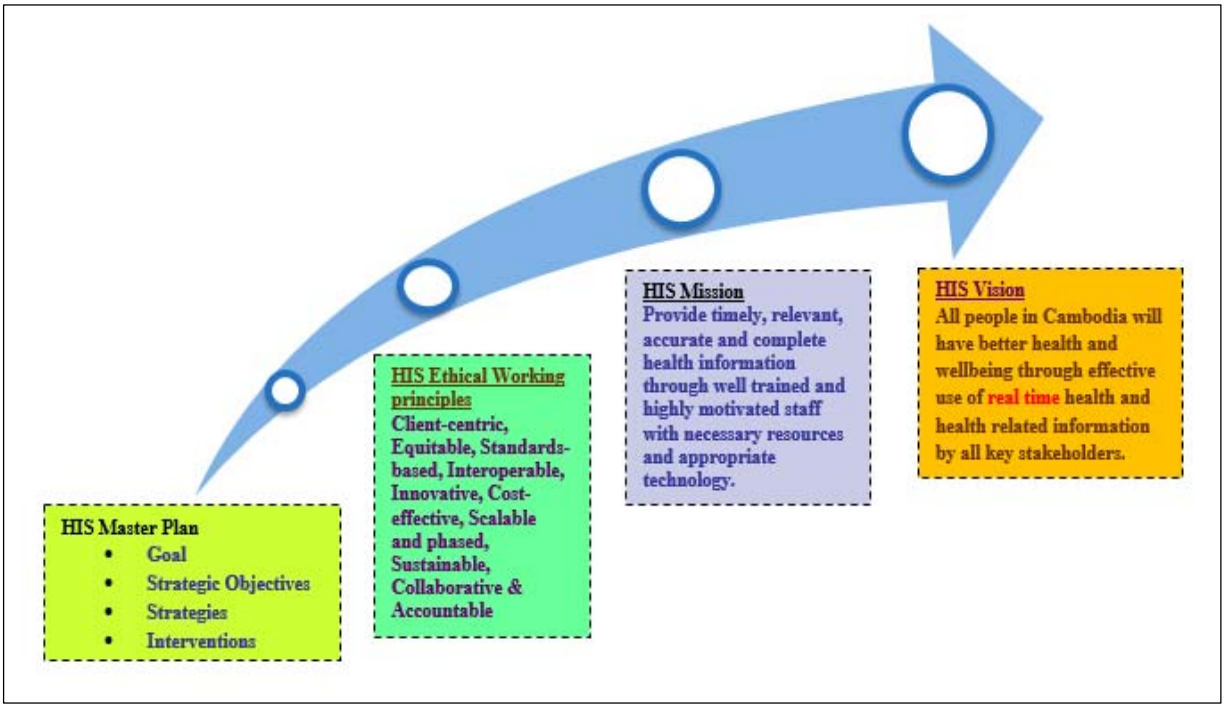
- Efforts should be made towards institutional strengthening of HIS at different levels and capacity development of HIS health workforce.
- Ministry of Health and partners should develop HR capacity plan (for national and sub-national staff) to cope with the requirements of the HIS master plan
- Define all categories of staff who need to be trained (e.g. HMIS, PMRS, Health Programs, others) and allocate health information tasks to other health workers. Create job descriptions for health information. Link capacity building activities such as refresher courses, use of Youtube videos, e-learning courses, preparation of annual plans, formal proper handover, etc. to professional development.
- Organize training workshops for doctors, coders and other health staff for recording diagnosis of disease conditions and cause of death as per ICD 10 simplified version.

3. STRATEGIC FRAMEWORK

3.1 STRATEGIC DIRECTION

The strategic direction sets a long-term broad policy direction for the entire range of health information systems (within both public and private sectors and dealing with health as well as health-related information). It articulates the strategic intent and constitutes the MoH blueprint for the health information systems development for years to come. The strategic direction is a guiding light for decision-makers, managers and health personnel to lead, manage and operate the health information systems, so that everyone in all health institutions at national and sub-national level moves in the same direction, while carrying out their respective activities that are steered towards a common vision. It also provides a framework within which the overall goal, strategic objectives and HIS strategies are formulated. Strategic statements include vision, mission, values and working principles (Figure 3.1). The HIS Master Plan, with clearly defined goal and objectives, along with clearly laid-out strategies, interventions and time bound targets, is developed as a means moving towards achieving the strategic intent of its development, in order to improve health outcome of the Cambodian population through better information, better decision making, better service delivery and better utilization of health services.

Figure 3.1: Strategic Direction for HIS in Cambodia



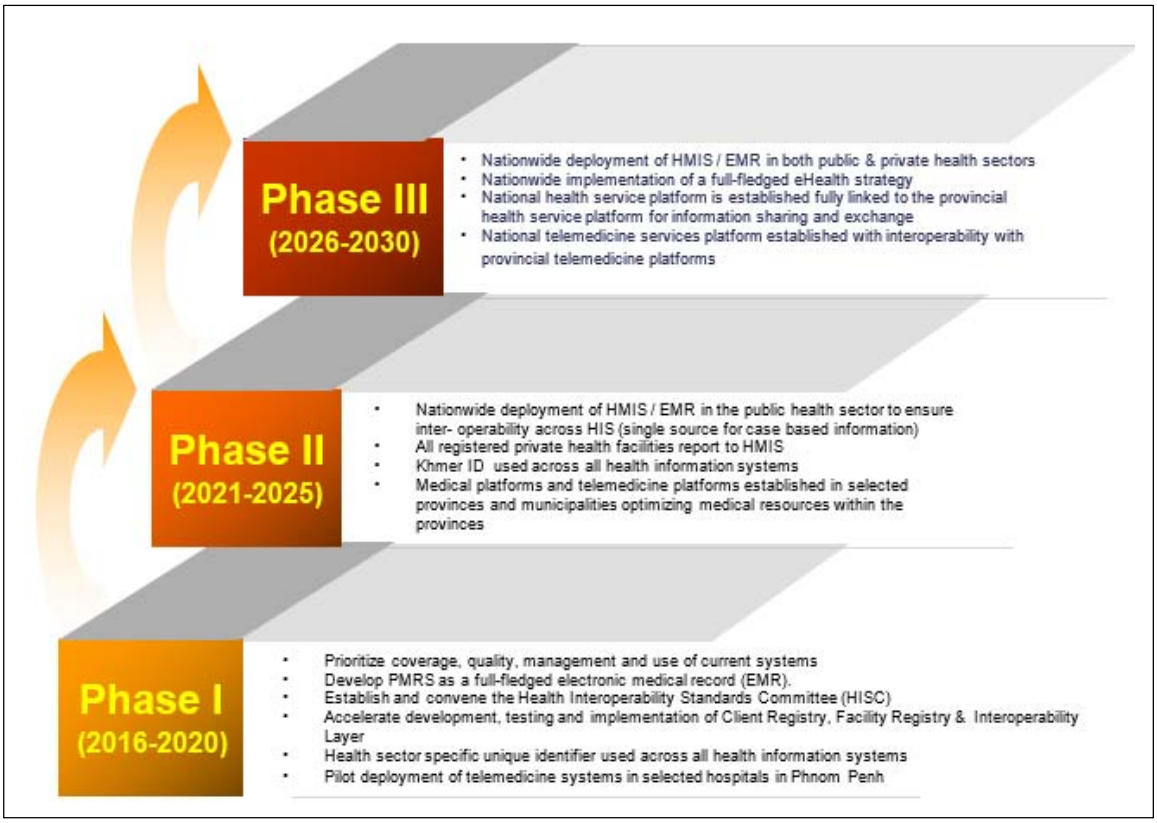
3.2 VISION AND MISSION

Vision:

All people in Cambodia will have better health and wellbeing through effective use of real-time health and health related information by all key stakeholders.

It is widely recognized that the better information, the better the decision, the better the service delivery and utilization and hence the better the health of the population. The long-term vision of Health Information System development in Cambodia is therefore to ensure availability of relevant, timely (including in real time), and high quality health and health related information for evidence-based policy formulation, decision-making, management and planning, and performance monitoring and evaluation, thereby contributing to improved health service delivery and improved health status. The long-term vision for HIS development in Cambodia is envisaged to be achieved in 3 phases as depicted in Figure 3.2.

Figure 3.2: Long term vision for HIS development in Cambodia



At the Measurement and Accountability for Results in Health (MA4Health) Summit, in June 2015, the United States Agency for International Development (USAID), WHO, and the World Bank called for action "to improve health facility and community information systems including disease and risk surveillance and financial and health workforce accounts, empowering decision makers at all levels with real-time access to information."[43] Achieving

[43] Measurement and Accountability for Results in Health (MA4Health). (2015). Health measurement and accountability post 2015: Five-point call to action. Retrieved from http://ma4health.hsaccess.org/docs/support-document/5-point-call-to-action.pdf?sfvrsn=0.

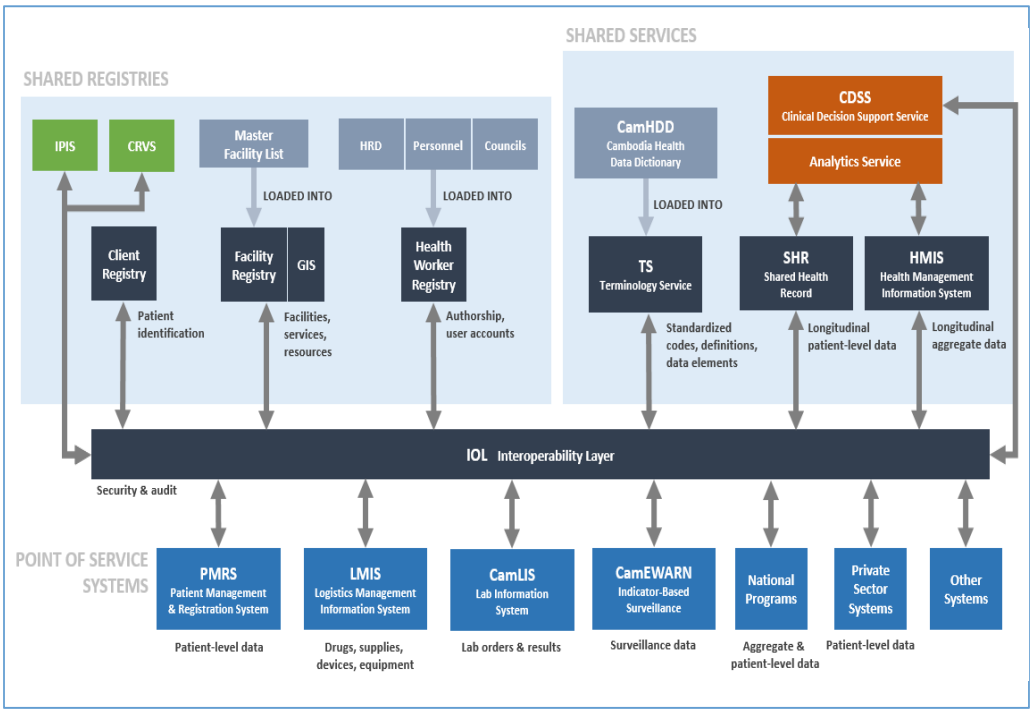
this goal in 15 years—the deadline set by the global health agency leaders who attended the MA4Health Summit—will require building the capacity of developing countries to collect, manage, and interpret health data. In order for Cambodia's vision to be translated into a reality, there is a need for the current silos of health information sub-systems to be virtually linked, integrated and become inter-operable so that the Department of Planning and Health Information is able to coordinate with the national programs, MOH departments, and other stakeholders in order to harmonize and integrate data at the national level for more effective planning and decision making in the next 5-10 years. This long term vision for HIS is conceptually depicted in Figure 3.3[44].

Mission:

Provide timely, relevant, accurate and complete health information through well trained and highly motivated staff with necessary resources and appropriate technology.

Increased and regular investment in the health information system, including communication and technology is a critical need for the health system strengthening as a whole. For example, one of the key interventions that this Master Plan prioritises for implementation is the expansion of the use of health sector specific Unique Patient Identifier to all health information systems in3 the country until the interface with the national ID is developed. Figure 3.4 shows how this is conceptualized to occur[45].

Figure 3.3: Conceptual Framework for long term interoperability of HIS in Cambodia

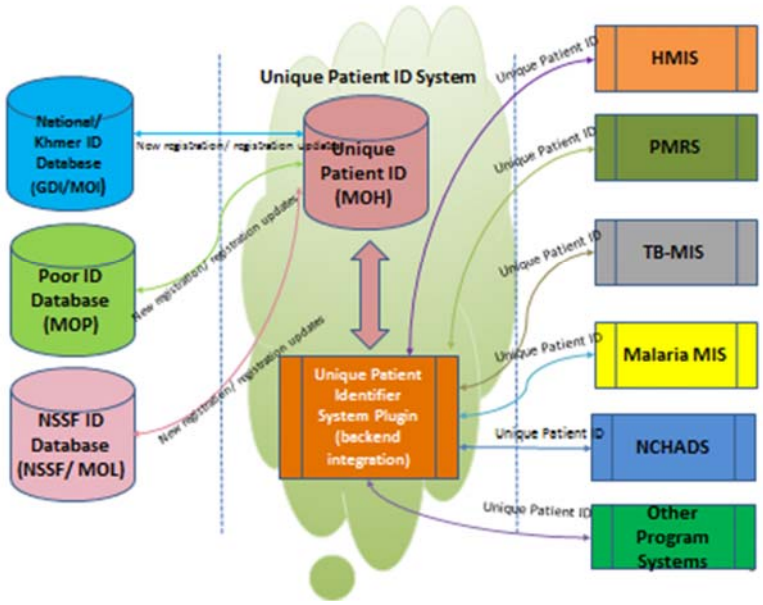


[44] Department of Planning and Health Information. *Health Interoperability Standards Framework (HISF).* Ministry of Health. June 2017

[45] Palladium. UIS Assessment. Consultation Workshop for UIS Assessment. 25 November 2016

Source: Department of Planning and Health Information. Health Interoperability Standards Framework (HISF). MOH. June 2017

Figure 3.4: Proposed Conceptual Architecture for use of Unique Patient Identifier in Cambodia



Source: Palladium. UIS Assessment. Consultation Workshop for UIS Assessment. 25 November 2016

3.3 GOAL, OBJECTIVES, STRATEGIES, PRIORITIES AND STRATEGIC INTERVENTIONS

3.3.1 Goal

High quality, accurate and timely health and health–related data and information are available and used together with results of sound health research. (Strategic Objective 6 of HSP 3).

HIS is one of the seven strategic areas of the HSP3 (2016-2020) and supported by five key HIS strategies (strategies # 26-30 in HSP3). The most important opportunity presented for the third Health Strategic Plan is to define, develop and initiate the use of health information as a central tool for consistent, evidence-based health planning and policy making, performance monitoring, quality improvement and strategy development. According to HSP3; by 2020 Cambodia's HIS will ensure availability of high quality health and health related information for policy decision making, planning and budgeting, performance monitoring, evaluation and research. Hence it is envisaged that during the Master Plan period, there will be expansion in the coverage of HMIS to both public and private sectors, a rapid scale up in the use of ICT/ EMR (electronic medical record) and introduction of Unique Health Identifier until adoption of the national ID, widespread use of ICD 10 for morbidity and mortality diagnosis and further strengthening of the disease surveillance system. The Master Plan is also expected to

incorporate system strengthening actions to ensure linkages with the national strategic planning in the area of civil registration and vital statistics.

DPHI, by definition of their role, should at some point become a single repository of all health information and this Strategic Master Plan is one step closer to achieving that objective. The interim objective for DPHI is to coordinate fully interoperable systems of health information and guide the dissemination of one set of data and strategic use of information for planning, decision making and monitoring and evaluation. DPHI is thus expected to play the role of the gatekeeper and ensure that all health sector players follow the Master Plan.

The Master Plan Strategic Objectives, Strategies and Strategic Interventions are essentially adopted from the Health Strategic Plan 2016-2020 (HSP3) in order to ensure alignment and harmonization with the latter.

3.3.2 HIS Strategic Objectives

For purposes of the Master Plan, strategies 26 to 30 of the HSP3 have been adopted as the five key HIS strategic objectives for the period 2016-2020. These are listed below.

1. Develop and implement legal tools and protocols for health information management. (Strategy #26 of HSP3)
2. Increase the quality, reliability and validity of health and health related data and information. (Strategy #27 of HSP3)
3. Improve institutional capacity on data management, especially at facilities and district level on data compilation, analysis, interpretation, reporting, dissemination and use. (Strategy #28 of HSP3)
4. Enhance the national disease surveillance and response systems, including public health emergency and disease reporting system. (Strategy #29 of HSP3)
5. Strengthen monitoring and evaluation system and promote health research. (Strategy #30 of HSP3)

For each of the above objectives, an appropriate verifiable outcome indicator has been identified. The five outcome indicators are listed below.

1. Significant improvements in health information governance found through an independent assessment of HIS in 2020.
2. /100% of government hospitals and 50% of health centers fully covered with PMRS as a full-fledged EMR by 2020.
3. Significant improvements in data management capacity found through an independent assessment of HIS in 2020
4. 100% of outbreaks reviewed and evaluated annually from 2018
5. Significant improvements in M&E system and research found through an independent assessment in 2020.

3.3.3 HIS Strategies

For purposes of the Master Plan, the strategic interventions articulated for each of the strategies 26 to 30 of the HSP3 have been adopted as the key HIS strategies for the period 2016-2020. These are enumerated below.

Strategies for Objective 1

1.6 Develop and enforce legislations and regulations concerning storage, confidentiality, retrieval and use of patient medical records.
1.7 Develop and implement national protocols for operations and management of the health information system, including flow of information, reporting, storage, data security and privacy.
1.8 Develop and use data kits such as dashboards and web-portal within HMIS to facilitate the use of health data and information.
1.9 Develop data quality assessment tools and institutionalize the tools in routine data quality monitoring.
1.10 Strengthen information systems on human resources/staffing, infrastructure, health services, population, laboratory (including biosafety/security/bio-risk management) and drug management support system.

Strategies for Objective 2

2.6 Promote data integration between different health information databases, focusing on standardization and interoperability.
2.7 Expand electronic medical record system, including patient registration, patient medical profiles, International Classification of Diseases, births, and deaths with medically defined causes accompanied by medical death certificates, as well as National Patient Unique Identifier system.
2.8 Use International Classification of Disease (ICD) based morbidity and mortality diagnosis and integrate ICD10/11 in HMIS and patient management registration system.
2.9 Increase coverage of reporting through the MoH web-based HMIS and national disease surveillance and response system, with compliance from the private health sector.
2.10 Conduct supportive supervision, spot checks, routine and follow-up monitoring of information systems, with timely feedback mechanism to ensure completeness, accuracy and quality of reporting.

Strategies for Objective 3

3.6 Develop common information standards and compatible platform to enable information sharing, including security architecture and regulations for privacy protection.

