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# National eHealth Strategy and Action Plan

Ministry of Health  
Kingdom of Bhutan  
*June 2018*

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## FOREWORD

The Royal Government of Bhutan is mandated by the Constitution of the Kingdom of Bhutan to provide free public health care services to its citizen. On the other hand, the government has prioritized Information Communication Technology (ICT) as the principal enabler for a knowledge-based society. In this light, Ministry of Health believes that the digitization of health care services will add impetus in achieving the sacred constitutional mandate as well as to ensure that health care resources are used more prudently and better health outcomes are met.

ICT has a great potential to impact upon almost every aspect of the health sector. In public health, information management and communication processes are of critical importance, and are greatly facilitated or limited by the availability of ICT. In addition to this, beyond the formal health sector, the ability of communities to access services and demand health services that responds to their priorities and needs, is importantly influenced by wider information and communication processes, mediated by ICT.

However, the great potential of ICT in health care can only be realized through a comprehensive, well planned and strategic approach. Consolidation of efforts and resources, creating conducive environment for ICT adoption, integrating systems and applications are some of the prerequisite to leverage ICT to provide quality health care services to each and every Bhutanese.

This ehealth strategy document for Ministry of Health has been developed through inclusive consultative processes involving stakeholders from across the Departments, Divisions, Services, Units and Jigme Dorji Wangchuck National Referral Hospital, District Hospitals and District Health Offices to understand their requirements, challenges and feedback.

I thank all the stakeholders for their meaningful and constructive contribution in developing this very important document, which will be the core for development of ICT initiatives in the next five years. I would also like to take this opportunity to thank WHO and ADB for their technical and financial assistance to make this venture a successful one. I am optimistic that this cooperative spirit will continue during the implementation phase.

Tashi Delek!



(Dr. Ugen Dophu)  
Secretary  
Ministry of Health  
Royal Government of Bhutan

## ACKNOWLEDGEMENTS

Ministry of Health is deeply grateful to the members of National eHealth Strategy Working Group, Technical Experts (national and international experts) whose contributions were invaluable for the development of this document. The comments and suggestions provided by the members from various departments and health allied agencies during the stakeholders consultation meeting has also enriched this document.

Further, the Ministry of Health would like to thank the international development partners, viz., World Health Organisation (WHO), Asian Development Bank (ADB), and the Asia eHealth Information Network (AeHIN), for their support.

## ACRONYMS

12th FYP	Twelve Five Year Plan
ADB	Asian Development Bank
AeHIN	Asian eHealth Information Network
BHU	Basic Health Unit
DH	District Hospital
DHIS2	District Health Information System v2
DHO	District Health Office
DITT	Department of Information Technology and Telecom
DoMSHI	Department of Medical Supplies and Health Infrastructure
DoPH	Department of Public Health
DoTMS	Department of Traditional Medicine Services
DMS	Department of Medical Services
eBMSIS	electronic Bhutan Medical Supplies and Inventory System
ePIS	electronic Patient Information System
GDC	Government Data Center
GDP	Gross Domestic Product
GGHE	General Government Health Expenditure
GNH	Gross National Happiness
HEDCP	Health Emergency and Disaster Contingency Plan
HERC	Health Emergency Response Centre
HHC	Health Help Centre
HIE	Health Information Exchange
HMIS	Health Management Information System
ICT	Information and Communications Technology
ID	Identity
ITU	International Telecommunication Union
JDWNRH	Jigme Dorji Wangchuck National Referral Hospital
LAN	Local Area Network
LIS	Laboratory Information System
MCH	Maternal and Child Health
MoH	Ministry of Health
MoIC	Ministry of Information and Communication

NEWARS	National Early Warning, Alert & Response Surveillance Information System
NKRA	National Key Result Area
ORC	Out-Reach Clinic
PPD	Policy and Planning Division
RCDC	Royal Centre for Disease Control
RGoB	Royal Government of Bhutan
RRH	Regional Referral Hospital
SDGs	Sustainable Development Goals
SOPs	Standard Operating Procedures
THE	Total Health Expenditure
TWG	Technical Working Group
UHC	Universal Health Coverage
VHW	Village Health Workers
VPN	Virtual Private Network
WAN	Wide Area Network
WHO	World Health Organization

## EXECUTIVE SUMMARY

The Royal Government of Bhutan recognises the value that ICT can bring towards achieving Gross National Happiness. The government has accorded high priority to ICT and it continues to do so. The constitution of the Kingdom of Bhutan ensures free basic health care to its citizens.