3.7 Expand IC application with appropriate training provision for health managers and health personnel who are responsible for data management including collection, compilation, analysis and interpretation, reporting dissemination and use.
3.8 Promote dissemination and use of quality health information among health personnel and the public to enhance health literacy among health personnel and the public.
3.9 Strengthen collaboration and coordination amongst relevant ministries and institutions and Development Partners for data collection for and analysis of population-based surveys from which the health sector can benefit.
3.10 Support the development of the national Civil Registration and system to collect vital statistics and promote their use in planning and health service delivery.

Strategies for Objective 4

4.1 Strengthen the existing routine early warning system on communicable diseases, known as Cam-Warn, and further integrate disease surveillance and response systems to reduce workload at facilities, district and provincial level.
4.2 Strengthen capacity of Rapid Response Team at facility, district and provincial level in detecting potential threats to public health, timely reporting accurate data, and responding to disease outbreak.
4.3 Develop the reporting of non-communicable diseases in the overall surveillance and case reporting and response system, including accident and injuries, with compliance for both public and private health sectors.
4.4 Perform routine and continuous monitoring of disease surveillance and response system to ensure accuracy, timeliness and completeness of reporting and other attributing factors.
4.5 Strengthen collaboration on communicable disease surveillance and response system through information sharing on potential threat and disease outbreak, knowledge sharing, and joint simulation exercises etc. with other relevant ministries and institutions and neighbouring countries.

Strategies for Objective 5 (Strategy #30 of HSP3)

5.1 Perform routine and continuous monitoring of plan implementation at required intervals by using the HSP3 Indicators Framework for M&E at different level of the health system.
5.2 Strengthen the use of the national M&E system, processes and tools to reduce multiple monitoring systems in the health sector, especially at operational level.
5.3 Enhance mutual accountability by the Ministry of Health and Development Partners to track progress of development cooperation towards the development results.
5.4 Establish governance structures with clearly defined roles and functions to advice oversee and coordinate health research system, while promoting the use of research findings for policy dialogue and formulation.

5.5 Develop and regularly update a health research agenda to coordinate and complement research activities.

3.3.4 HIS Strategic Priorities

The top ten priority strategic areas identified by DPHI and its partners for incorporation into the Master Pan are depicted in Figure 3.5 and described in detail below.

Figure 3.5: Top 10 Strategic Priority Areas for supporting HIS Objectives in Cambodia

<table>
<tr><td colspan="4">1. Leadership and Governance</td></tr>
<tr><td>2. Legislation, Policy & Compliance</td><td>3. Stakeholder Engagement</td><td>4. Services, Applications & Tools</td><td>5. Standards & Interoperability</td></tr>
<tr><td>6. Capacity and Workforce</td><td>7. Investment, Affordability and Sustainability</td><td>8.Infrastructure</td><td>9. Benefits Realisation</td></tr>
<tr><td colspan="4">10.Monitoring and Evaluation</td></tr>
</table>

Strategic Priority 1: Leadership and Governance

International experience has demonstrated that the successful implementation of integrated Health Information Systems (HIS) is complex and that it requires a strong national Strategic Master Plan. This Master Plan, set in the context of the DPHI's strategic aims and aligned to the strategic priorities set by the MOH in the form of HSP3, recognises that leadership (political, executive and technical) is critical for the successful realisation of the Master Plan.

Strategic Priority 2: Legislation, Policy & Compliance

HIS affects multiple stakeholder types and extends across multiple domains, including personal health, healthcare provision, ICT and management. Efficient and effective implementation of the Master Plan require appropriate legislations, regulations and policies to be put in place with a high degree of compliance . While the potential benefits of HIS implementations are high, their realisation can be risky, costly and challenging.

Strategic Priority 3: Stakeholder Engagement

HIS requires effective collaboration in order to succeed. This can only be achieved by engaging with all stakeholder groups affected by HIS. This helps to mobilise support, identify opportunities, highlight priorities, manage and mitigate risk.

Strategic Priority 4: Services, Applications and Tools

There is a wide range of digital applications and tools with the potential to support and improve healthcare delivery. The applications include electronic medical record systems, healthcare

information systems, surveillance systems, business intelligence for health, electronic content management, decision support and knowledge management. Tools include software and hardware devices, especially those used in eHealth and mHealth.

Strategic Priority 5: Standards and Interoperability

Standards are the cornerstone of the HIS Master Plan implementation. Besides interoperability standards which are essential for the accurate exchange of data, there is a requirement for national standards for procurement (hardware and software), software accreditation, data structure, terminology, clinical coding, security, messaging and the electronic health record.

Strategic Priority 6: Capacity and Workforce

Having adequate human resource capacity is essential to successful delivery on this Master Plan. This involves developing career paths, training and skill retention strategies in order to build up a workforce that can innovate, develop, deploy, maintain and support all eHealth interventions, especially health information systems and health management information systems. Define a standardised eHealth competency framework for health workers and health IT practitioners providing an understanding of required eHealth knowledge, skills and attributes for each professional group.

Strategic Priority 7: Investment, Affordability and Sustainability

Before commencement of the Master Plan implementation, financing must be procured and its sustainability assured over the total duration of the Plan. This requires proper planning and identification of benefits, so that value for money and affordability are balanced and results delivered as quickly as practically feasible. There is a need to undertake economic assessments of potentially beneficial interventions to support policy makers and MOH departments and national health programmes to make informed decisions when allocating scarce resources.

Strategic Priority 8: Infrastructure

The incremental approach adopted by this Master Plan aims to deploy eHealth capability in a step-wise manner. There are four areas which will provide the foundations for all other future eHealth activities: infrastructure, connectivity, registration of patients, facilities and providers, and a basic national electronic medical record.

Strategic Priority 9: Benefits Realisation

Specific actions are required to ensure that Master Plan interventions deliver on their promise and that anticipated benefits are realised for all stakeholders. These actions, which include all change management interventions including transitioning from NGO partners in regard to HMIS and PMRS by end of 2018, need to be clearly identified and planned. If they are not addressed adequately net benefits may not be demonstrated within a realistic timeframe and funding envelope.

Strategic Priority 10: Monitoring and Evaluation of the Master Plan

It is essential to monitor and evaluate performance on the implementation of the Master Plan on an ongoing basis. This will ensure that the objectives are being adhered to; lessons learnt are captured and used as inputs for future planning.

3.3.5 HIS Strategic Interventions

Table 3.1 depicts the key strategic interventions proposed to be implemented under each of the strategic objectives of the Master Plan.

Table 3.1: Strategic Interventions for HIS in Cambodia

Strategic Priority (SP)	**Strategies**	**Strategic Interventions**
Objective 1: *Develop and implement legal tools and protocols for health information management. (Strategy #26 of HSP3)* *Outcome indicator:* Significant improvements in health information governance found through an independent assessment of HIS in 2020.		
SP 1: Leadership & Governance SP 2: Legislation, Policy & Compliance	1.1. Develop and enforce legislations and regulations concerning storage, confidentiality, retrieval and use of patient medical records.	• Strengthen governance mechanisms for implementing an integrated HIS through strengthened collaboration within MOH and with other line ministries and partners. • Establish the legal framework for implementing an integrated HIS
SP 4: Services, applications and tools	1.2. Develop and implement national protocols for operations and management of the health information system, including flow of information, reporting, storage, data security and privacy. 1.3. Develop and use data kits such as dashboards and web-portal within HMIS to facilitate the use of health data and information. 1.4. Develop data quality assessment tools and institutionalize the tools in routine data quality monitoring.	• Develop and use national protocols and guidelines for health management information system • Develop and use data kits for ensuring the effective use of health information. • Develop and use data quality assessment tools
SP 3: Stakeholder Engagement	1.5. Strengthen information systems on human resources/ staffing, infrastructure, health services, population, laboratory (including biosafety/security/bio-risk management) and drug management support system.	• Establish and maintain a robust human resources information system • Establish and maintain a robust logistics management information system • Establish and maintain a robust financial management information system
Objective 2: *Increase the quality, reliability and validity of health and health related data and information. (Strategy #27 of HSP3)* *Outcome indicator:* 100% of government hospitals and 50% of health centres fully covered with PMRS as a full-fledged EMR by 2020.		

SP 5: Standards and interoperability	2.1 Promote data integration between different health information databases, focusing on standardization and interoperability.	• Establish Health Interoperability Standards and develop Client Registry, Facility Registry, and Interoperability Layer
SP 4: Services, applications and tools	2.2 Expand electronic medical record system, including patient registration, patient medical profiles, International Classification of Diseases, births, and deaths with medically defined causes accompanied by medical death certificates, as well as National Patient Unique Identifier system. 2.3 Use International Classification of Disease (ICD) based morbidity and mortality diagnosis and integrate ICD10/11 in HMIS and patient management registration system. 2.4 Increase coverage of reporting through the MoH web-based HMIS and national disease surveillance and response system, with compliance from the private health sector.	• Expand the use and evolution of PMRS as a full-fledged EMR at all health facilities in the country in a phased manner. • Ensure the implementation of a Unique Identification System (UIS) throughout the health sector aligned with the IPIS • Ensure the country-wide implementation of the ICD-10 simplified version • Improve the coverage of HMIS and IBS reporting including from the private sector
SP 6: Capacity and workforce	2.5 Conduct supportive supervision, spot checks, routine and follow-up monitoring of information systems, with timely feedback mechanism to ensure completeness, accuracy and quality of reporting.	• Strengthen supportive supervision and ensure the efficient and effective collection, compilation, analysis, reporting and use of data for decision making. • Geo-enable the Health Information Systems in Cambodia in order for geography and time to be integrated in the HIS and for the health sector to fully benefit from the power of geography, geospatial data and technologies.
Objective 3: *Improve institutional capacity on data management, especially at facilities and district level on data compilation, analysis, interpretation, reporting, dissemination and use. (Strategy #28 of HSP3)* *Outcome indicator:* Significant improvements in data management capacity found through an independent assessment of HIS in 2020		
SP 5: Standards and interoperability	3.1 Develop common information standards and compatible platform to enable information sharing, including security architecture and regulations for privacy protection.	• Develop and implement standards and data sharing arrangements
SP 7: Investment, affordability and sustainability SP 8: Infrastructure	3.2 Expand ICT application with appropriate training provision for health managers and health personnel who are responsible for data management including collection, compilation, analysis and interpretation, reporting dissemination and use.	• Implement a consolidated transition plan which envisages MOH's role enhancement to include the take-over of HMIS &PMRS by end of 2018 • Cost the Master Plan, undertake gaps analysis and mobilize required resources

		• Develop MOH ICT Strategy to reflect synergies with the Cambodian ICT Master Plan and implement by mobilising financial and other resources
SP 9: Benefits realization	3.3 Promote dissemination and use of quality health information among health personnel and the public to enhance health literacy among health personnel and the public. 3.4 Strengthen collaboration and coordination amongst relevant ministries and institutions and Development Partners for data collection for and analysis of population-based surveys from which the health sector can benefit. 3.5 Support the development of the national Civil Registration and system to collect vital statistics and promote their use in planning and health service delivery.	• Design and implement long-term HIS professional development and training plan aligned to the National Health Workforce Plan, job descriptions, handbooks, checklists • Develop and implement a Benefits Realization Plan • Promote effective use of data for decision making • Collaborate and coordinate with related ministries and partners • Collaborate with MOI in developing Civil Registration and National Identification Systems
Objective 4: *Enhance the national disease surveillance and response systems, including public health emergency and disease reporting system. (Strategy #29 of HSP3)* *Outcome indicator:* 100% of outbreaks reviewed and evaluated annually from 2018		
SP 5: Standards and interoperability	4.1 Strengthen the existing routine early warning system on communicable diseases, known as CamEWARN, and further integrate disease surveillance and response systems to reduce workload at facilities, district and provincial level.	• Strengthen Indicator based surveillance (IBS) and response system • Strengthen Event based Surveillance (EBS) and response systems • Establish an integrated disease surveillance and response system
SP 6: Capacity and workforce	4.2 Strengthen capacity of Rapid Response Team at facility, district and provincial level in detecting potential threats to public health, timely reporting accurate data, and responding to disease outbreak. 4.3 Develop the reporting of non-communicable diseases in the overall surveillance and case reporting and response system, including accident and injuries, with compliance for both public and private health sectors. 4.4 Perform routine and continuous monitoring of disease surveillance and response system to ensure accuracy, timeliness and completeness of reporting and other attributing factors.	• Strengthen capacity of sub-national Rapid Response teams • Strengthen surveillance of non-communicable diseases and conditions • Monitor Surveillance and Response Systems

SP 9: Benefits realization	4.5 Strengthen collaboration on communicable disease surveillance and response system through information sharing on potential threat and disease outbreak, knowledge sharing, and joint simulation exercises etc. with other relevant ministries and institutions and neighbouring countries.	• Strengthen collaboration among partners for effective Surveillance and Response Systems
Objective 5: *Strengthen monitoring and evaluation system and promote health research. (Strategy #30 of HSP3)* *Outcome indicator:* Significant improvements in M&E system and research found through an independent assessment in 2020.		
SP 10: Monitoring and Evaluation	5.1 Perform routine and continuous monitoring of plan implementation at required intervals by using the HSP3 Indicators Framework for M&E at different level of the health system. 5.2 Strengthen the use of the national M&E system, processes and tools to reduce multiple monitoring systems in the health sector, especially at operational level. 5.3 Enhance mutual accountability by the Ministry of Health and Development Partners to track progress of development cooperation towards the development results.	• Undertake routine and continuous monitoring of HSP3 • Strengthening the use of national M&E systems • Strengthen mutual accountability between MOH and its clients
SP 2: Leadership & Governance	5.4 Establish governance structures with clearly defined roles and functions to advice oversee and coordinate health research system, while promoting the use of research findings for policy dialogue and formulation.	• Establish governance structures for health research
SP 9: Benefits realization	5.5 Develop and regularly update a health research agenda to coordinate and complement research activities.	• Develop and implement a health research agenda

3.4 KEY STRATEGIC PRIORITY ACTIONS & MILESTONES

Key strategic priority actions and milestones for implementing the Master Plan along with the timelines and responsible entities are summarized in Table 3.2. A brief rationale for each of the proposed actions/milestones is also provided.

Table 3.2: HIS Master Plan- Key Strategic Priority Actions and Milestones

#	Key Strategic Priority Action/ Milestone	Timeline	Responsible entities	Comments
Objective 1: Develop and implement legal tools and protocols for health information management. (Strategy #26 of HSP3)				
SP1: Leadership & Governance				
1	Establish a high level Steering Committee (SC) for	By 30 September 2017	MOH top leadership, DPHI	Leadership (political, executive and clinical) is critical for strengthening collaboration both within the MOH and with other line

	HIS chaired by Minister of Health or Secretary of State for Health			ministries and other partners and thus ensuring the successful realization of the Master Plan. Membership from MOI, MOP, NiDA, MPTC, Ministry of Information, MEF, and relevant departments and programs of MOH. SC to be charged with the responsibility for setting directions (via the HIS Master Plan) and making decisions.
2	Set up a Program Management Office	By 1 October 2017	DPHI	For supporting Steering Committee and TWG, day to day coordination, convening and coordinating meetings, recording of minutes of meetings and agreements, track stakeholder commitments and keep stakeholders informed. The PMO will also ensure that DPHI plays its gatekeeper role for all health information systems in the county in an efficient and effective manner.
3	Upgrade DPHI to assume M&E role for the entire health sector	By 30 June 2018	MOH top leadership, DPHI	Currently the M&E role is unevenly distributed among different MOH departments and programs. There is an urgent need to have an overall coordinating entity. In view of its role in collection and dissemination of major sources of health information, DPHI would be the most suitable department to take on this role.
SP 2:Legislation, Policy & Compliance				
4	Draft new legislations and regulations & obtain government clearance	By 31 Dec 2018	DPHI with technical support from HIS TWG & AeHIN	Currently there is no single legislation that mandates the provision of health and health related information for compilation and analysis of health statistics in the country.
SP3:Stakeholder Engagement				
5	Convene quarterly stakeholder meetings and attend meetings convened by MOI, MOP, MPTC, etc..	First meeting held by 30 September 2017, quarterly thereafter.	DPHI	This Master Plan needs effective collaboration in order to succeed. This can only be achieved by engaging with all stakeholder groups. The aim of the meetings is to mobilise support, identify opportunities, highlight priorities, and manage and mitigate risk.
6	Integrated national HRH database in place and use	By 1 January 2018	Personnel Department, HRD Department, WHO TA	The ongoing work in regard to the integration of the Database on Human Resource Development and Personnel maintained by the HRD department and the annual projection tool of the Personnel Department will need to be expedited in order to ensure more efficient HR planning and management.
7	HMIS linked to MLMIS in place.	By 31 December 2018	EDB, DDF and HIS Bureau, DPHI	A single integrated system for supply chain management providing real time visibility completed in selected provinces and interoperability established with HMIS.
Objective 2: Increase the quality, reliability and validity of health and health related data and information. (Strategy #27 of HSP3)				
SP 5: Standards and Interoperability				
8	Establish Health Interoperability Standards Committee (HISC)	By 30 September 2017	DPHI & HIS TWG	Besides interoperability standards which are essential for the accurate exchange of data, there is a requirement for national standards

	nested within HIS TWG			for procurement (hardware and software), software – accreditation, data structure, terminology, clinical coding, security, messaging and the electronic medical record.
9	An Interoperability Layer in place and communicating reliably with a Client Registry, a common geo-registry for health facilities, ODs, administrative districts and villages geo-enabled Facility Registry, PMRS and CamLIS.	By 31 December 2020	DPHI, HISC, AeHIN GIS Lab, URC and InSTEDD	By 2020, all data exchange should only occur via the Interoperability Layer, with minimal exceptions. HMIS should begin to derive data necessary to calculate certain indicators from PMRS and CamLIS, via the Interoperability Layer, to augment direct indicator reporting into HMIS. Simultaneously, it is expected that with ADB support, the HIS in Cambodia will be geo-enabled.
SP 4: Services, Applications & Tools				
SP 6: Capacity and Workforce				
15	Organize training workshops for doctors, coders and other health staff for recording diagnosis as per ICD 10 simplified version.	- National TOT workshop held by 30 Sep 2017 - Sub-national workshops completed by 31 Dec 2018	DPHI with support from WHO, Palladium and URC	Currently, very few doctors in the public hospitals in the country are recording the disease conditions and cause of death using the ICD 10. Lessons learned from previous field trial in 2015 deploying the ICD-10 APN simplified version will be used in developing an ICD coding system to track diseases and deaths which can improve accountability and planning for the health system. The proposed training is aimed at supporting and strengthening the application of the ICD simplified version in Cambodia.
16	100% coverage of provinces with master lists and registries developed under the GIS project.	By 31 December 2018	DPHI with technical support from AeHIN GIS Lab	The ADB funded GIS project aims to geo-enable the HIS in Cambodia in order for geography and time to be integrated in the HIS and for the health sector to fully benefit from the power of geography, geospatial data and technologies. The outcome envisaged is a common geo-registry and strengthened geospatial data management and GIS capacity of the HIS Bureau at both the central and provincial levels.
Objective 3: Improve institutional capacity on data management, especially at facilities and district level on data compilation, analysis, interpretation, reporting, dissemination and use. (Strategy #28 of HSP3)				
SP 5: Standards and Interoperability				
17	Establish data sharing arrangements between HIS 3.0, PMRS and national program databases by using Client Registry (CR) and Open Health Information	- By 31 Dec 2018: for TB HIS and Malaria-MIS - By 31 Dec 2019: for HIV/AIDS database system	DPHI, URC, Palladium, national programs & Standards Committee	Apart from HMIS and PMRS established and managed by DHIS, several database systems are developed and managed by other departments and vertical programs of the Ministry of Health and of other sectors. All these multiple systems are operating in silos due to verticalization/ fragmentation of programs. There is duplication of effort and disparities in reporting. Hence, there is a need for both integration of and interoperability

	Exchange (OpenHIE)			between different systems that are currently operating in Cambodia.
18	Develop and sign a MOU between MOH and MOI regarding CRVS and IPIS integration with MOH systems and processes	By 31 Dec 2017	MOH top leadership, DPHI and MOI top leadership	High ranking officials from the two ministries should be brought together to work on and agree on the contents of the MOU.
SP 7: Investment, Affordability & Sustainability				
19	Finalize & implement a consolidated transition plan	By 30 June 2018	DPHI, URC & Palladium	USAID, the major development partner which has supported the two major systems (HMIS and PMRS) managed by DPHI has confirmed that their funding would come to a close by end of 2018. Hence a robust plan needs to be put in place for DPHI to take over the responsibility for management of HMIS and PMRS from Palladium and URC respectively.
20	Cost the Master Plan and mobilize resources following the organization of a convergence workshop	Workshop held by 30 September 2017	DPHI with support from AeHIN.	Financing must be procured and its sustainability protected over the duration of the project. This requires proper planning and identification of benefits, so that value for money and affordability are balanced and results delivered as quickly as feasible. The costing of implementation of Master Plan should include all levels. Mobilize required resources with incremental increase and ownership of Government.
SP 8: Infrastructure				
21	Procure, install and maintain the ICT infrastructure necessary for all HIS in the country.	By 30 June 2018	DPHI with funding support from DPs	Investment in ICTs is essential in taking any country to the next level of productivity and efficiency. The current ICT infrastructure in the health sector is not sufficiently robust or reliable to support a high level of availability and performance and thereby ensure the safe and effective use of health information.
SP 9: Benefits realization				
22	Develop a benefits realization plan which specifies health outcome benefits expected at local level for all HIS & eHealth interventions	By 31 Dec 2018	DPHI & HIS TWG	Specific actions are required to ensure that HIS interventions deliver on their promise and that anticipated benefits are realised for all stakeholders. These actions, which include all change management interventions, need to be clearly identified and planned. If they are not addressed adequately net benefits may not be demonstrated within a realistic timeframe and funding envelope.
Objective 4: Enhance the national disease surveillance and response systems, including public health emergency and disease reporting system. (Strategy #29 of HSP3)				
SP 5: Standards & Interoperability				
23	Strengthen EBS by integrating all events into single online database and report	By 31 Dec 2017	CDCD with support from WHO TA	Currently MS Access based desktop applications. Data collection through hotlines. Need to be integrated and made web-based.

24	Integrate diabetes and hypertension databases	By 31 Dec 2017	PMD with support from WHO TA	Currently MS Access based desktop applications. Data collection through sentinel sites. As the two diseases are closely interrelated in terms of risk factors, co-existence and care, there is a need to integrate and establish a web-based integrated system hosted by Preventive Medicine Department.
SP 6: Capacity and workforce				
25	SOPs for outbreak investigation and response endorsed and implemented	By 31 Dec 2017	CDCD with support from WHO TA	The SOP once complied with, is expected to strengthen capacity of Rapid Response Teams at facility, district and provincial level in detecting potential threats to public health, timely reporting accurate data, and responding to disease outbreaks.
Objective 5: Strengthen monitoring and evaluation system and promote health research. (Strategy #30 of HSP3)				
SP 10: Monitoring & Evaluation				
26	Develop M&E Strategy for Master Plan aligned to the overarching M&E Strategy of HSP3	By 30 September 2017	DPHI & HIS TWG	It is essential to monitor and evaluate performance on the Master Plan on an ongoing basis. This will ensure that the objectives are being adhered to and allow for any mid-course corrections.
SP 9: Benefits realization				
27	A central repository for all survey and research data set up in NIPH.	By 30 June 2018	NIPH with TA support from WHO	Routine archiving and sharing of health research data in a central repository is expected to reinforce the collaborative and cumulative processes involved in creating scientific knowledge. This increases the transparency and accountability of research and bolsters its reliability and authority by enabling other investigators to repeat or extend analyses while reducing the possibility of data duplication.

3.5 VALUES AND WORKING PRINCIPLES

The MOH intends to achieve its stated HIS vision and mission through application of ethical principles that are guiding the MOH's overall work in the health sector. A value-based commitment of the MOH is: "Rights to health for all Cambodians and Equity". Figure 3.5 depicts key ethical working principles for HIS in Cambodia.

Figure 3.5: Ethical Working Principles for HIS in Cambodia

Day-to-day management practices and activities of decision-makers, health managers and operational staff in all health institutions at all levels of the health system who deal with and use HIS are guided by a set of ethical working principles that are the basis for data collection, compilation, analysis, reporting and decision-making to ensure that health institutions are operating in a way that is consistent with the HIS vision, mission and values, to ensure availability of relevant, timely, and high quality health and health related information for evidence-based policy formulation, decision-making, management and planning, and performance monitoring and evaluation, thereby contributing to improved health service delivery and improved health status.

Ethical Working Principles for HIS
1. Client-centric Collect and provide information that is respectful of and responsive to individual patient and consumer preferences, needs, and values. The consumers of health information are those who monitor health sector performance and make decisions regarding utilization of health resources – managers and service providers within the health sector, as well as external authorities and civil society in general. HIS/M&E services must cater to the needs and priorities identified by all of these groups.
2. Equitable Remove socio-cultural, geographical, financial and bureaucratic barriers in access to and utilization of quality health information among all key stakeholders.
3. Standards based

Different systems within the overall HIS umbrella should confer to international standards that are well-supported and widely-adopted. Standards for building/upgrading systems and system-to-system connections so that data can be exchanged meaningfully should be put in place and be complied with. Common definitions of indicators, data collection instruments, and data processing and analysis procedures should form the foundation for effective HIS. Without consistent principles and definitions performance cannot be systematically measured and improved across locations or over time.
4. Interoperable The different systems and databases should be able to share data with each other and understand it for appropriate use.
5. Innovative The national decentralization and deconcentration policy has stimulated innovations at sub-national, health facility, and community levels in management and information use. These best practices should be shared and adapted for more widespread use.
6. Cost-effective A cost-effective HIS is one in which one in which work process and flow require minimal resource expenditures of time and money while at the same time data are of sufficient quality to support quality in decision making and there is continuous use of information to improve health systems performance, leading to continuous improvement in health status.
7. Scalable and phased In view of the ambitious objectives of the Master Plan and the breadth of interventions, a phased approach needs to be followed building on what already exists in public and private sectors and scaling up interventions in an incremental fashion and carrying out as prioritized by key stakeholders.
8. Sustainable The restructured and integrated HIS must be sustainable both in terms of human resources and budget. Given the human resource shortages and high turnover rates, the system must be easy to use so that new staff can quickly learn to operate it. In addition to simplicity, the system should be appropriate for the M&E needs at each level so that health staff find it useful. System design should take into account recurrent costs for stationery and ICT and minimize these costs. Labour costs for operating the system should also be minimized.
9. Collaborative Encourage a collaborative approach by leveraging partnerships, e.g. other government ministries and departments, private sector, NGOs, neighbouring country governments, research organisations. There is a need to seek support and opportunity to involve partners, including the private sector, for restructuring the HIS and improving M&E. It is important to create harmonious synergy between health experts and ICT experts while building on the technology infrastructure, systems and data repositories already in place through the adoption of common standards and a collaborative approach to the implementation of the Master Plan.
10. Accountable Improving responsiveness and good governance by application of laws and regulations, customs, ethical standards and norms, with emphasis on patient-centred health service delivery.

4. IMPLEMENTATION FRAMEWORK FOR HIS

The implementation framework for the Master Plan is depicted in Annex 2. The framework is constructed on the basis of a logical approach to implementation with Vision, Mission and Goal statements at the top of the matrix. The five identified strategic objectives are then listed sequentially with the corresponding outcome indicators, strategies, and strategic interventions. For each of the strategic interventions, key activities are identified and the timeline for their implementation is plotted. Against each of these activities, one or more objectively verifiable indicators are described along with means of verification, responsible entities and resources required such as technical assistance, government and donor support, etc.

While most of the activities are developmental in nature and are expected to be completed during the master plan period, some are routine and will continue through the plan period and beyond. The resources they require will need to costed and appear in routine operational budgets. Each activity will have a start and completion date which will need to be identified and presented in detailed operational plans. The generation of the defined immediate products signals the successful completion of the activity, and can be used as a progress indicator for monitoring purposes. In addition, each activity has an entity defined as responsible for the implementation of the activity. Obviously, there will be other offices, departments, programs and institutions collaborating with the activity, in addition to the responsible office and these have also been included in the matrix.

Finally, each activity may require additional resources for its successful implementation. An attempt is made at this point only to identify the type of resources required for each activity, not the amounts. However, the activity description should provide the coefficients needed to calculate the resource requirements, such as the number of facilities to be involved, the number of courses and participants to be trained, and other indications of the size of the product "coverage" and include in the detailed HIS annual operational plans. This Implementation Framework will be further refined and used during subsequent discussions with stakeholders within the health system and with donors in order to confirm interest, responsibilities for implementation, and technical and financial support. The Implementation Framework also provides a basis for the monitoring of implementation and product development, and will be reflected in the HIS M & E Framework.

5. COSTING AND FINANCING

5.1 COSTING OF HIS

As part of the Health Strategic Plan (2016-2020), the MOH with support from WHO undertook a costing of all the strategic objectives including strategic objective 6 (Health Information Systems), using the OneHealth Tool, a model for medium-to long-term strategic planning in the health sector[46]. Cost of operating and maintaining HIS, including costs of ICT equipment have been taken into consideration. Costs are for the public health sector only and are presented in constant U.S. dollars (US$). Table 5.1 summarizes the cost estimates for HIS as per the HSP 3. A total amount of US$ 14.2 million is projected to be the total cost for HIS over the five year period.

Table 5.1: HSP3 Cost estimates for Strategic Objective 6 (HIS) (in USD)

HIS dimensions	2016	2017	2018	2019	2020	Total
Governance	9,600	9,600	9,600	9,600	9,600	**48,000**
Strategic planning	122,900	94,600	3,000	13,000	3,000	**236,500**
Policy and regulations	92,000	138,100	0	20,000	0	**250,100**
Information use	1,798,981	2,664,556	1,878,204	1,806,504	1,805,404	**9,953,648**
Infrastructure	780,800	813,200	283,800	323,500	285,800	**2,487,100**
Human capital development	203,200	314,500	203,200	301,000	203,200	**1,225,100**
Total	**3,007,481**	**4,034,556**	**2,377,804**	**2,473,604**	**2,307,004**	**14,200,448**

Since work on the HIS Master Plan was yet to begin whilst the HSP 3 was being developed, it is essential to undertake a detailed costing of the HIS based on the strategic interventions included in the HIS Master Plan.

The costing for the HIS Master Plan (2016-2020) may be performed using an activity-based costing approach to provide a robust estimate of the resources required to achieve the 5 strategic objectives of the plan. The methodology identified resources down to the sub-activity level. Quantities required need to be determined of each resource for each activity on a quarterly basis over the life of the Master Plan. Unit costs may be sourced from historical expenditure for

[46] Ministry of Health. The Third Health Strategic Plan 2016-2020. Department of Planning & Health Information. June 2016

commodities, travel, and human resources and active Global Fund and USAID grant budgets. Inflation needs to be factored in for the duration of the Master Plan.

5.2 FINANCING OF HIS

Unlike other areas especially some of the major national health programs where funds come from multiple sources (government, bilateral, donor agencies, etc.), HIS has historically had low and irregular investments despite the need for generating quality data. Since its implementation began in 1995, the HIS faced irregularity of financial support and technical assistance, which hampered expected improvement of the HIS as well as capacity building of health information staff. For example, despite having an 8 year Strategic Plan (2007-2015) in place, only a small proportion of the required funds could be mobilized, mainly for monitoring and evaluation. The budgetary commitments of different development partners for HIS related activities in 2018 in US$ are shown in Table 5.2.

Table 4.2: Provisional financial commitments from development partners for HIS in 2018 (in USD)

GAVI	**HEQIP** (WB, DFAT, KfW, Korea)	**WHO**	**USCDC**	**USAID** (through Palladium)	**USAID** (through URC)	**Total commitments for 2018**
Cash	**Cash**	**In-kind**	**Both**	**Cash**	**Cash**	**Both**
103, 175	500,000	80,000	100,000	350,000	405,000	**1,583,175**

The financial allocations for 2019 and 2020 are estimated to be much lower at around US$ 783,175 per year with the ending of USAID support through Palladium (only up to mid-2018) and URC (only up to end of 2019)[47]. However, it may be noted that only direct allocations for HIS activities made by different development partners have been taken into consideration in the above estimates. For example, these allocations do not include HIS activities that are part of overall HSS measures or those which are undertaken as part of specific disease programs.

5.3 FINANCIAL GAP ANALYSIS

A preliminary analysis based on HSP3 cost estimates for HIS and financial commitments from development partners (see Table 5.3) shows that there is a substantial financial gap that needs to be bridged if HIS is to be implemented successfully during the period up to 2020. For e.g. the financial gap for 2018 works out to US$ 794,629 (cost estimate of US$ 2,377,804 minus a total financial commitment of US$ 1,583,175) and the gap goes up to US$1,690,429 in 2019 and US$ 1,690,429 in 2020 respectively.

[47] Personal communication from Dr. Chantha Chak, HSS Team Leader, USAID Cambodia on 2 June 2017.

Table 5.3: Provisional Financial Gap Analysis for the period 2018-2020 (in USD)

Category	2018	2019	2020	Total (2018-2020)
Cost estimate for HIS	2,377,804	2,473,604	2,307,004	7,158,412
Financial commitments from development partners	1,583,175	783,175	783,175	3,149,525
Estimated financial gap	794,629	1,690,429	1,523,829	4,008,887

When the HIS Master Plan is fully costed using an activity-based costing approach, the financial gap is likely to be much higher than currently estimated.

5.4 RESOURCE MOBILIZATION

To successfully implement the HIS Master Plan, the Ministry of Health and DPHI will undertake a detailed costing exercise and financial gap analysis through the adoption of a participatory approach and utilising required technical assistance in order to provide a robust estimate of the resources required to achieve the 5 strategic objectives of the plan. The findings from this exercise will be presented at a convergence workshop proposed to be held during the latter half of 2017 and attended by key government, NGO and development partners. It is expected that further financial commitments may be made by the relevant development partners following the workshop in order to reduce the financial gap.

MOH and DPHI will continue to develop relationships with current financial partners, while exploring new potential sources and mechanisms for sustainable resources necessary for achieving the objectives of the Master Plan. The DPHI will increase dialogue with relevant ministries and departments within the Royal Government of Cambodia including the Ministry of Economy and Finance (MEF) in order to understand how to mobilize required resources for HIS with incremental increase and ownership of Government. Furthermore, DPHI will continue to emphasize the importance of ensuring transparency, accountability, and efficiency in resource disbursements to ensure effective collaboration.

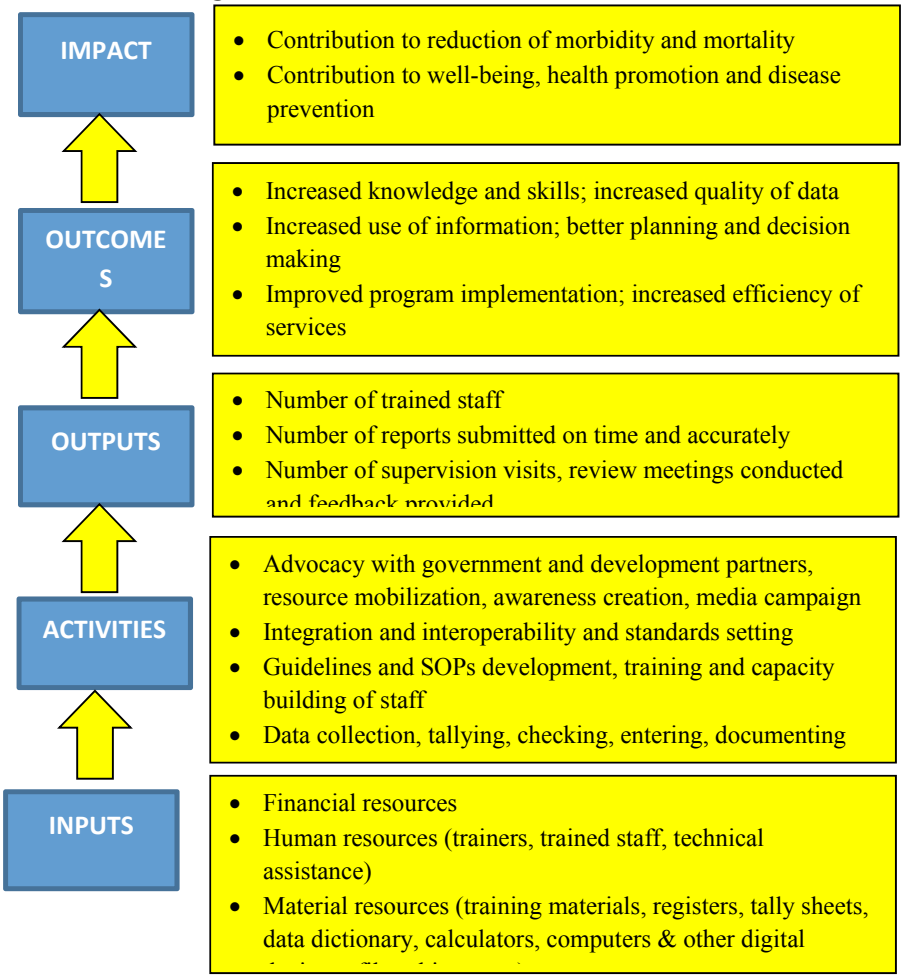
6. ONITORING AND EVALUATION

6.1 NEED FOR MONITORING AND EVALUATION OF THE MASTER PLAN

It is essential to monitor and evaluate performance of the HIS Master Plan on an ongoing basis. This will ensure that the objectives are being adhered to and provide inputs for future planning. M&E is a core part of any strategy, program, or project that is undertaken in the health sector. This allows the management of such work to assess whether objectives are being met, or how to redirect resources to better achieve the stated objectives if they are not being met. Having a good M&E framework for the Master Plan enables the Ministry of Health and key stakeholders to track and assess the results of implementing the Master Plan.