To continue funding free basic public health care, Ministry of Health (MOH) must find new initiatives to curb wastages and deliver care more efficiently. At the same time, MOH must fulfil the aspirations of a more informed population in providing quality health care service.

In order to provide quality, free and sustainable health care services, the MoH must explore new initiatives and ICT is one such solution. The eHealth Strategy and Action Plan seeks to deliver/take health care services closer to the citizen at their doorstep. It aims to provide accessible, convenient and cost-effective health care services to the citizen.

The eHealth Strategy and Action Plan is in line with the overall objectives and programme of the 12th Five Year Plan and with the e-Gov policy of the Ministry of Information and Communications. The programmes and projects in the eHealth Strategy and Action Plan are holistic and coherent covering all aspect of health care system.

The eHealth Strategy and Action Plan are ambitious documents like any other plan and therefore requires strong governance and management commitment, user support and collective effort of all the stakeholders. It is also important to note that there are several critical success factors that we should be mindful of while implementing the eHealth Strategy and Action Plan.

# 1 STRATEGIC CONTEXT FOR E-HEALTH

## 1.1 Strategic health and development goals and challenges

Section 21 of Principles of State Policy of Article 9 in the Bhutanese Constitution states, “The state shall provide free access to basic public health services in both modern and traditional medicines” essentially emphasising on the state’s mandate to provide healthcare to all Bhutanese for free. In order to realize this, the RGoB is prioritising on using ICT as an enabler for improving health of all citizens in the coming five year plan period.

This eHealth strategy and action plan has been developed in the context of the 12th Five Year Plan for Bhutan 2018-2023 (12th FYP)[1]. The 12th FYP defines the domain of health as comprising of good conditions of the human body and mind. A healthy quality of life allows us to get through our daily activities without undue fatigue or physical stress. The ehealth strategy is also in tandem with the National Health Policy of Bhutan<sup>1</sup> which states that “Digitized Health record and information system shall be instituted in all the health facilities for faster and effective health information generation to support decision making.”

The 12th FYP also makes elaborate references to the Sustainable Development Goals (SDGs) that were agreed by the global community in 2015. Of the 17 SDGs, 9 goals are directly relevant to health while all of the goals are influenced by health to some extent. Within the SDG framework, SDG 3 elucidates the need to “Ensure healthy lives and promote wellbeing for all at all ages” spans all programmes and needs across the health sector. Health is well-positioned in the SDGs as a key feature of human development in a more integrated manner than previous practices with a focus towards universal health coverage (UHC) to “leave no one behind.” Moreover, social, environmental and economic determinants, such as education, income and urbanization, have an impact on health and, in turn, benefits from a healthy population.

The 12th FYP notes that “Given the similarities between our development philosophy of GNH and SDGs, both aspiring to pursue a sustainable socio-economic development path, alignment of SDGs in our five year plans does not pose a challenge”. A priority for the 12th FYP is improving access to quality health services, and promoting a healthy and caring society. The Ministry of Health, as the lead agency, is responsible for National Key Result Area (NKRA) 14, which is “Healthy and Caring Society enhanced”. However, improvements in health depend on the results of activities in other Key Result Areas. For example, the following NKRA also have an impact on the nation’s health status:

- NKRA 3: Poverty Eradicated and Inequality Reduced
- NKRA 5: Healthy Ecosystem Services Maintained