Figure 6.1 depicts the results chain in demonstration of implementation and impact of the health information system which forms the basis for the Monitoring and Evaluation of the Master Plan.

Figure 6.1: HIS Master Plan- Results Chain



6.2 MONITORING AND EVALUATION FRAMEWORK FOR THE MASTER PLAN

The M&E approach focuses on measuring the execution of the Master Plan and is central in answering the question of whether the Ministry of Health is on track in terms of its implementation of the Master Plan. The Monitoring and Evaluation Matrix summarised in Annex 3 presents the list of outcome, output and process indicators to be used for monitoring the implementation and outputs of the HIS Master Plan 2016-2020. All the indicators related to Health Information System that have been included in the national indicator framework presented in Annex 3 of the HSP3 document have also been included in the Monitoring & Evaluation Indicator Matrix for HIS Master Plan (Annex 3).

The indicators, data sources, frequency, and responsibility are grouped by each objective in the plan, and its associated strategic interventions. Every effort has been made to restrict the number of indicators to a manageable number to ensure the efficiency and effectiveness of monitoring the plan. It should be remembered that the plan extends over the five year period of the Master Plan and that not all of the activities included in the plan will be implemented at the same time. Also, once certain activities have been successfully completed, their monitoring will no longer be necessary, and these indicators will be excluded from regular monitoring activities. As such, the actual number of monitoring indicators in use at any given moment are likely to be far fewer than the complete set of 54 indicators included in the Monitoring &Evaluation Indicator Matrix for HIS Master Plan(Annex 4).

Responsibilities for the monitoring of each indicator have been clearly delineated in the matrix. These typically devolve to the relevant department or institution at collaborating ministries. These departments and institutions will arrange to form monitoring teams and assign specific responsibilities to them for the conduct of monitoring activities including schedules, and the calculation and reporting of the indicators. The reporting of these indicators will be carried out at the frequency recorded in the matrix to the HIS Technical Working Group, the apex body responsible for the overall implementation of the plan. DPHI as the chair of the HIS-TWG will then arrange to produce an annual report of the indicators, showing trends over time, and the status of implementation of each of the activities.

It should be noted that the objectives and strategies included in the HIS Master Plan 2016-2020 have been integrated into the third Health Strategic Plan (HSP3), 2016-2020 which is the MOH's plan for the future development of the health sector, and the improvement of the health status of the Cambodian people. The final evaluation of the HIS Master Plan, therefore, will form part of the overall evaluation of the HSP3 per the evaluation design recorded therein. HSP3 also calls for a midterm review in 2018, at which time the HIS Master Plan will be reviewed as well. Following the review, midcourse adjustments and corrections to the plan as required will be instituted.

7. PRE-REQUISITES AND CRITICAL SUCCESS FACTORS

7.1 PRE-REQUISITES AND CRITICAL SUCCESS FACTORS FOR THE HIS MASTER PLAN

There is clear recognition within the Master Plan 2016-2020 that its successful implementation impinges on a series of assumptions and potential risks which need to be kept in mind and carefully and diligently handled. These are summarised below.

1. *Political commitment*: First and foremost is the necessity for the Master Plan to be fully endorsed by the RGC with supporting inter-ministerial MOUs, policies, mandates and legislation.
2. *Financial support*: The Master Plan needs to be adequately funded and supported by government and the principal health development partners. The availability of the appropriate Government budget/ partner funding to support the sustainability of various initiatives in the Master Plan needs to be ensured.
3. *Legal Environment*: Policies, legalisation and regulatory framework required for submission of information and sharing and management of data.
4. *Coordination with multiple stakeholders*: It is imperative that the wide array of organizations and stakeholders involved in the implementation of the plan maintain a sound network and adopt the necessary coordination mechanisms. A shared vision and collaborative approach among all stakeholders for the coordination, planning and implementation of the *Master Plan* initiatives is a top priority.
5. *Communication to multiple stakeholders*: The plan needs to be widely communicated to, and understood by stakeholders, professional associations, media and citizens.
6. *Policy and Legal Framework*: The Master Plan must act as a catalyst to support more effective policy and action at national and local levels. Ensuring legal and regulatory compliances are fundamental to successful achievement of the Master Plan outcomes.
7. *Managing the technical landscape:* In the background of technological advances sweeping across the world and across all sectors, key players involved in implementing the Master Plan will need to ensure that they remain updated on the technological initiatives and innovations becoming available and be flexible enough to absorb the lessons from the best practices especially within the GMS Region.
8. *Common understanding*: A clear understanding of the strategic priorities and objectives for both HIS strengthening and e-Health is required among DPHI, line ministries, MOH departments, national health programs, NGO partners and development partners.
9. *Standardised approach*: The Master Plan has to provide a platform to ensure a more consistent and standardized approach to managing public health data and information.
10. *Enabling environment:* Efforts must be directed toward data sharing across organizations/ ministries (MOH, MOI, MOP, MOL to work together)
11. *Robust implementation*: The Master Plan needs to be fully implemented so that it can deliver the information required for informed decision making. Strong project management and change management approach to effectively coordinate activities, and support the required organizational, behavioral and attitudinal changes.

REFERENCES

1. Abdelhak M, Grostick S, Hankin MA, Jacobs E. Health Information: Management of a Strategic Resource. Philadelphia, WB Saunders Company, 1996.
2. Asia Pacific Observatory on Health Systems and Policies. The Kingdom of Cambodia health system review (Health Systems in Transition, Vol. 5 No. 2 2015). World Health Organization Regional Office for the Western Pacific
3. CDHS 2005 & 2014. The Health Sector Progress Report 2008 & 2015 (MoH) Health Sector Analysis Report January 2015.
4.DAMA International. Guide to Data Management Body of Knowledge (DAMA DMBOK ®) https://technicspub.com/dmbok/
5. Department of Health, Republic of South Africa. *National eHealth Strategy*. 2012-2017. July 2012
6. Department of Planning and Health Information. Ministry of Health. *Health Interoperability Standards Framework (HISF).* June 2017
7. Department of Planning and Health Information. Ministry of Health. The Third Health Strategic Plan 2016-2020. Cambodia. June 2016
8. Derek Ritz. PMRS Evaluation. ecGroup Inc. July 2016.
9. Federal Ministry of Health. HMIS Reform Team. Ethiopia. *Health Management Information System (HMIS) / Monitoring and Evaluation (M&E) Strategic Plan for Ethiopian Health Sector*. January 2008.
10. Federal Ministry of Health, Nigeria. *National Health ICT Strategic Framework.* 2015 – 2020*. Draft for review. October 2015*
11. Health Informatics Centre, Planning Division, Ministry of Health Malaysia. *HIMS BLUEPRINT.* 2nd Edition: 2013
12. Health Informatics Society of Sri Lanka. *eHealth in Sri Lanka.* 1 March 2017. http://www.hissl.lk
13. http://hiscambodia.org/public/homepage_en.php?m=1
14. http://wiki.gis.com/wiki/index.php/GIS_Glossary
15. https://www.linkedin.com/pulse/cambodia-telecom-law-2015-brd-law-office
16. Hurtubise, R. Managing information systems: concepts and tools. West Hartford, CT, Kumarian Press, 1984.
17. Johns M. Health Information Management Technology: Chicago, American Health Information Management Association, 2002.
18.Joseph Tan. Health Management Information Systems: A managerial perspective. Jones & Bartlett Publishers, LLC. http://samples.jbpub.com/9780763756918/56918_CH01_Tan.pdf
19. Kingdom of Cambodia. National Strategic Plan of Identification 2017-2026. Phnom Penh, June 2016
20. Measurement and Accountability for Results in Health (MA4Health). (2015). Health measurement and accountability post 2015: Five-point call to action. Retrieved from http://ma4health.hsaccess.org/docs/support-document/5-point-call-to-action.pdf?sfvrsn=0.
21. Michael Stahl. *Identification numbers within the Cambodian health system and beyond*. Summary Report. Asian Development Bank. November 2016
22. Ministry of Health, Cambodia. *Draft pilot implementation plan and budget for strengthening the Logistics Management Information System*. Under the GFATM Health System Strengthening Grant. Updated 13 March 2017.
23. Ministry of Health, Government of Jamaica. *National Health Information System Strengthening and e-Health Strategic Plan 2014 to 2018*. October 2013
24. Ministry of Health, Lao PDR. *National Health Information System Strategic Plan (HISSP).*2009-2015. March 2009
25. Ministry of Medical Services. Ministry of Public Health & Sanitation. Kenya. National e-health strategy 2011-2017. April, 2011.

26. Ministry of Planning. Strategic Plan Update 2014-2018. Unofficial Translation. January 2014.
27. Ministry of Posts and Telecommunications. The Cambodian ICT Master Plan 2020.
28. National Institute of Statistics, Ministry of Planning. Cambodia Socio-Economic Survey 2014. October 2015
29. National Institute of Statistics, Ministry of Panning. Population Projection of Cambodia 2013-2023, February 2017.
30. National Institute of Statistics, Ministry of Planning. Statistics Law 2015. Unofficial Translation. February 2016.
31. National Institute of Statistics, Report 1, Fertility and Mortality in Cambodia, General Population Census of Cambodia 2008, Analysis of Census Results, Phnom Penh. 2010.
32. National Maternal and Child Health Center (NMCHC). Assessing Maternal and Newborn Hospital Data in Cambodia. Draft Report. January 2017.
33. *Palladium*. UIS Assessment. Consultation Workshop for UIS Assessment. 25 November 2016
34. Phommasack, Bounlay et al. "Mekong Basin Disease Surveillance (MBDS): A Trust-Based Network." *Emerging Health Threats Journal* 6 (2013): 10.3402/ehtj.v6i0.19944. *PMC*. Web. 27 July 2017.
35.Royal Government of Cambodia. National Strategic Development Plan 2014-2018 (http://cdc-crdb.gov.kh/cdc/documents/NSDP_2014-2018.pdf)
36. Royal Government of Cambodia. National Strategic Plan of Identification 2017-2026. Phnom Penh. June 2016
37. Shiferaw G, Jones D and Krystall P. *Feasibility Study on Options to Strengthen Cambodia's Health Products Logistics Management Information System (LMIS)* submitted to MOH on 6 September, 2016. WHO, USAID, US-PEPFAR and US-CDC.
38. The National Alliance for Health Information Technology. Report to the Office of the National Coordinator for Health Information Technology on *Defining Key Health Information Technology Terms.* April 28, 2008.
39. United Nations (2016). E-government survey 2016. New York: United Nations (https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/29-Cambodia)
40. URC. Sustainability Analysis and Scale-up Plan: The MOH Patient Management Registration System (PMRS) October 2015.
41. US Government. Modernization Roadmap for the Geospatial Platform (Version 4.0). US Department of the Interior & Federal Geographic Data Committee, March 2011, p. 12.
42.WHO. Health Information System. Toolkit on monitoring health systems strengthening. June 2008.
43. WHO Regional Office for the Western Pacific. *Guidelines for the development of Health Management Information Systems*. Manila, Philippines. 1993.
44. WHO Regional Office for the Western Pacific. *A selection of important health indicators.* Manila, Philippines. 2000.
45. WHO Regional Office for the Western Pacific. *Developing Health Management Information Systems: A Practical Guide for Developing Countries*. World Health Organization 2004. Manila, Philippines: World Health Organization.
http://www.wpro.who.int/publications/docs/Health_manage.pdfg
46. WHO. Regional Office for the Western Pacific. *Improving Data Quality.* A guide for developing countries.2003.
47. WHO. International Statistical Classification of Diseases and Related Health Problems, 10th Revision. Vol. 1, Rules and Guidelines for Mortality and Morbidity Coding. Geneva, WHO, 30–123, 1993.
48.WHO. International Statistical Classification of Diseases and Related Health Problems, 10th Revision. Vol. 2. Statistical Presentation. Geneva, WHO, 124–138, 1993.
49.Youmans K. Basic Statistics for Health Information Professionals. Revised Edition. Chicago, AHIMA, 2000.

Annex 1

Landscape of different Health Information Systems in operation in Cambodia- April 2017

System	Level of data	Stakeholders	Information Domains	Functions / Use Cases	Deployment	Technology (Software/ Hardware)	Components	Data Capture Method
HMIS	Aggregated system	DPHI Palladium	Outpatient care Inpatient care Laboratory Maternal & child health Immunization Communicable diseases Dental care Blood bank Imaging Physiotherapy	HC1 and HO2 reporting Health system planning and management GIS#	HCs, RHs, PHs, NHs, ODs, PHDs, private clinics (limited) URL (HIS 3.0): hismohcambodia.org URL (HIS 2.0): hiscambodia.org	Software: Web-based (originally developed by URC) Hardware: desktop/laptop	Front-end web app mySQL DB DB Tables: HC1 HO2 HCP PMTCT TB-MIS	Method (with internet): Transcription from paper-based register or intermediary Excel spreadsheet Method (without internet): Submission of HC1/HO2 paper form to OD
PMRS	HF-PoC	DPHI URC	Inpatient care (Hospital) Outpatient care (Hospital and HC) Treatment from (HC) IMCI information (HC) Diabetic (HC) Emergency Information (Hospital and HC) Maternal & child health (Hospital and HC) Paediatric Care (Hospital and HC) Partially- laboratory (HC – BT, Malary,) Vital signs information (HC)	Patient registration Patient ID assignment Patient dossier retrieval Health insurance (HEF) Patient billing Referral tracking system Monitoring system	Hospitals and HCs (limited) Note: special workflows at Battambang PH and KSFH	Web-based (self-developed) Hardware: desktop, tablet Hosting: Amazon Web Services Singapore	ADT EHR IIS Gazetteer (province, district, commune, vile) Standard diagnostics Client registry (OpenEMPI)# Interoperability layer (OpenHIM)#	Method: Direct entry during patient registration and billing
Health Financing	Aggregated subsystem	DPHI GIZ	HFM H-SPIS	Aggregate data, Health system planning and management	HC, RH, National Social Security	Software: Web based Desk top, laptop at HC and OD	?	Report from OD to DPHI, reviewed by PHD

System	Level of data	Stakeholders	Information Domains	Functions / Use Cases	Deployment	Technology (Software/ Hardware)	Components	Data Capture Method
Health Insurance	Individual membership level	NSSF	Eligible Members of the National Social Security Fund	Eligible Members of the National Social Security Fund	Development by private company, contracted by NSSF; maintenance by NSSF IT division	Web Based	Java MSSQL	Direct data entry; Data Import from employers (manual; USB)
MIS-Malaria	Community PoC Aggregated data	CNM Malaria Consortium	Malaria	Aggregate reporting Case management# Case surveillance# Stock management#	HCs, VMWs	MS Access (self-developed) Hardware: desktop/laptop?, mobile#	MS Access DB Android mobile app#	Method (with internet): Transcription from paper-based register Method (without internet): Submission of Malaria form to OD
VCCT*	HF PoC	NCHADS WHO PEPFAR	HIV/AIDS	Case base Case surveillance	HC and VCCT	Migrate to web base, what kind of software?	?	Application base only 1/3 of VCCT sites Transcription from paper-based register
STD*	HF PoC	NCHADS	HIV/AIDS					
OI/ART	HF PoC	NCHADS WHO UNAIDS PEPFAR	HIV/AIDS	Case base Case management Case surveillance	ART clinic National program	Migrate to web base	?	Transcription from paper-based register
?ART logistics system	Aggregated?	NCHADS CHAI						
TB-MIS	HF PoC Commu PoC	CENAT Palladium	TB	Case management Lab results	TB hospitals	Web-based (originally developed by MSH)	e-TB Manager DB tables part of HMIS	
Diabetes-DMS	HF PoC	DPM	Diabetes	Case management	Sentinel sites (12 sites)	MS Access		Point of care
Hypertension-DMS	HF pOC	DPM	Hypertension	Case management	Sentinel sites (12 sites)	MS Access		Point of care
NCD-DMS#	???? Diabetic	DPM	NCDs					

System	Level of data	Stakeholders	Information Domains	Functions / Use Cases	Deployment	Technology (Software/ Hardware)	Components	Data Capture Method
RCVIS	Indi?	DPM Handicap International NRSC	Road traffic accidents Injuries Domestic violence record	Case reporting to NRSC Aggregate data	?hospitals	Web-based		Transcription from paper form
MDSR	HF and comm PoC	NMCHC URC	Maternal & child health					
NMCHC Registration System	HF PoC	NMCHC	Maternal & child health	Patient registration Patient ID assignment Patient dossier retrieval Patient billing	NMCHC Hospital	Web-based (intranet-self-developed) Hardware: desktop	?	Financial and Patient demographics
NMCHC Clinical Databases		NMCHC	Obstetrics & Gynecology Neonatal care unit (NCU) Delivery Operating Theater (OT)	Case register Aggregate reporting to HMIS and NMCHC Steering Committee Program management (NMCH monthly , Quarterly meeting) Report to the minister every moth through his cabinet	NMCHC Hospital	MS Access (self-developed) Hardware: desktop	Numerous MS Access databases	Transcription from paper-based register into system every month. Patient profile (point of care)
PMTCT	HF POC	NMCHC/ PMTCT	Integrated testing in ANC, delivery & postnatal care service		NMCHC & PMTCT	Web based		NMCHC + PMTCT
?	Aggregate in HMIS	NMCHC/NIP	Immunization					
?	Aggregate in HMIS	NMCHC/NNP	Nutrition					
DB on HRD and Personnel	Provider (WHO for info)	HRD Personnel Dept	Personal profile: training, skills	Reporting	PHD	Web-based		

System	Level of data	Stakeholders	Information Domains	Functions / Use Cases	Deployment	Technology (Software/ Hardware)	Components	Data Capture Method
DMT	Provider (WHO for info)	Personnel Dept	Health workers in public sector					
?Future combined DB	Provider (WHO for info)	HRD Personnel Dept	?					
NATDID	Provider (WHO for info)/GFATM /USAID	DDF	Drugs	Stock management	CMS			
PRODID*	Drug RACHA? Or DDF	DDF	Drugs					
ODDID	Drug RACHA? Or DDF	DDF	Drugs	Stock management	ODs			
HOSDID	Drug RACHA? Or DDF	DDF	Drugs	Stock management	RHs, PHs, NHs			
HCM	???	DDF	Drugs	Stock management	HCs			
LMIS#	Provider (WHO for info)/GFATM /USAID	DDF USAID	All commodities		Pilot in 4 provinces?			
MEDEMIS		DHS, JICA, National Working Group	Management of medical equipment	Report on condition	DHS Hospitals	Access Database Desktop Laptop	?	Export to Excel/ Paper
CamEWARN	Aggregated data, WHO for info?	DCDC WHO	Communicable diseases	Indicator-based surveillance (IBS)	All public health facilities	Web-based (DHIS2) Local server	Java + postgresql	Transcription from logbook and surveillance form