<sup>1</sup> National Health Policy of Bhutan. 2011. <http://www.health.gov.bt/wp-content/uploads/moh-files/2015/11/National-Health-Policy.pdf>

- NKRA 7: Quality of Education and Skills Improved
- NKRA 8: Water, Food and Nutrition Security Enhanced ·
- NKRA 9: Infrastructure, Communication and Public Service Delivery Improved ·
- NKRA 10: Gender Equality Promoted, Women and Girls Empowered·
- NKRA 11: Productive and Gainful Employment Created ·
- NKRA 15: Livability, Safety and Sustainability of Human Settlements Improved

In essence, inline with RGOB's policy to prioritise ICT, the ehealth strategy is based on the foundational goal to create a knowledge based society. However, Health systems have been described as “complex adaptive systems” (World Bank 2007<sup>2</sup>). This means that they can learn and change themselves, but also that changes are not linear or easily predictable (The Health Foundation 2010<sup>3</sup>). These characteristics make it difficult to be certain about the outcome attributed to any investment decision in health, and leaves it to the rules of probability.

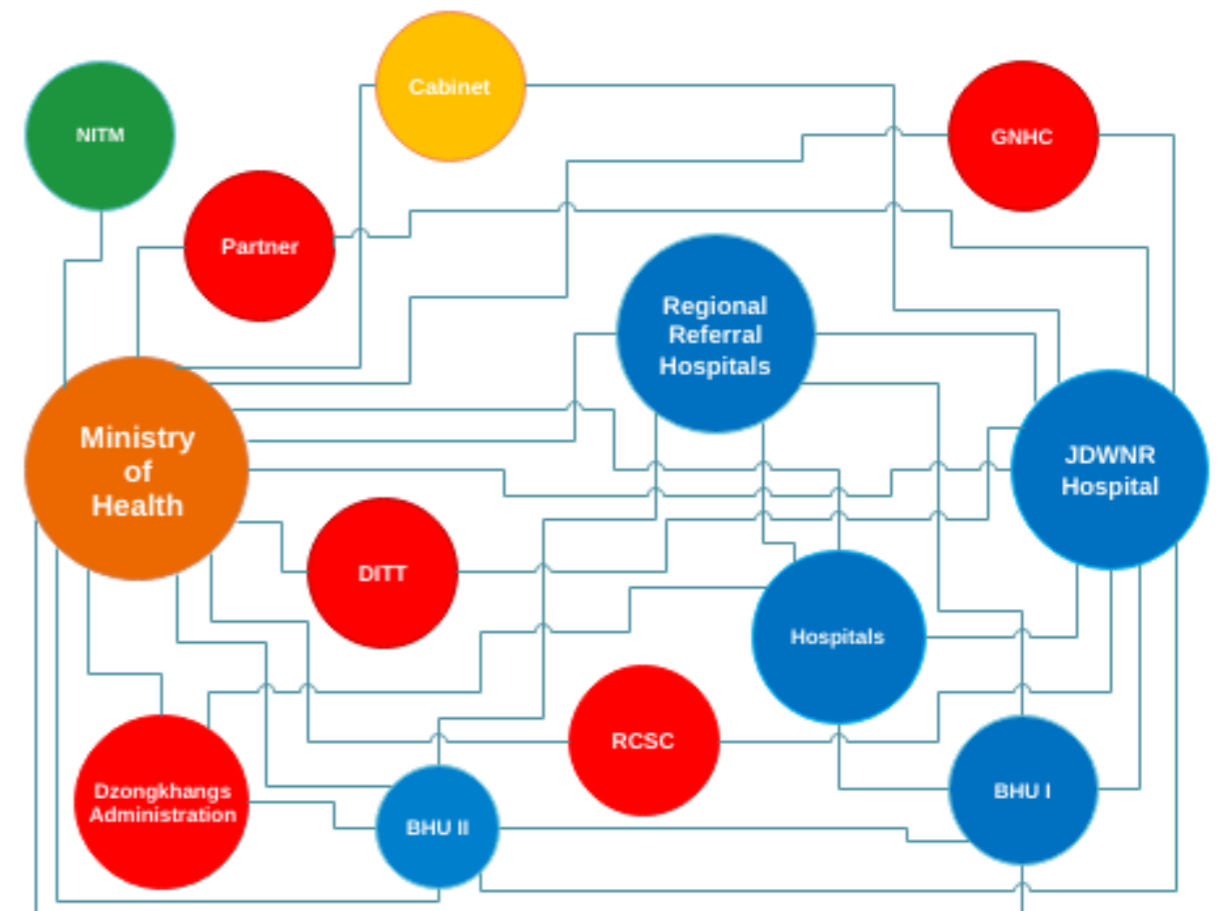
## 1.2 Health System status

Bhutan's health system is predominantly public financed and managed. Healthcare is delivered through a three tiered approach comprising of BHUs, General Hospitals and Referral Hospitals, with complex and critical cases referred to empanelled hospitals in India through government financing. There is also a strong collaboration between the traditional and allopathic sector whose services are delivered from the same health facilities. Village Health Workers (VHW) play a crucial role in promoting health in grassroot communities.

There are three referral hospitals, 29 hospitals including military hospitals, 25 Basic Health Units grade I (BHU-Is), 186 BHU grade II (BHU-IIs), 52 sub-posts, 551 Outreach Clinics and 56 indigenous units including one traditional medicine hospital. The number of health facilities per 10,000 population has reached 3.7. Primary care services are supported by secondary and tertiary care services through a perceived referral system. Health information and ambulance service can be obtained from the Health Help Centre (HHC). A national Health Emergency and Disaster Contingency Plan (HEDCP) has been developed to respond to public health emergencies and disease outbreaks.

<sup>2</sup> World Bank. 2007. *What is a Health System?*. Healthy Development. The World Bank Strategy for HNP Results AnnexL, Washington DC: World Bank. <http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/281627-1154048816360/AnnexLHNPStrategyWhatisaHealthSystemApril242007.pdf>.