System	Level of data	Stakeholders	Information Domains	Functions / Use Cases	Deployment	Technology (Software/ Hardware)	Components	Data Capture Method
Event Monitoring DB	Aggregated	DCDC WHO	Communicable diseases Public health threats	Event-based surveillance (EBS)	C-CDC	Hotline 115, IVR, SMS, GeoChat	MS Access, Rubby…	Phone call, SMS, electronic data entry
ILI/SARI		DCDC WHO	Influenza	Influenza sentinel surveillance: influenza-like illness (ILI) Severe acute respiratory illness (SARI)	Sentinel sites/labs	Web base (15 sites)	Front-end web app mySQL DB Epidemiological data and lab	Direct entry from sentinel sites
CamLIS	HF PoC	HSD WHO	Lab tests	Lab result management	NPH, NMCHC, RHs (limited)	Web base (12 sites)	Front-end web app mySQL DB	Paper lab orders Electronic lab results
IPIS#	Population based	MOI	Identification Demographics	Identity and demographics management	Population-wide		Integrated Population Registry Khmer ID Passport system Residential system Nationality system	
CRVS#	Population based	MOI	CiviVital statistics	Vital event registration, notification, and reporting	Population-wide		Notification services Registration services Information services Vital statistics services	
Ophthalmology system	HF-POC							
UHS database	Provider Plan?							
Health professional data-base	Provider registry URC?				MCC, CMC, nurse, dentist, pharmacy			

Annex 2

Implementation Framework for HIS Master Plan (2016-2020)

Vision	**All people in Cambodia will have better health and wellbeing through effective use of health and health related information by all key stakeholders.**									
Mission	**Provide timely, relevant, accurate and complete health information through well trained and highly motivated staff with necessary resources and appropriate technology.**									
Goal	**High quality, accurate and timely health and health–related data and information are available and used together with results of sound health research. *(Strategic Objective 6 of HSP 3).***									
Strategic Objectives & Strategies	***Key Activities***	***Timescale***					***Indicators***	***Means of Verification***	***Responsible Entities***	***Resources required***
		2016	2017	2018	2019	2020				
Strategic Objective 1: Develop and implement legal tools and protocols for health information management. (Strategy #26 of HSP3) ***Outcome Indicator: Significant improvements in health information governance found through an independent assessment of HIS in 2020.***										
Strategy 1.1 Develop and enforce legislations and regulations concerning storage, confidentiality, retrieval and use of patient medical records.	*Strategic Intervention: Strengthen governance mechanisms for implementing an integrated HIS through strengthened collaboration within MOH and with other line ministries and partners.*									
	1.1.1 Identify and obtain approval for the governance structure to lead the imple-mentation of the Master Plan		x				MOH approves the governance structure for the Master Plan implementation by 30 September 2017	RGC/MOH notification of governance structure for the Master Plan	Minister of Health	
	1.1.2 Establish a high level Inter-ministerial Steering Committee (SC) for HIS chaired by Minister /Secretary of State for Health		x				Steering Committee (SC) for HIS established by 30 September 2017	TORs for SC	Minister of Health	
	1.1.3 Set up a Program Management Office		xx				Program Management Office functioning by 1 October 2017	Updated Organogram	Minister of Health	Additional staff
	1.1.4 Upgrade DPHI to assume M&E role for the entire health sector		xx	xx			DPHI strengthened & upgraded as Department of Planning & M&E by 30 June 2018	Updated Organogram	Minister of Health	New unit within DPHI
	1.1.5 Revitalize HIS TWG and finalize Terms of Reference		xxx				HIS TWG TORs finalised by 30 September 2017	TORs document	DPHI & TWG members	
	1.1.6 Convene quarterly meetings of HIS Technical Working Group		xxxx	xxxx	xxxx	xxxx	# of TWG Meetings held as planned and minutes circulated.	TWG Meeting Minutes	DPHI	
	1.1.7 Submit regular progress reports to HIS-TWG and Health TWG		xx	xxxx	xxxx	xxxx	DPHI submits quarterly reports to HIS-TWG & annual reports to Health TWG	Quarterly/annual progress reports submitted by DPHI	DPHI	
	1.1.8 Conduct annual advocacy meetings with key government officials and canvass inter-sectoral support for HIS		x	x	x	x	# of annual advocacy meetings held as planned	Meeting reports	DPHI	

	1.1.9 Convene quarterly stakeholder meetings and attend meetings convened by MOI,MOP, MPTC & others		xx	xxxx	xxxx	xxxx	# of quarterly stakeholder meetings held as planned and minutes circulated.	Meeting reports	DPHI	
	Strategic Intervention: Establish the legal framework for implementing an integrated HIS.									
	1.1.10 Review and strengthen existing legislations, regulations & administrative procedures related to health data recording, reporting, storage, retrieval, dissemination governing both public and private sector.		x			x	# of inventory reports of existing legislations, regulations & administrative procedures and identified gaps available by Q3, 2017.	Inventory reports	DPHI	Short term TA
	1.1.11 Draft new legislations and regulations concerning storage, privacy, confidentiality, security, retrieval & use of patient medical records through working group discussions and HIS TWG endorsement by end of 2017.		x				New legislations, regulations & administrative procedures drafted by Q4, 2017	Draft copies of new legislations, regulations and procedures	DPHI, HIS-TWG	Short term TA
	1.1.12 Obtain government clearance of legislations and regulations by end of 2018.			x			Updated legislations, regulations and procedures in place by end of 2018.	Updated legislations, regulations and procedures	DPHI, RGC	
	1.1.13 Develop and approve a national eHealth policy framework by end of 2020.				x		National eHealth policy frame-work developed, finalised & adopted by end of 2020.	National eHealth policy framework	DPHI	AeHIN technical support
	1.1.14 Develop and approve a national eHealth regulatory framework by end of 2020.					x	eHealth regulatory framework developed, finalised and adopted by MOH by end of 2020.	eHealth regulatory framework	DPHI	AeHIN technical support
	1.1.15 Determine effective risk mitigation for eHealth projects.					x	Risk mitigation strategy for eHealth projects published by end of 2020.	Risk mitigation strategy for eHealth projects		AeHIN technical support
	1.1.16 Develop a licensing policy				x		Licensing policy established by end of 2019	Licensing policy	DPHI, RGC	

	1.1.17 Strengthen and develop coordinated mechanisms (e.g. routine supervision visits and periodic high level joint visits), oversight regulations and administrative procedures, related to health data and monitor compliance (2019-2020) for enforcement of legislation,				xxxx x	xxxx	# of high level joint supervision and oversight visits carried out HIS reporting enforcement manual with procedures, responsibilities, standard reports, and penalties available by June 2019.	Supervision and oversight reports Reporting enforcement manual	DPHI, DPs	
Strategy 1.2 Develop and implement national protocols for operations and management of the health information system, including flow of information, reporting, storage, data security and privacy.	*Strategic Intervention: Develop and use national protocols and guidelines for health management information system*									
	1.2.1 Undertake HMIS user protocol development (data sharing/ownership/ use, research, standards, reporting, timeline, etc.) through stakeholder consultations and working groups and endorsement from HIS TWG		x				Draft protocols (data sharing/ownership/ use, research, standards, reporting, timeline, etc.) endorsed by HIS TWG by end of 2017.	Draft protocol documents.	Palladium, DPHI and TWG	
	1.2.2 Obtain MOH clearance of national protocols.			x			HMIS user protocols finalized & approved by MOH by end of 2018.	Draft protocol documents.	DPHI and MOH	
	1.2.3 Develop and disseminate guidelines which contain standard definitions for HMIS, PMRS, IBS & national programs		x			x	Guidelines with clear and harmonized definitions disseminated by end of 2017	Guidelines document	DPHI, CDC Department, Palladium & URC	
	1.2.4 Monitor compliance during implementation of national protocols (2019-2020) through routine supervision visits & periodic high level joint oversight visits.				xx	xx	# of supervision and oversight visits carried out	Supervision and oversight reports	Palladium and DPHI	
	1.2.5 Execute modifications in HMIS a. Create new features and tools to meet new requirements in HMIS and mobile applications b. Organize annual consultation meetings with NPs, MOH departments and other stake-		 x	 xx x	 xxxx x	 xx x	 New features and tools created in HMIS and mobile applications. Annual consultation meetings held as planned.	 Tools for verification Meeting minutes.	 Palladium and DPHI Palladium and DPHI	

	holders to ensure consistency of indicators & HMIS info. needs									
Strategy 1.3 Develop and use data kits such as dashboards and web-portal within HMIS to facilitate the use of health data and information.	*Strategic Intervention: Develop and use data kits for ensuring the effective use of health information.*									
	1.3.1 Organise stakeholder consultation for web portal Requirement Assessment in December 2016	x					Stakeholder consultation workshop held as scheduled and report disseminated.	Stakeholder consultation workshop report	Palladium with DPHI, MOH, National Programs, Implementing partners, DPs & other ministries	
	1.3.2 Undertake preparatory work for developing the web portal (Agreement reached on content for web portal, list of indicators for publishing on web portal and graphic presentation of indicators) by March 20 Palladium with DPHI, MOH	x	x				Preparatory work completed as planned.	Documentation relating to the web portal content, indicator list and graphic presentations.	Palladium with DPHI, MOH	
	1.3.3 Development of web portal in April 2017		x				Web portal in place by October 2017.	Verification of web portal operations	Palladium with DPHI, MOH	
	1.3.4 Training of designated DPHI staff in preparing/ revising Dashboard and web portal management in May 2017		x				Training completed and report circulated by end of December 2017.	Training report	Palladium with DPHI, MOH	
	1.3.5 Implementation of web portal with quarterly updates on status of agreed indicators and monthly news or events updates (June 2017 onwards)		xx	xxxx	xxxx	xxxx	# of quarterly updates on status of agreed indicators produced from January 2018 onwards	Quarterly updates	Palladium with DPHI, MOH	
Strategies 1.4 Develop data quality assessment tools and institutionalize the tools in routine data quality monitoring.	*Strategic Intervention: Develop and use data quality assessment tools*									
	1.4.1 Review and modify existing Data Quality Assessment methods, tools and guidelines		x		x		- Completeness of reporting - Internal consistency of reported data - Consistency of population data - External comparison of coverage rates	- Data quality assessment - Data quality score card - Data quality review Toolkit	DPHI-MOH	WHO
	1.4.2 Develop DQA training curriculum.		x				- DQA curriculum	- Data quality assessment	DPHI-MOH	Global Fund

								- DQA 2017		
	1.4.3 Conduct training of trainers (DPHI, PHD and OD) including use of CSPro for data analysis.		xxx	xxxx			- Training completed and report circulated by end of December 2018	- Training report	DPHI-MOH	Global Fund
	1.4.4 Annual self-assessment DQA by health facilities, OD and Municipality HD /PHD				x	x	- health facilities, OD and Municipality HD /PHD able to do self-assessment	- Completed report	DPHI-MOH	National Budget
	1.4.5 Undertake health system-wide DQA every two years		x		x		- Completeness of reporting - Internal consistency of reported data - Consistency of population data - External comparison of coverage rates	- Data quality assessment - Data quality score card - Data quality review Toolkit	DPHI-MOH	Global Fund
	1.4.6 Establish automated/ manual data checks and establish routine audit		xxxx	xxxx	xxxx	xxxx	- Number of audits	- DQI Checklist	PHD/OD	National budget
	1.4.7 Monitor data collection and reporting for completeness and conduct data quality supervision		xxxx	xxxx	xxxx	xxxx	- Number of supervision visits	- DQI checklist	PHD/OD	National budget
	1.4.8 Conduct supervision & data quality coordination meetings		xxxx	xxxx	xxxx	xxxx	- % of data quality coordination meetings conducted as planned	- DQI checklist	PHD/OD	National budget
	1.4.9 Expand the participation of the HMIS by the public & private sector with improved data quality		xxxx	xxxx	xxxx	xxxx	- Data consistency index maintained at 100% in public health facilities.	- DQI checklist	PHD/OD	National budget
Strategy 1.5 Strengthen information systems on human resources/ staffing, infrastructure, health services, population, laboratory (including biosafety/ security/bio-risk management) and drug management support system.	*Strategic Intervention: Establish and maintain a robust human resources information system*									
	1.5.1.1 Support the development of an integrated national HRH data and planning system	xxxx	xxxx				Development, maintenance and use of an integrated HRH database	Integrated database in operation	Personnel Department (PD), Human Resource Development Department (HRDD), Health Services Department (HSD) & Health Profession Councils (HPCs)	WHO TA

	1.5.1.2 Build capacities (staff, equipment, supplies) to support the monitoring and use of database in HRH planning.		xxxx	xxxx	xxxx	xxxx	On-the-job training of HRH staff completed as scheduled.	Integrated database in use at different levels	HSD, HRDD, PHD, HPC	WHO TA
	1.5.1.3 Develop and implement processes to support the collection of information from the private sector.	xxxx	xxxx	xxxx	xxxx	xxxx	Systems to collect information on the private sector health workforce in place.	Private sector heath workforce data available on integrated database	HRDD , PHD, & HPC	
	1.5.1.4 Use the HRH database to project the HRH needs based on the population health needs and service delivery levels.	xxxx	xxxx	xxxx	xxxx	xxxx	# of health facilities with updated information on annual staffing gap % of HCs with staff in place as per MPA staffing norm % of HCs with staff in place as per CPA staffing norm	Updated figures on annual staffing gap available Extract from HMIS-HCP Extract from HMIS-HCP	PD, HRDD , HSD, HPCs,	
	1.5.1.5 Develop a comprehensive database for in-service trainings, including an agreed protocol for the planning and reporting on in-service trainings by all stakeholders.	xxxx	xxxx				In service training plans and reports template used by stake-holders In service training database established and in operation	Template In service training database	HRDD , PHD, TU, HPC	WHO TA
	1.5.1.6 Make information on in-service trainings easily accessible to other line ministry departments and national programs.	xxxx	xxxx				In service training database accessed by other line ministry departments and national programs		HRDD , PHD, TU, HPC	
	1.5.1.7 Establish mechanisms for the regular review and use of data on in-service training at all administrative levels.		xx	xxxx	xxxx	xxxx	In service training data reviewed during monthly PHD and OD management meetings	Minutes of monthly PHD and OD management meetings	HRD, PHD, TU, HPC	
	1.5.1.8 Assign a Training Coordinator in each PHD responsible for coordinating and organizing the collection of data on in-service trainings.		x				List of training coordinators available	List of training coordinators	HRD, PHD, TU	
	1.5.1.9 Introduce a mandatory requirement of all national programs, development and NGO partners to share information on in-service trainings.			x			Sharing information on in-service trainings made mandatory	Notification of mandate	HRD	

	1.5.1.10 Data on in-service training utilized for the formulation of training plans and to monitor the quality of the trainings.		xx	xxxx	xxxx	xxxx	% of training plans made based on in-service training data Quality of in-service training monitored regularly	Training plans Training monitoring reports	HRDD, PHD, TU HRDD, PHD, TU	
	Strategic Intervention: Establish and maintain a robust logistics management information system									
	1.5.2.1 Undertake enhancement and migration of the LMIS software to an updated platform and deployment of the pilot in five provinces		xx	x			A single integrated system for supply chain management providing real time visibility in place in five selected provinces, DDF and CMS and CNM, CENAT and NCHADS.	LMIS pilot project reports	MOH LMIS TWG, Essential Drugs Bureau (EDB), DDF and CMS and CNM, CENAT and NCHADS.	GF funding support, USAID TA
	1.5.2.2 Scale up the enhanced LMIS nationwide.			xxx	xxxx	xxxx	A single integrated system for supply chain management providing real time visibility in place in the entire country.	Physical verification of the functioning of the integrated system	EDB, DDF	GF funding support
	1.5.2.3 Hold periodic meetings and discussions with DDF for integrating HMIS and MLMIS (including the capture of private sector medicine use) to help reconcile medicine needs, and quantities to be supplied, with disease profiles.		xx	x			HMIS linked to MLMIS in place by 2018.	Physical verification of integrated database.	EDB, DDF and HIS Bureau, DPHI.	
	1.5.2.4 Update training modules, train staff and increase supervision and support to encourage good stock management and accurate record keeping for staff at all levels based on rational use of medicines.		xx	xxxx	xxxx	xxxx	% of HCs with stock-out of predetermined 15 items in the national Essential Drugs List (Target for 2020: <5%)	HMIS/MLMIS	EDB, DDF and HIS Bureau, DPHI.	
	1.5.2.5 Collect and collate information and data on medicines utilization and pharmacy practices		xxxx	xxxx	xxxx	xxxx	System for collection, collation and use of data in place.	Supervision/ Monitoring reports	EDB, DDF and HIS Bureau, DPHI.	

	1.5.2.6 Strengthen ADR reporting through the preparation, training and implementation of relevant SOPs & guidelines.		xx				Observed improvements in ADR reporting (both quantitative and qualitative)	Supervision/ Monitoring reports	EDB, DDF.	
	1.5.2.7 Enter reported and confirmed ADR into the global monitoring database maintained by Uppsala Monitoring Centre (UMC).	xxxx	xxxx	xxxx	xxxx	xxxx	List of ADR reported to UMC.	ADR reports and UMC database verification	EDB, DDF.	
	Sub-Strategy: Establish and maintain a robust financial management information system									
	1.5.3.1 Update HMIS reporting forms to include financial data following which public health facilities submit financial data		xx	xxxx	xxxx	xxxx	HMIS reporting forms updated to include financial data	Verification online	Bureau of Health Economics and Financing (BHEF) of DPHI	WHO TA
	1.5.3.2 Strengthen the system for tracking budgets and expenditure from all sources of finance and link with the development of National Health Accounts (NHA).		xxxx	xxxx	xxxx	xxxx	Current expenditure on health as % of GDP	Extract from Health Finance Manage-ment system	BHEF, DPHI	WHO TA
	1.5.3.3 Organise National Health Accounts (NHA) and disseminate results to key stakeholders.		xxxx	xx			NHA conducted and report published NHA report disseminated among key stakeholders	NHA Report NHA Dissemination report	BHEF, DPHI	WHO TA
Strategic Objective 2: Increase the quality, reliability and validity of health and health related data and information. (Strategy #27 of HSP3) ***Outcome Indicator: 100% of government hospitals and 50% of health centres fully covered with PMRS as a full-fledged EMR by 2020.***										
Strategy 2.1 Promote data integration between different health information databases, focusing on standardization and interoperability.	*Strategic Intervention: Establish Health Interoperability Standards and develop Client Registry, Facility Registry, and Interoperability Layer.*									
	2.1.1 Establish and convene the Health Interoperability Standards Committee (HISC)		xx	xxxx	xxxx	xxxx	# of meetings of Standards Committee nested within HIS TWG held as scheduled	Minutes of Standards Committee meetings	DPHI, external participants	
	2.1.2 Accelerate development, implementation, and testing of Client Registry		xx	xxxx	xxxx	xxxx	A Client Registry in place and reliably communicating with an Interoperability Layer, PMRS and CamLIS.	Physical verification of client registry	DPHI, URC, NCHADS, InSTEDD	USAID & ADB TA support
	2.1.3 Accelerate development, implementation, and testing of Facility Registry		xx	xxxx	xxxx	xxxx	A common geo-registry for health facilities, ODs, administrative divisions and	Physical verification of facility registry	DPHI, AeHIN GIS Lab, InSTEDD	USAID & ADB TA support

							villages set up and linked to HMIS, PMRS, etc.			
	2.1.4 Accelerate development, implementation, and testing of Interoperability Layer		xx	xxxx	xxxx	xxxx	An Interoperability Layer in place and reliably communicating with a Client Registry, PMRS and CamLIS.	Physical verification of interoperability layer	DPHI, URC	USAID & ADB TA support
	2.1.5 Prepare a robust plan for data integration based on user needs, gathering requirements, and determining processes.			xx	xx		Plan for data integration endorsed by HIS TWG	Data integration plan	DPHI, HIS TWG	AeHIN technical support
	2.1.6 Design (specifications, standards, data model, HW/SW configuration, user interfaces, analysis of alternatives) the data integration				xx	xx	Architecture design for data integration endorsed by HIS TWG	Architecture design for data integration	DPHI, HIS TWG	AeHIN technical support
	2.1.7 Develop data integration (software/database, networks, data/work flow, testing, verification/validation, technical documentation				xx	xxxx	Data entered into one system can be shared with another system/national program based on national HIS policy	Data entry into any system and it would reflect in the national program system	HIS TWG, DPHI	Policy formulation, standards setting and maintenance, TA from partners, internal technical capacity-building
	2.1.8 Deployment through on the job training of users					xxxx	% of HIS users who were imparted on the job training on interoperability of systems	Training Reports	DPHI	
	2.1.9 Operation and maintenance					xxxx			DPHI	
	2.1.10 Scale-up and expansion					xxxx			DPHI	
	2.1.11 Software updates and enhancements					xxxx			DPHI	
Strategy 2.2 Expand electronic medical record system, including patient registration, patient	*Strategic Intervention:* Expand the use and evolution of PMRS as a full-fledged EMR at all health facilities in the country in a phased manner.									
	2.2.1.1 Revise and strengthen PMRS (medical records, storage and retrieval facilities) including ICD-10 coding.		xxxx				Existing PMRS strengthened and implemented	PMRS Database	DPHI and URC	

medical profiles, International Classification of Diseases, births, and deaths with medically defined causes accompanied by medical death certificates, as well as National Patient Unique Identifier system.	2.2.1.2 Expand the use of the existing PMRS solution at hospitals and health centres on behalf of HEF beneficiaries to service all patients ("full" PMRS).		xxxx	xxxx			There is a mechanism for HIS TWG to govern over the different systems and applications (by 2018).	PMRS and other applications can identify patients using UIS. PMRS and other applications can link program data to the patient's identifier.	DPHI,URC & HIS TWG	HR capacity-building, TA from partners, policy formulation
	2.2.1.3 Develop PMRS as a full-fledged electronic medical record (EMR), supported by additional modules/systems such as laboratory (CamLIS), pharmacy, imaging, and logistics systems, etc.			xxxx	xxxx	xxxx	- Full scale up of PMRS as a full-fledged EMR in all hospitals completed by 31 Dec 2018 - Full scale up of PMRS as a full-fledged EMR in all HCs completed by 31 Dec 2020	Implementation report	DPHI,URC & HIS TWG	AeHIN technical support
	2.2.1.4 Re-architect PMRS as a suite of software solutions gradually evolving into 4 "products" including the digital health infrastructure. (1) Register/admit/discharge /transfer; (2) client registry; (3) insurance information system; (4) EHR			xxxx	xxxx	xxxx	PMRS's evolution into 4 products completed by 31 Dec 2020.	Actual adoption of the 4 evolved products	DPHI,URC & HIS TWG	AeHIN technical support
	2.2.1.5 Implement other elements of digital health infrastructure, as necessary			xxxx	xxxx	xxxx			DPHI,URC & HIS TWG	AeHIN technical support
	2.2.1.6 Support the take-over of the evolved PMRS solution by DPHI through re-organization of duties and training of new teams.			xx	xx		DPHI revamped to take over PMRS function by June 2018	Progress update provided to the HIS TWG by DPHI	DPHI	
	Strategic Intervention: Ensure the implementation of a Unique Identification System (UIS) throughout the health sector aligned with the IPIS									
	2.2.2.1 Create an Enabling Environment prior to the commencement of the Unique Identification System (UIS) initiative through securing political commitment and reaching an agreement on Data		xx				Data sharing agreements between MOI and other line ministries including MOH signed by end of 2017	Signed data sharing agreements between MOI and other line ministries including MOH	MOI, MOP, MOL, MOH	

	sharing across organizations/ ministries (MOI, MOP, MOL, MOH) through inter-ministerial and inter-organizational consultations by end of 2017.									
	2.2.2.2 Develop/update policies, legalisation and regulatory framework that would enable cross organizational and cross-ministerial information sharing and management by mid-2018.		xx	xx			Regulatory framework to would enable cross organizational and cross-ministerial information sharing and management in place by mid-2018.	Regulatory framework documentation	MOI	
	2.2.2.3 Establish a Centre of Excellence (CoE) at MOH by mid-2018 for leading and managing the Unique Patient Identifier initiative by recruiting and deploying a team of functional health experts, integration experts, Data warehousing experts, Data migration experts along with solution architects to design the solution.		xx	xx			Centre of Excellence (CoE) established at MOH by mid-2018 for leading and managing the Unique Patient Identifier initiative	Unique Patient Identifier initiative team in place within DPHI	DPHI and top management of MOH	Government budget and donor funding. AeHIN technical support
	2.2.2.4 Expand the use of health sector specific Unique Patient Identifier to all health information systems in the country until the interface with the national ID is developed.		xx	xxxx	xxxx	x	One time configuration set-up for Unique Patient Identifier is completed by 31 Dec 2017.	National Unique Patient Identifier used in all health information sub-systems	DPHI & HIS TWG	
	2.2.2.5 Leverage upon the National ID database and PMRS database & manage the interfaces between these 2 data bases.			xx	xxxx	xxxx	Interoperability established between National ID database and PMRS database	Outputs from PMRS database	DPHI & MOI	
	2.2.2.6 Advocate and obtain committed Government budget/ funding for sustainability of the initiative by mid-2018.		xx	xx			Government budget and donor funding obtained for continued use of Unique Patient Identifier	Approved budgets	DPHI and top management of MOH	

	2.2.2.7 Align the patient ID with the Khmer ID that is proposed to replace the national ID in the long term					xxxx	Patient ID aligned with the Khmer ID by December 2020	Adoption of Khmer ID for all patient health records	DPHI & MOI	Government budget and donor funding.
	2.2.2.8 Maintain patient data privacy and confidentiality and establish a high availability and secure ICT infrastructure with strong ICT governance standards and a solid business continuity plan.		xx	xxxx	xxxx	xxxx	ICT governance standards maintained continuously	Independent assessment reports	DPHI	
Strategy 2.3 Use International Classification of Disease (ICD) based morbidity and mortality diagnosis and integrate ICD10/11 in HMIS and patient management registration system.	*Strategic Intervention: Ensure the country-wide implementation of the ICD-10 Simplified version*									
	2.3.1 Conduct TOT on WHO-FIC APN ICD-10 Simplified version before 30 September 2017		x	xx			# of subnational trainers trained on WHO-FIC APN ICD-10 Simplified version.	TOT report	DPHI, URC & Palladium	WHO TA
	2.3.2 Conduct and evaluate a pilot study for ICD implementation in hospital focusing on mortality coding.		xx				Assessment of pilot study results and plan for a national scale up available.	Evaluation report of pilot study.	DPHI, URC & Palladium	WHO TA
	2.3.3 Plan and implement a country-wide expansion of the revised ICD10		x	xxxx	xxxx	xxxx	% of hospitals using ICD-10 codes	Extracts from PMRS database	DPHI, URC & MOI	WHO TA
	2.3.4 Organize subnational training workshops for doctors, coders and other health staff for recording diagnosis on WHO-FIC APN ICD-10 Simplified version.		xx	xxxx			# of subnational health staff and coders trained on WHO-FIC APN ICD-10 Simplified version by end of 2018.	Training reports	DPHI, URC & Palladium	WHO TA
	2.3.5 Distribute copies of ICD-10 Simplified version to all health facilities.		xx	xxxx			# of ICD-10 Simplified version distributed to health facilities.	Distribution lists	DPHI and URC	
	2.3.6 Health staff or ICD Coder use ICD-10 Simplified version.		xx	xxxx	xxxx	xxxx	% of hospitals using ICD-10 codes	Extracts from PMRS database	DPHI and URC	
Strategy 2.4 Increase coverage of reporting through the MoH web-based HMIS and national disease	*Strategic Intervention: Improve the coverage of HMIS and IBS reporting including from the private sector*									
	2.4.1 Broaden the participation of private providers in the national HIS, including the surveillance system, through inventorying		xx	xxxx	xxxx	xxxx	# of private providers trained and provided with access to HMIS and PMRS for data entry	Training reports	DPHI, Communicable Disease Control Department	

surveillance and response system, with compliance from the private health sector.	them, and sensitizing and informing them about legislation, training them and providing them with the necessary standard forms, and adjusting HMIS software.						Number and percentage of licensed private providers/ facilities reporting to HMIS		(CDCD) and National Health Programs	
	2.4.2 Improve HMIS data quality (public–private) through data quality assessment system, training/coaching (subnational), cross-check/validation.		xx	xxxx	xxxx	xxxx	Data quality index maintained at 100% across the public health facilities	Extracts from HIS 3.0	DPHI, PHDs and ODs	
	2.4.3 Improve feedback on data to public–private sectors (national/sub-national) through publicly accessible means.		xx	xxxx	xxxx	xxxx	Annual HIS Bulletins & Newsletters published and posted on MOH websites	Links to MOH websites	DPHI & CDCD	
	2.4.4 Improve collaboration between the HIS TWG and Public Private Partnerships (PPP) TWG to synergise efforts		x	x	x	x	# of Annual conjoint HIS TWG and PPP TWG meetings held	Meeting minutes	HIS TWG and PPP TWG	
Strategy 2.5 Conduct supportive supervision, spot check, routine and follow-up monitoring of information systems, with timely feedback mechanism to ensure completeness, accuracy and quality of reporting.	*Strategic Intervention: Strengthen supportive supervision and ensure the efficient and effective collection, compilation, analysis, reporting and use of data for decision making.*									
	2.5.1 Strengthen HIS supervision at national and sub-national levels with feedback focused on data quality and performance standards adherence through publicly accessible means.		x	x	x	x	# of HIS Bureau supervision reports shared with subnational level	Supervision reports	HIS Bureau, DPHI	
	2.5.2 Conduct supervision and data quality coordination meetings at national and sub-national levels		x	x	x	x	# of coordination meetings conducted at national and sub-national levels	Coordination meeting minutes	DPHI, PHDs	
	2.5.3 Disseminate health information products for evidence based decision making to MOH, DPs, NGOs and public.	x	x	x	x	x	# of health information products disseminated to key stakeholders	Verification of health information products	DPHI	
	2.5.4 Conduct special assessments of HIS facilities (tools, materials, furniture, ICT means, location, and staffing) at		x	x	x	x	Special assessments of HIS facilities conducted annually	Updated lists available for verification	DPHI	

	all levels and update the lists on an ongoing basis.									
Strategy 2.6 Build the capacity of DPHI staff at central and provincial levels in geospatial technologies (GNSS and GIS) and applications: Establish, maintain, update and share master lists for the core geographic objects (health facilities, operational districts, administrative districts and villages)	*Strategic Intervention: Geo-enable the Health Information Systems in Cambodia in order to fully benefit from the power of geography, geospatial data and technologies.* *Outcome: Strengthened geospatial data management and GIS capacity of the Health Information System Bureau at both the central and provincial level*									
	2.6.1 Develop guidelines, including data specifications, standards and protocols to improve geospatial data availability and quality		x				Availability of guidelines, standards and protocols	Existence of the documents	DPHI, MOH	AeHIN GIS Lab Palladium
	2.6.2 Conduct a pilot project covering the provinces of Kampong Cham, Kratie and Tbong Khmum as a way to build DPHI's GNSS and GIS capacity		x				Number of provinces covered by the pilot project	GIS datasets and data products generated through the pilot project	DPHI, MOH	AeHIN GIS Lab, Palladium
	2.6.3 Conduct a provincial level training on GNSS and GIS		x				Number of HIS staff trained at the central and provincial level	List of participants to the training	DPHI, MOH	
	2.6.4 Use the pilot project to define the structure and content of the master lists for the selected provinces		x				Number of provinces covered by the master lists	Existence of the template and master lists for the covered provinces	DPHI, MOH	AeHIN GIS Lab, Palladium
	2.6.5 Establish collaboration with MOI, MLMUPC, NIS and other relevant stakeholders for regular maintenance and update of the 4 master lists		x				Number of established collaborations	Workshop report	DPHI, MOH	
	2.6.6 Define the specifications, workflows and rules needed to maintain, update and share the 4 master lists through the use of registries		x				A workshop on this topic has taken place	Workshop report	DPHI, MOH	AeHIN GIS Lab, InSTEDD, Palladium
	2.6.7 Identify the platform(s) to serve as registry(ies) for the 4 master lists		x				Number of platform options that have been evaluated	Evaluation report	DPHI, MOH	AeHIN GIS Lab
	2.6.8 Pilot test the identified platform(s) to serve as registry(ies) for the area covered by the pilot project		x	x			Number of master lists uploaded in the platform(s)	Content of the platform(s)	DPHI, MOH	AeHIN GIS Lab

	2.6.9 Expand the master lists, the registries and the defined processes (maintenance, updating, sharing) to the rest of the country			x	x		Number of Provinces covered by the master lists and registries	Content of the registry	DPHI, MOH	
	2.6.10 Develop a policy enforcing the mandate of HIS Bureau as well as use of defined guidelines, standards, protocols, master lists and registries.		x				Release of the policy	Existence of the policy	DPHI, MOH	AeHIN GIS Lab
	2.6.11 Support the integration of the defined guidelines, standards, protocols and master lists across the health information system.			x	x	x	Number of information systems complying to the defined guidelines, standards, protocols and master lists	Compliance check	DPHI, MOH	
Objective 3: Improve institutional capacity on data management, especially at facilities and district level on data compilation, analysis, interpretation, reporting, dissemination and use. (Strategy #28 of HSP3) ***Outcome Indicator: Significant improvements in data management capacity found through an independent assessment of HIS in 2020***										
Strategy 3.1 Develop common information standards and compatible information sharing, including security architecture and regulations for privacy protection.	*Strategic Intervention: Develop and implement standards and data sharing arrangements*									
	3.1.1 Establish and convene Standards Committee nested within the HIS TWG		x				Standards Committee established by September 2017	TORs for the Standards Committee	DPHI & HIS TWG	
	3.1.2 Inventory current and planned HIS (sub-systems), prioritize interoperability profiles, identify standards, implement policy and guidelines		x	x	x	x	Inventory of HIS (sub systems) presented to HIS TWG by December 2017	Sub-systems inventory	DPHI & Standards Committee	
	3.1.3 Develop Road Map for phased and continual development of Standards		x				Road Map for development of Standards presented to HIS TWG by June 2017	Road Map for development of Standards	DPHI & Standards Committee	
	3.1.4 Establish data sharing arrangements between HMIS, PMRS and national program databases by using Client Registry (CR) and Open Health Information Exchange (OpenHIE)			x	x	x	- By 31 Dec 2018: for TB HIS and Malaria-MIS - By 31 Dec 2019: for HIV/AIDS database system - By 31 Dec 2020: PMRS becomes single source for case based information for all systems	Signed data sharing agreements	DPHI, CDCD and National Health Programs	
	3.1.5 Develop and sign a MOU between MOH and MOI						MOU between MOH and MOI signed by 31 Dec 2017	Signed MOU	MOH top leadership,	

	regarding CRVS and IPIS integration with MOH systems and processes								DPHI and MOI top leadership	
	3.1.5 Implement health enterprise architectural (EA) approach for managing current and future data and ICT requirements, standardization, Interoperability Enterprise architecture, standards, interoperability meetings			xxxx	xxxx	xxxx	Health enterprise architectural (EA) approach implemented as per SOP	Independent assessment report	DPHI and Standards Committee.	AeHIN technical support
	3.1.6 Facilitate initial development of the Cambodia Health Data Dictionary			x	x	x	First version of Cambodia Health Data Dictionary endorsed by HIS TWG by June 2018.	Cambodia Health Data Dictionary	HIS TWG, DPHI and Standards Committee	AeHIN technical support
	3.1.7 Maintain and enhance technical documentation			x	x	x	Required technical documentation in place	Verification of Technical documentation	HIS TWG, DPHI and Standards Committee	AeHIN technical support
	3.1.7 Implementation of standards in existing and planned systems			x	x	x	Compliance with standards observed during high level monitoring missions	Mission reports	HIS TWG, DPHI and Standards Committee	
	3.1.8 Enhance and update health system databases			x	x	x	Health system databases updated on a continuous basis	Database verification	DPHI and HIS TWG	
	3.1.9 Improve HMIS data by inclusion of disease-specific program, support services.		x	x	x	x	HMIS database updated with most relevant data elements for national health programs	Database verification	DPHI, CDCD and National Health Programs	
	Strategic Intervention: Implement a consolidated transition plan which envisages MOH's role enhancement to include the take-over of HMIS &PMRS by end of 2018									
	3.1.10 Review and finalize the transition plan submitted by Palladium for HMIS		xx				Palladium's transition plan for HMIS finalised and endorsed by HIS TWG by July 2017.	HIS TWG meeting minutes confirming endorsement	DPHI, Palladium and HIS TWG	USAID financial/ technical support
	3.1.11 Review and finalize the sustainability analysis and scale up plan submitted by URC for PMRS.		xx				URC's sustainability analysis and scale up plan for PMRS finalised and endorsed by HIS TWG by July 2017.	HIS TWG meeting minutes confirming endorsement	DPHI, URC and HIS TWG	USAID financial/ technical support

	3.1.12 Finalize & implement a consolidated transition plan for complete MOH takeover of HMIS and PMRS			xxxx	xxxx	xxxx	DPHI implements HMIS and PMRS functions in a seamless manner from mid-2018 onwards	-continued maintenance of applications - continued maintenance of cloud servers - management of dashboard and web portals - on the job training - monitoring of key indicators	DPHI, Palladium, URC, HIS TWG, PHDs and ODs	USAID financial/ technical support
	Strategic Intervention: Cost the Master Plan, undertake gaps analysis and mobilize required resources									
	3.1.13 Cost the Master Plan and mobilize resources following the organization of a convergence workshop		xxx	xx			Convergence workshop organized by September 2017	Workshop report with development partner commitments to HIS	DPHI	AeHIN Technical support
Strategy 3.2 Expand ICT application with appropriate training provision for health managers and health personnel who are responsible for data management including collection, compilation, analysis and interpretation, reporting dissemination and use.	*Strategic Intervention: Develop MOH ICT Strategy to reflect synergies with the Cambodian ICT Master Plan and implement by mobilising financial and other resources*									
	3.2.1 Develop and obtain RGC approval for an appropriate MOH ICT Strategy fully aligned with the Cambodian ICT Master Plan		xx	x			MOH ICT Strategy fully aligned with the Cambodian ICT Master Plan approved by RGC by March 2018.	MOH ICT Strategy document	MOH top management, DPHI and MOPT	
	3.2.2 Establish an MOH Information Technology, Systems and Services Unit (ITSSU)		xx	xxxx			MOH ITSSU established and functional by 31 December 2018.	Physical location and commencement of operations.	MOH top management, MEF, MOPT and DPHI	AeHIN Technical support
	3.2.3 Expand ICT infrastructure including software and hardware with adequate training on the use of ICT.		xx	xx			ICT infrastructure installed as per approved plan by June 2018 % of PHDs with IT staff posted	Installation completion documentation PHD reports	MOH top management, DPHI, MOPT & Personnel Dept.	
	3.2.4 Initiate the use of Tele-medicine services where approrpiate to connect national hospitals and provincial referral hospitals as to provide specialized services or manage diagnosis, treatment and care of complicated diseases.		xx	xx			Tele-medicine services operations launched by June 2018	SOP and guidelines for telemedicine services	Department of Hospital Services and DPHI	

	3.2.5 Upgrade ICT facilities to strengthen disease surveillance and response system and emergency public health interventions, disaster management and others.		xx	xxxx			A single database system developed and in place to record public health events	Public health events database	CDCD and DPHI	
	3.2.6 Build up a central health repository by integrating existing databases for the analysis, use and dissemination and of health information.		xx	xxxx	xxxx	xxxx	Linkages established between all sub-systems of HIS by December 2020	Verification of virtual central health repository	DPHI, CDCD, other MOH departments and National Health Programs	WHO TA and AeHIN technical support
	3.2.7 Out-source ICT hardware and software maintenance services to specialized firms.		xx	xxxx	xxxx	xxxx	Hardware and software maintenance services in place by end of 2018 and thereafter	Maintenance service contracts	DPHI	
	Strategic Intervention: Design and implement long-term HIS professional development and training plan aligned to the National Health Workforce Plan, job descriptions, handbooks, checklists									
	3.2.8 Design and implement long-term HIS professional development and training plan, job descriptions, handbooks, checklists		xx	xx			Long-term HIS professional development and training plan endorsed by HIS TWG by June 2017	HIS professional development and training plan	DPHI and HRDD	
	3.2.9 Convene working group(s) to finalise training curriculum.						Training curricula updated by June 2017	Updated training curricula	DPHI and HRDD	
	3.2.10 Organizing training to all level users of HIS on an annual basis		x	x	x	x	# of HIS users trained during the year	Training reports	DPHI and HRDD	
	3.2.11 Provide supplemental implementation support for existing or new HIS workforce training programmes		x	x	x	x	# of HIS personnel trained during the year	Training reports	DPHI, HRDD, PHDs and ODs	RGC Budget/ DP support
	3.2.12 Organise HIS Workforce Training Programme Meetings and Workshops		x	x	x	x	# of Training Meetings and Workshops conducted during the year	Meetings and Workshops reports	DPHI, HRDD, PHDs and ODs	
	3.2.13 Conduct localised HIS pre-service/in-service training on collection, analysis, reporting, and use of data		x	x	x	x	# of pre-service candidates imparted health information training	Pre-service training reports	DPHI, HRDD, PHDs and ODs	

	3.2.14 Organise national/sub-national training events and meetings		x	x	x	x	# of national/sub-national training events and meetings conducted during the year	Meeting reports	DPHI, HRDD, PHDs and ODs	
	3.2.15 Explore and implement HIS Professional Development Opportunities		x	x	x	x	# of HIS professionals who availed higher education opportunities during the year	Professional development plans	DPHI, HRDD	
	3.2.16 Specialized overseas training or short courses		x	x	x	x	# of participants at overseas training or short courses	Back to office reports from participants	DPHI, HRDD	
	3.2.17 Support attendance at academic courses, certifications, diploma and degree programs		x	x	x	x	# of HIS personnel who attended academic courses, certifications, diploma and degree programs during the year	Extract from HRIS database	DPHI, HRDD	
	3.2.18 Attend and co-arrange AeHIN conferences and workshops		x	x	x	x	# of HIS personnel who attended AeHIN conferences and workshops during the year	HIS training reports	DPHI, AeHIN	DP support
	3.2.19 Support participation in online tutorials, references, tools, and textbooks		x	x	x	x	# of HIS personnel who participated in online tutorials	Extract from HRIS database	DPHI, HRDD	
	3.2.20 Join AeHIN Hour webinars		x	x	x	x	# of Hour webinars attended	HIS training reports	DPHI, AeHIN	
	3.2.21 Join OpenHIE Implementer Community Calls		x	x	x	x	# of Community Calls attended	HIS training reports	DPHI, AeHIN	
	3.2.22 Enroll in SNOMED CT E-Learning Courses		x	x	x	x	# of HIS personnel who enrolled in SNOMED Courses	HIS training reports	DPHI, AeHIN	
	3.2.23 Sponsor fellowships		x	x	x	x	# of HIS professionals who availed fellowships during the year	Extract from HRIS database	DPHI, HRDD	DP support
	3.2.24 Organise study tours to observe best practices and share experiences		x	x	x	x	# of HIS study tour participants during the year	Study tour reports	DPHI, HRDD, AeHIN	DP support
	3.2.25 Support professional association membership fees and participation in meetings		x	x	x	x	# of HIS personnel who availed professional association membership fees	Professional asso-ciation membership fees receipts	DPHI, HRDD	
	Strategic Intervention: Develop and implement a Benefits Realization Plan									
	3.2.26 Develop a benefits realization plan which specifies health outcome benefits expected at local level for all HIS & eHealth interventions		xx	xxxx			Benefits Realization Plan endorsed by HIS TWG by 31 Dec 2018	Benefits Realization Plan	DPHI & HIS TWG	

Strategy 3.3 Promote dissemination and use of quality health information among health personnel and the public to enhance health literacy among health personnel and the public.	*Strategic Intervention: Promote effective use of data for decision making*									
	3.3.1 Conduct TOT on data use for decision making		x	x	x	x	# of TOT participants during the year	TOT Report	DPHI	
	3.3.2 Conduct training of health staff at different levels on effective use of data for decision making		x	x	x	x	# of data use training participants during the year	Training reports	DPHI, PHDs and ODs	
	3.3.3 Host HMIS bulletins and newsletters on MOH websites		x	x	x	x	# of Annual HMIS bulletins and newsletters	Annual HMIS bulletins and newsletters	DPHI	
Strategy 3.4 Strengthen collaboration and coordination amongst relevant ministries and institutions and Development Partners for data collection for and analysis of population-based surveys from which the health sector can benefit.	*Strategic Intervention: Collaborate and coordinate with related ministries and partners*									
	3.4.1 Update timely population data in the HMIS database based on Cambodia Inter-Censal Population Survey 2013 Results (CIPS 2013) and use the data for updating key health indicator computations.		x				Population data in the HMIS database updated by June 2017	HMIS database verification	Palladium and DPHI	
	3.4.2 Develop and implement procedures for generating and providing census data and population projections to the OD level		x				Procedures for generating and providing census data and population projections to the OD level completed by September 2017	HMIS database verification	Palladium and DPHI	
	3.4.3 Provide training for HIS officers on the use of census data for planning and monitoring		x	xx			Training for HIS officers on the use of census data for planning and monitoring completed by June 2018	Training reports	Palladium and DPHI	
	3.4.4 Provide inputs through the Statistical Advisory Committee of NIS for the General Population Census of Cambodia in 2019 and use census data for updating key health indicator computations.			xx	xx		Inputs provided to NIS for 2019 Census	Statistical Advisory Committee Meeting Minutes.	DPHI	
	3.4.5 Add adult mortality questions to the 2019 census questionnaire, and conduct a post-census survey on cause of death			xx	xx		Adult mortality questions added to the 2019 census questionnaire	Post-census survey report on cause of death	DPHI and NIS	

	3.4.6 Coordinate with NIS, UNICEF and other partners and support the design, data collection and report writing for the 2017 Multi-Indicators Cluster Survey (MICS).		xxxx	xx			2017 Multi-Indicators Cluster Survey (MICS) completed as planned	2017 Multi-Indicators Cluster Survey (MICS) Report	DPHI and NIS	
	3.4.7 Coordinate with NIS, MOP and other partners and support the design, data collection and report writing for the 2018 DHS.		xx	xxxx			2018 DHS completed as planned	2018 DHS Report	DPHI and NIS	
	3.4.8 Provide inputs through the Statistical Advisory Committee of NIS for the Annual Cambodia Socio Economic Surveys (CSES) from 2016-2020 and use the data for analysis of key health indicators.	x	x	x	x	x	Inputs provided to NIS for Annual Cambodia Socio Economic Surveys (CSES) from 2016-2020	CSES 2016-2020 Reports	DPHI and NIS	
	3.4.9 Support NIS in the collation, availability and dissemination of SDG Indicators during 2016-2020.	x	x	x	x	x	DPHI and NIS	DPHI and NIS	DPHI and NIS	
Strategy 3.5 Support the development of the national Civil Registration and system to collect vital statistics and promote their use in planning and health service delivery.	*Strategic Intervention: Collaborate with MOI in developing Civil Registration and National Identification Systems*									
	3.5.1 Contribute to MOI efforts to draft Civil Registration, Identification and Vital Statistics Law and submit to national assembly by 2018.		xx	xxxx			Civil Registration, Identification and Vital Statistics Law submitted to national assembly by 2018	Draft Law	MOI and DPHI	
	3.5.2 Contribute to the formulation of a new sub-decree on Civil Registration, Identification and Vital Statistics by 2018.		xx	xxxx			A new sub-decree on Civil Registration, Identification and Vital Statistics enacted by 2018.	New sub-decree on Civil Registration, Identification and Vital Statistics	MOI and DPHI	
	3.5.3 Contribute to the amendment of law necessary for establishing the Integrated Population Identification System (IPIS) by 2019.		xx	xxxx	xxxx		Integrated Population Identification System (IPIS) in place by 2019.	Law related to IPIS	MOI and DPHI	
	3.5.4 Contribute to the amendment of sub-decrees		xx	xxxx	xxxx		Sub-decrees passed for establishing the IPIS by 2019.	Sub-decrees related to IPIS	MOI and DPHI	

	necessary for establishing the IPIS by 2019.									
	3.5.5 Contribute to the establishment of a universal ICT-based civil registration system by 2019.		xx	xxxx	xxxx		SOP and guidelines for universal ICT-based civil registration system endorsed by December 2019	SOP and guidelines for universal ICT-based civil registration system	MOI and DPHI	
	3.5.6 Design and supply birth and death notification forms to health facility staff, train staff and ensure staff submit monthly reports to their respective communes.		xx	xxxx	xxxx	xxxx	% of health facilities that have received birth and death notification forms	Distribution lists	DPHI	
	3.5.7 Contribute to the strengthening of the capacity of the CRVS management and operation through training of physicians, etc.		xx	xxxx	xxxx	xxxx	# of physicians trained on CRVS	Training reports	DPHI, PHDs & ODs	
	3.5.8 Integrate (real-time) Health Information System with the CRVS by updating and extending the Patient Medical Registration System to all health facilities. Develop death reports including cause of death (ICD-10 coding and verbal autopsy) and implement throughout the public health facilities and expand to the private health facilities in a phased manner		xx	xxxx	xxxx	xxxx	% of deaths recorded "other" as cause of death maintained at < 10%	Extracts from CRVS	MOI and DPHI	WHO TA
	3.5.9 Foster health sector participation in timely notification and registration of vital events.		xx	xxxx	xxxx	xxxx	>90% of all health facility births registered at commune level	Extract from CRVS database	MOI and DPHI	
Objective 4: **Enhance the national disease surveillance and response systems, including public health emergency and disease reporting system.** (Strategy #29 of HSP3) ***Outcome Indicator: 100% of outbreaks reviewed and evaluated annually from 2018***										
Strategy 4.1 Strengthen the existing routine early warning system on communicable diseases,	*Strategic Intervention: Strengthen Indicator based surveillance (IBS) and response system*									
	4.1.1.1 Review and revise training materials (including CamEWARN)	x	x			x	# of training materials finalized and disseminated	CDCD Program report	CDCD	TA. WHO & US-CDC

known as Cam-Warn, and further integrate disease surveillance and response systems to reduce workload at facilities, district and provincial level.	4.1.1.2 Evaluate surveillance and response training	x				x	# of surveillance and response training evaluations conducted and evaluation reports available	CDCD Program report	CDCD	WHO & US-CDC
	4.1.1.3 Finalize and disseminate surveillance manual	x	x				Surveillance Manual is finalized and disseminated	CDCD CDC Program report	CDCD	TA
	4.1.1.4 Develop curriculum and training materials for supervision and coaching		x				Curriculum and training materials developed for supervision and coaching	CDCD Program report	CDCD	TA
	4.1.1.5 Conduct training on supervision and coaching		x	x	x	x	Training provided on supervision and coaching	CDCD Program report	CDCD	WHO & US-CDC
	4.1.1.6 Conduct regular supervision to assess data capture qualities		x	x	x	x	Supervision reports	CDCD supervision report	CDCD	C-CDC
	4.1.1.7 Mid- year (semester) workshop to review progress on surveillance and response	x	x	x	x	x	A mid- year workshop organized and a progress report is available	CDC Program report	CDCD	CDC/ADB WHO & US-CDC
	4.1.1.8 Annual workshop to review progress and planning on surveillance and response	x	x	x	x	x	An annual workshop organized & a progress report is available	CDC Program report	CDCD	CDC/ADB, WHO & US-CDC
	4.1.1.9 Create a surveillance data validation system (CamEWARN, ILI/SARI)	x			x		A surveillance data validation system is created & functioning	CDC Program report	CDCD	
	4.1.1.10 Send an official letter to national hospitals and private providers to collect and upload the data to database		x				Official letter sent and confirmed NH and private providers received the letter	CDC Program report	CDCD	
	4.1.1.11 Train private providers on CamEWARN		x	x	x	x	# of private providers trained on CamEWARN	CDC Program report	CDCD	WHO & US-CDC
	4.1.1.12 Ongoing training to provincial RRT on surveillance and response	x	x	x	x	x	# of ongoing training to provincial RRT on surveillance and response	CDC Program report	CDCD	CDC/ADB, WHO & US-CDC
	4.1.1.13 Develop video trainings for RRT		x				# of video trainings for RRT developed	CDC Program report	CDCD	WHO, ADB?
	4.1.1.14 Equip IT infrastructure for surveillance		x	x	x	x	# IT infrastructure for surveillance are equipped based on plan	CDC Program report	CDCD	WHO, ADB?
	4.1.1.15 Conduct evaluation of influenza surveillance system	x					# of evaluation of influenza surveillance system conducted	CDC Program report	CDCD	WHO, US CDC TA

	4.1.1.16 Maintain influenza surveillance system		x	x	x	x	Influenza surveillance system fully functions	CDC Program report	CDCD	
	4.1.1.17 Produce and upload CamLIS reports on CDC's websites		x	x	x	x	CamLIS report available on CDC's website	CDC Program report	CDCD	WHO, US-CDC
	Strategic Intervention: Strengthen Event based Surveillance (EBS) and response systems									
	4.1.2.1 Strengthen EBS by integrating all events into single database and report		x				One single database developed for all events	CDC Program report	CDCD	WHO TA
	4.1.2.2 Develop online database for EBS		x				EBS migrates to online database	CDC Program report	CDCD	WHO TA
	4.1.2.3 Incorporate key private sector facilities to report EBS		x	x	x	x	Key private sector facilities reported in EBS	CDC Program report	CDCD	
	4.1.2.4 Assign CDC officer to screen media		x	x	x	x	CDC officer to perform media surveillance	CDC Program report	CDCD	
	4.1.2.5 Provide training on event based surveillance to clinicians	x	x	x	x	x	Training provided on EBS to clinicians and a training report is available.	CDC Program report	CDCD	CDC/ADB, WHO & US-CDC
	4.1.2.6 Review hotline system		x				New automatic messaging system installed	CDC Program report	CDCD	WHO & US-CDC, InSTEDD
	Strategic Intervention: Establish an integrated disease surveillance and response system									
	4.1.3.1 Integrate and synchronize lab data within CDC database		x	x			Lab data integrated and synchronized	CDC Program report	CDCD	WHO, US-CDC
	4.1.3.2 Integrate all disease surveillance and response systems into one single system in a phased manner.		x	x	x	x	One single integrated disease surveillance and response system in place.	CDC Program report	CDCD	WHO, US-CDC
Strategy 4.2 Strengthen capacity of Rapid Response Team at facility, district and provincial level in detecting potential threats to public health, timely reporting accurate data, and	*Strategic Intervention: Strengthen capacity of sub-national Rapid Response teams*									
	4.2.1 Translate and submit administrative and logistic SOP for outbreak investigation and response for MOH endorsement		x				SOPs for outbreak investigation and response endorsed and implemented	CDC Program report	CDCD.	WHO, US-CDC
	4.2.2 Outbreak response team engage AET graduates and local RRT in conducting outbreak investigation and response	x	x	x	x	x	AET graduates and local RRT engaged in outbreaks and reports available	CDC Program report	CDCD	WHO, US-CDC

responding to disease outbreak.	4.2.3 Develop scenario- based exercises to test complex outbreak investigation and response and conduct exercise		x	x	x	x	Table top exercise conducted	CDC Program report	CDCD.	WHO, US-CDC
	4.2.4 Develop a standard protocol for writing an outbreak investigation and response	x					Standard protocol is available.	CDC Program report	CDCD	WHO, US-CDC
	4.2.5 Conduct outbreak review and evaluation system regularly	X	x	x	x	x	100% of outbreaks reviewed and evaluated	CDC Program report	CDCD	WHO, US-CDC
Strategy 4.3 Develop the reporting of non-communicable diseases in the overall surveillance and case reporting and response system, including accident and injuries, with compliance for both public and private health sectors.	*Strategic Intervention: Strengthen surveillance of non-communicable diseases and conditions*									
	4.3.1 Integrate diabetes and hypertension databases		x				Two databases (diabetes and hypertension) are integrated	CDC Program report	PMD,	WHO
	4.3.2 Strengthen the database for accidents and injuries reporting		x				Database for accidents and injuries functioning and accessible	Verification of MoI Database	MoI	
Strategy 4.4 Perform routine and continuous monitoring of disease surveillance and response system to ensure accuracy, timeliness and completeness of reporting and other attributing factors.	*Strategic Intervention: Monitoring of Surveillance and Response Systems*									
	4.4.1 Establish a mechanism to regularly review the accuracy, timeliness and completeness of diseases surveillance		x				Diseases surveillance is regularly reviewed for accuracy, timeliness and completeness	CDC Program report	CDCD	
Strategy 4.5 Strengthen collaboration on communicable disease surveillance and response system through information sharing on potential	*Strategic Intervention: Strengthen collaboration among partners for effective Surveillance and Response Systems*									
	4.5.1 Establish a multi-stakeholders working group for ILI/SARI		x				TWG for ILI/SARI established and functioning	CDC Program report	CDCD	
	4.5.2 Identify information and contents to be shared with other sectors	x					Meetings held and information & contents to be shared agreed	CDC Program report	CDCD	WHO & US-CDC

threat and disease outbreak, knowledge sharing, and joint simulation exercises etc. with other relevant ministries and institutions and neighbouring countries.	4.5.3 Develop multi- sectoral, multidisciplinary SOP for outbreak investigation and response		x				SOPs for outbreak investigation and response developed and implemented	SOPs	CDCD	WHO & US-CDC Short term TA
	4.5.4 Develop/adapt One Health Training materials		x	x			One Health Training materials adopt and developed	CDC Program report	CDCD	Short term TA
	4.5.5 Conduct One Health Training between AET and CAVET		x	x	x	x	One Health Training provided to AET and CAVET	CDC Program report	CDCD	WHO & US-CDC
	4.2.1 Translate and submit administrative and logistic SOP for outbreak investigation and response for MOH endorsement		x				The SOPs endorsed and implemented	CDC Program report	CDCD	WHO & US-CDC
Objective 5: Strengthen monitoring and evaluation system and promote health research. (Strategy #30 of HSP3) **Outcome Indicator: Significant improvements in M&E system and research found through an independent assessment in 2020.**										
Strategy 5.1 Perform routine and continuous monitoring of plan implementation at required intervals by using the HSP3 Indicators Framework for M&E at different level of the health system.	*Strategic Intervention: Undertake routine and continuous monitoring of HSP3*									
	5.1.1 Track progress and measure achievements through annual health sector performance reviews, MTR & end-year evaluation of HSP3 based on HSP3 indicator framework	x	x	x	x	x	Annual health sector performance reviews (in 2016, 2017 and 2019), mid-term review (in 2018) & end-year evaluation (2020) of HSP3 conducted successfully.	Reports for the different reviews.	DPHI with technical support from 4 MOH Task Forces for M&E	
	5.1.2 Facilitate quarterly and annual reviews by MOH departments, national programmes, provincial and OD health offices.	xxxx	xxxx	xxxx	xxxx	xxxx	Quarterly and annual reviews conducted at national and subnational levels	Reports for the different reviews.	DPHI, MOH departments, national programmes, PHDs & ODs	4 MOH Task Forces for M&E
Strategy 5.2 Strengthen the use of the national M&E system, processes and tools to reduce multiple monitoring systems in the health sector, especially at operational level.	*Strategic Intervention: Strengthen the use of national M&E systems*									
	5.2.1 Develop M&E Strategy for Master Plan		xxx				M&E Strategy for Master Plan developed, aligned to the overarching M&E Strategy of the health sector (HSP3)	M&E Framework section in the Master Plan	DPHI and HIS TWG	
	5.2.2 Master Plan monitored and quarterly reports presented to the HIS TWG		xx	xxxx	xxxx	xxxx	# of quarterly reports on Master Plan progress presented to the HIS TWG	Quarterly reports	DPHI and HIS TWG	
	5.2.3 Present progress report on Master Plan implementation at the Joint Annual Performance Reviews			x	x	x	Progress reports on Master Plan presented at the Joint Annual Performance Reviews	Master Plan Progress reports	DPHI and HIS TWG	

	5.2.4 supervision or monitoring on DQA and clinical services evaluation		xx	xxxx	xxxx	xxxx	# of monitoring visits conducted during the year for routine DQA	Monitoring visit reports	DPHI	
Strategy 5.3 Enhance mutual accountability by the MOH and Development Partners to track progress of development cooperation towards the development results.	*Strategic Intervention: Strengthen mutual accountability between MOH and its clients*									
	5.3.1 Utilise Joint Annual Performance Reviews to track progress and enhance mutual accountability	x	x	x	x	x	JAPRs conducted utilising HIS data	JAPR Reports	DPHI	
Strategy 5.4 Establish governance structures with clearly defined roles and functions to advice oversee and coordinate health research system, while promoting the use of research findings for policy dialogue and formulation.	*Strategic Intervention: Establish governance structures for health research*									
	5.4.1 Establish a National Health Research and Health Journal Committee with clear terms of reference which are distinct from the National Ethics Committee for Health Research (NECHR)		x				National Health Research Committee established.	TORs for National Health Research Committee	NIPH and DPHI	
	5.4.2 Commission health system/ policy related research by mobilising MOH and DP support			x	x	x	# of health system/ policy related research studies commissioned and completed per year	Research reports/publications	DPHI	DP funding support
	5.4.3 Promote the use of research findings for policy dialogue and formulation.			x	x	x	# of research studies with policy recommendations	Research reports/ publications with policy recommendations	NIPH and DPHI	
Strategy 5.5 Develop and regularly update a health research agenda to coordinate and complement research activities.	*Strategic Intervention: Develop and implement a health research agenda*									
	5.5.1 Establish and convene working group meetings to finalise a health research agenda.			x x			# of working group meetings held during the year	Working group meeting minutes	NIPH and DPHI	
	5.5.2 Promote health system/policy researches based on need			x	x	x	# of health system/policy researches commissioned and completed per year	Research reports/publications	DPHI	DP funding support
	5.5.3 Collaborate with research organisations and higher education institutions (e.g. NIPH, UHS, etc.)			x	x	x	# of collaborative meetings held during the year	Meeting minutes	DPHI, NIPH and UHS	

	5.5.4 Determine research areas especially in support of: • eHealth standards localisation • EHR implementation • Health Insurance • eHealth economics and benefits • mHealth • Web and media technologies • Open source solutions			x	x	x	# of eHealth research studies completed during the year	eHealth Research reports/publications	DPHI,	AeHIN technical support. DP funding support
	5.5.5 Establish and share publicly a central repository for all survey and research data			x x			A central repository for all survey and research data set up in NIPH by June 2018.	Central repository in operation	NIPH	WHO TA

Annex 3

Monitoring & Evaluation Indicator Matrix for His Master Plan

#	INDICATORS	BASELINE (2015)	TARGETS					DATA SOURCE	FREQUENCY	RESPONSI-BILITY
			2016	2017	2018	2019	2020			
I	***Objective 1:*** Develop and implement legal tools and protocols for health information management. (Strategy #26 of HSP3)									
	***Outcome Indicator*:** Significant improvements in health information governance found through an independent assessment of HIS in 2020. *Note: Self-assessment scorecard will be developed by the end of 2017.*	Self-assessment score in 2018	NA	NA	TBD	TBD	TBD	Self-assessment scorecard	Annual	External evaluation team and DPHI
	Intervention: Strengthen governance mechanisms for implementing an integrated HIS through strengthened collaboration within MOH and with other line ministries and partners.									
1	# of TWG Meetings held as planned and minutes circulated.	0	0	4	4	4	4	Meeting minutes	Quarterly	DPHI
2	# of annual advocacy meetings held as planned	0	0	1	1	1	1	Meeting minutes	Annual	DPHI/Development partners
	Intervention: Establish the legal framework for implementing an integrated HIS.									
3	National eHealth policy framework developed, finalised and adopted by MOH by end of 2020.	0					In place	eHealth policy document	Once - end of 2020	DPHI
4	# of high level joint supervision and oversight visits carried out	0		2	4	4	4	Supervision reports	Quarterly	DPHI
5	# of HIS reporting enforcement manual with procedures, responsibilities, standard reports, and penalties available by 2019.	0					1	Reporting enforcement manual	Once by 2019	DPHI
	Intervention: Develop and use national protocols and guidelines for health management information system									
6	HMIS user protocols (data sharing/ownership/ use, research, standards, reporting, timeline, etc.) finalized and approved by MOH by end of 2018.	0			In place			HMIS user protocols	Once by end of 2018	DPHI & Palladium
7	Guidelines of HIS harmonized definitions revised approved by MOH and disseminated by 2018	0			In place			HMIS Guidelines	Once by 2018	DPHI & Palladium
	Intervention: Develop and use data kits for ensuring the effective use of health information.									
8	# of quarterly updates on status of agreed indicators produced from October 2017 onwards on HMIS web portal	0	0	3	4	4	4	Extracts from HMIS web portal	Quarterly	DPHI& Palladium
	Intervention: Develop and use data quality assessment tools									

9	% of health facilities, OD and Municipality HD /PHD that have undertaken self-assessment DQA	0	0	20%	40%	60%	80%	DQA reports	Annual	DPHI, PHDs, ODs & HFs
10	#of data quality coordination meetings conducted as planned	0	0	4	4	4	4	Meeting reports	Quarterly	DPHI, PHDs & ODs
	Intervention: Establish and maintain a robust human resources information system									
11	% of HCs with staff in place as per MPA staffing norm	NA	NA	25%	50%	75%	95%	HMIS-HCP	Annual	HRDD, PHDs & ODs
12	% of HCs with staff in place as per CPA staffing norm	NA	NA	25%	50%	75%	95%	HMIS-HCP	Annual	HRDD, PHDs & ODs
16	% of training plans made based on in-service training data???	NA	NA	25%	50%	75%	95%	In-service training database	Annual	HRDD, PHDs & ODs
	Intervention: Establish and maintain a robust logistics management information system									
13	HMIS linked to LMIS in place by 2018.	NA	NA	NA	Yes	NA	NA	Verification of web linkage	One-time	EDB, DDF and HIS Bureau, DPHI.
	Intervention: Establish and maintain a robust financial management information system									
14	Current expenditure on health as % of GDP	1.24%	1.50%	1.75%	2%	2%	2%	Health Finance Management system	Annual	Bureau of Health Economics and Financing (BHEF) of DPHI
15	National Health Accounts (NHA) conducted and results disseminated to key stakeholders.	2012		Yes			Yes	NHA Report	Once in 4 yrs?	BHEF, DPHI
II	***Objective 2:*** **Increase the quality, reliability and validity of health and health related data and information.** (Strategy #27 of HSP3)									
	Outcome Indicator: % of government hospitals and health centres fully covered with PMRS as a full-fledged EMR by 2020.	NA NA	100% NA	100% 10%	100% 20%	100% 30%	100% 50%	Status report	Quarterly	DPHI,URC & HIS TWG
	Intervention: Establish Health Interoperability Standards and develop Client Registry, Facility Registry and Interoperability Layer									
16	Data entered into one system can be shared with another system/national program based on national HIS policy					Yes	Yes	HIS TWG verification	Ongoing monitoring	DPHI, HIS TWG
17	% of HIS users who were imparted on the job training on interoperability of systems	NA	NA	NA	NA	NA	50%	Training reports	Annual	DPHI, HIS TWG
	Intervention: Expand the use and evolution of PMRS as a full-fledged EMR at all health facilities in the country in a phased manner.									
18	There is a mechanism for HIS TWG to govern over the different systems and applications (by 2018). *Note: PMRS and other applications can identify patients using UIS. PMRS and other applications can link program data to the patient's identifier.*	NA	NA	NA	Yes	Yes	Yes	Online verification	Ongoing monitoring	DPHI,URC & HIS TWG

	Intervention: Ensure the implementation of a Unique Identification System (UIS) throughout the health sector aligned with the IPIS									
19	One time configuration set-up for Unique Patient Identifier is completed by 31 Dec 2017. *Note: National Unique Patient Identifier used in all health information sub-systems following the one time configuration*	NA	Yes	NA	NA	NA	NA	Online verification	One-time reporting	DPHI,URC & HIS TWG
	Intervention: Ensure the country-wide implementation of the ICD-10 Simplified version									
20	# of subnational health staff and coders trained on WHO-FIC APN ICD-10 Simplified version	?	?	TBD	TBD	TBD		Training reports	Quarterly	DPHI and WHO
21	% of hospitals using ICD-10 codes	NA	NA	TBD	TBD	TBD		Online verification	Quarterly	DPHI and WHO
	Intervention: Improve the coverage of HMIS and IBS reporting including from the private sector									
22	% of licensed private providers/ facilities reporting to HMIS	2%	10%	15%	20%	25%	30%	HMIS	Quarterly	DPHI and Palladium
23	Data quality index (to be renamed as Data Consistency Index or DCI))	93%	96%	98%	100%	100%	100%	HMIS	Quarterly	DPHI and Palladium
	Intervention: Strengthen supportive supervision and ensure the efficient and effective collection, compilation, analysis, reporting and use of data for decision making.									
24	# of HIS Bureau supervision reports shared with subnational level	TBD	TBD	TBD	TBD	TBD	TBD	Supervision reports	Quarterly	DPHI
	Intervention: Geo-enable the Health Information Systems in Cambodia in order to fully benefit from the power of geography, geospatial data and technologies.									
25	Number of HIS staff trained at the central and provincial level on geospatial data management and technologies	NA	NA	TBD	TBD	TBD	TBD	Training reports	Once in 2018	DPHI
26	Number of Provinces covered by the common geo-registry	NA	NA	TBD	TBD	NA	NA	Common geo-registry	2017-2018	DPHI
III	***Objective 3:*** **Improve institutional capacity on data management, especially at facilities and district level on data compilation, analysis, interpretation, reporting, dissemination and use.** (Strategy #28 of HSP3)									
	Outcome Indicator: Significant improvements in data management capacity found through an independent assessment of HIS in 2020.	Self-assessment score in 2017	NA	TBD	TBD	TBD	TBD	Self-assessment scorecard	Annual	External evaluation team and DPHI
	Intervention: Develop and implement standards and data sharing arrangements.									
27	# of data sharing agreements signed between HMIS, PMRS and national program databases by using Client Registry (CR) and Open Health Information Exchange (OpenHIE)	NA	NA	NA	NA	3	4	Signed data sharing agreements	Annual	DPHI, CDCD and National Health Programs
28	First version of Cambodia Health Data Dictionary endorsed by HIS TWG by June 2018	NA	NA	NA	Yes	NA	NA	Cambodia Health Data Dictionary	Once in 2018	DPHI, CDCD and National Health Programs
	Intervention: Implement a consolidated transition plan which envisages MOH's role enhancement to include the take-over of HMIS &PMRS by end of 2018.									
29	Convergence workshop organized by 2017 to mobilize resources for seamless takeover of HMIS and PMRS by DPHI	NA	NA	Yes	NA	NA	NA	Workshop report	Once in 2017	DPHI with AeHIN Technical support

	Intervention: Develop MOH ICT Strategy to reflect synergies with the Cambodian ICT Master Plan and implement by mobilizing financial and other resources									
30	Linkages established between all sub-systems of HIS by December 2020	NA	NA	NA	NA	NA	Yes	Verification of virtual central health repository	Once in 2020	DPHI, CDCD, other MOH departments & National Health Programs
	Intervention: Design and implement long-term HIS professional development and training plan aligned to the National Health Workforce Plan, job descriptions, handbooks, checklists									
31	# of HIS personnel trained during the year	NA	TBD	TBD	TBD	TBD	TBD	Training reports	Annual	DPHI, HRDD, PHDs and ODs
	Intervention: Promote effective use of data for decision making									
32	# of data use training participants during the year	NA	TBD	TBD	TBD	TBD	TBD	Training reports	Annual	DPHI
	Intervention: Collaborate and coordinate with related ministries and partners									
33	2019DHS completed as planned	2014	NA	NA	Yes	NA	NA	DHS report	Once in 2019	NIS and DPHI
	Intervention: Collaborate with MOI in developing Civil Registration and National Identification Systems									
34	% of health facilities that have received birth and death notification forms	NA	NA	50%	100%	100%	100%	Distribution lists	Annual	DPHI, PHDs, ODs, MOI
35	% of deaths recorded "other" as cause of death maintained at HFs	?	NA	NA	< 10%	< 10%	< 10%	Extracts from CRVS	Quarterly	MOI and DPHI
IV	***Objective 4:*** **Enhance the national disease surveillance and response systems, including public health emergency and disease reporting system.** (Strategy #29 of HSP3)									
	Outcome Indicator: 100% of outbreaks reviewed and evaluated annually from 2018	100%	100%	100%	100%	100%	100%	CDCD Program report	Quarterly	• National Epidemiology Conference held annually by CDCD • Joint External Evaluation done in late 2016 • Post-outbreak reviews carried out for food borne diseases
	Intervention: Strengthening Indicator based surveillance (IBS)									
36	# of surveillance and response training evaluations conducted and evaluation reports available	100%	100%	100%	100%	100%	TBD	CDCD Program report	Annual	CDCD, WHO & US-CDC
37	# of private providers trained on CamEWARN	0%	0	240	240	240	240	CDCD Program report	Annual (6 training courses x 40 persons = 240)	CDCD

37	One single database developed for all events	NA	NA	NA	X	X	X	CDCD Program report	Currently 3 databases recording the events		CDCD will develop one single database for all events
	Intervention: Strengthen the capacity of sub-national Rapid Response teams										
38	SOP for outbreak investigation and response endorsed and implemented	NA	Yes (Draft)	Yes (Submitted)				CDCD Program report	One time reporting in 2017		CDCD already submit the SOP for endorsement
	Intervention: Strengthen surveillance of non-communicable diseases and conditions										
39	Two databases (diabetes and hypertension) are integrated	NA	NA	Yes	NA	NA	NA	CDCD Program report	One time reporting in 2017		PMD
	Intervention: Monitor Surveillance and Response Systems										
40	TWG for ILI/SARI established and functioning	NA	NA	Yes	NA	NA	NA	CDCD Program report	Annual		CDCD has focal point to handle the ILI and SARI
	Intervention: Strengthen collaboration among partners for effective Surveillance and Response Systems										
41	SOPs for outbreak investigation and response developed and implemented	NA	NA	Yes	Yes	Yes	Yes	SOPs	One time in 2017		CDCD
V	***Objective 5:*** **Strengthen monitoring and evaluation system and promote health research.** (Strategy #30 of HSP3)										
	Outcome Indicator**:** Significant improvements in M&E system and research found through an independent assessment in 2020.(See Objective1)	Self-assessment score in 2017	NA	TBD	TBD	TBD	TBD	Self-assessment scorecard	Annual		External evaluation team and DPHI
	Intervention: Undertake routine and continuous monitoring of HSP3										
42	Annual health sector performance reviews (in 2016, 2017 and 2019), mid-term review (in 2018) & end-year evaluation (2020) of HSP3 conducted successfully.	Yes	Yes	Yes	Yes	Yes	Yes	Progress reports	Annual		DPHI and HIS TWG
	Intervention: Strengthen the use of national M&E systems										
43	# of quarterly reports on Master Plan progress presented to the HIS TWG	NA	NA	2	4	4	4	Progress reports	Quarterly		DPHI and HIS TWG
	Intervention: Strengthen mutual accountability between MOH and its clients										
44	# of JAPRs conducted utilizing HIS data	1	1	1	1	1	1	JAPR Reports	Annual	DPHI and 4 Task Forces	
	Intervention: Establish governance structures for health research										
45	# of health system/ policy related research studies commissioned and completed per year	NA	NA	TBD	TBD	TBD	TBD	NIPH reports	Annual		NIPH and DPH
	Intervention: Implement a health research agenda										
46	A central repository for all survey and research data set up in NIPH by June 2018.	NA	NA	NA	Yes	Yes	Yes	Central repository in operation	Annual		NIPH