<sup>3</sup> The Health Foundation. 2010. *Complex Adaptive Systems*. Evidence Scan, London: The Health Foundation. <http://www.health.org.uk/sites/health/files/ComplexAdaptiveSystems.pdf>.



In 2014 total health expenditure (THE) by Government was 3.6% of GDP. The general government health expenditure (GGHE) as a proportion of the general government expenditure (GGE) has fluctuated between 8% and 12%. The expenditure on curative services has dominated the total health spending, above 70% of THE for the fiscal year 2012–2013. The engagement of the private sector in health-care delivery is limited to pharmaceutical retail shops and selective diagnostic centres, but this is increasingly becoming an policy area of growing importance.

With a largely progressive health financing framework a minimal burden is posed by health expenditure on household livelihood. Nevertheless, disparities exist in access and utilization of health services as well as in health outcomes between urban and rural areas, income levels, districts and between western, central and eastern regions.

There have been significant gains in life expectancy over the last 50 years (from 32.4 years in 1960 to 69.5 years in 2014). Since 2010, immunization levels have been maintained at over 95%. While communicable diseases remain a substantial burden, non-communicable diseases are constantly on the rise. Other challenging issues include substance dependence, suicide and other mental health problems. Various cancers, heart disease and kidney diseases are the top three conditions that require out of country referrals. The government bears all the associated costs including air travel, which is around 5% of THE.



While the Human Resources for Health Master Plan (2013–2023) estimates a staff requirement of more than 10,000, at present their strength is only just over 4000 including the administrative staff. Among the different fields, the gap needs to be most urgently bridged for specialists, as demands for generalists are gradually being met. In 2017, the number of doctors and nurses per 10,000 population was 3.3 and 14.1, respectively.

Monitoring change and trends in the health system, enabling the gathering of data and evidence for research, and informing decision makers is reliant on a sound health information system. Though great strides have been made since the paper-only environment of the early 1980s, this strategy shows there is much more to do.

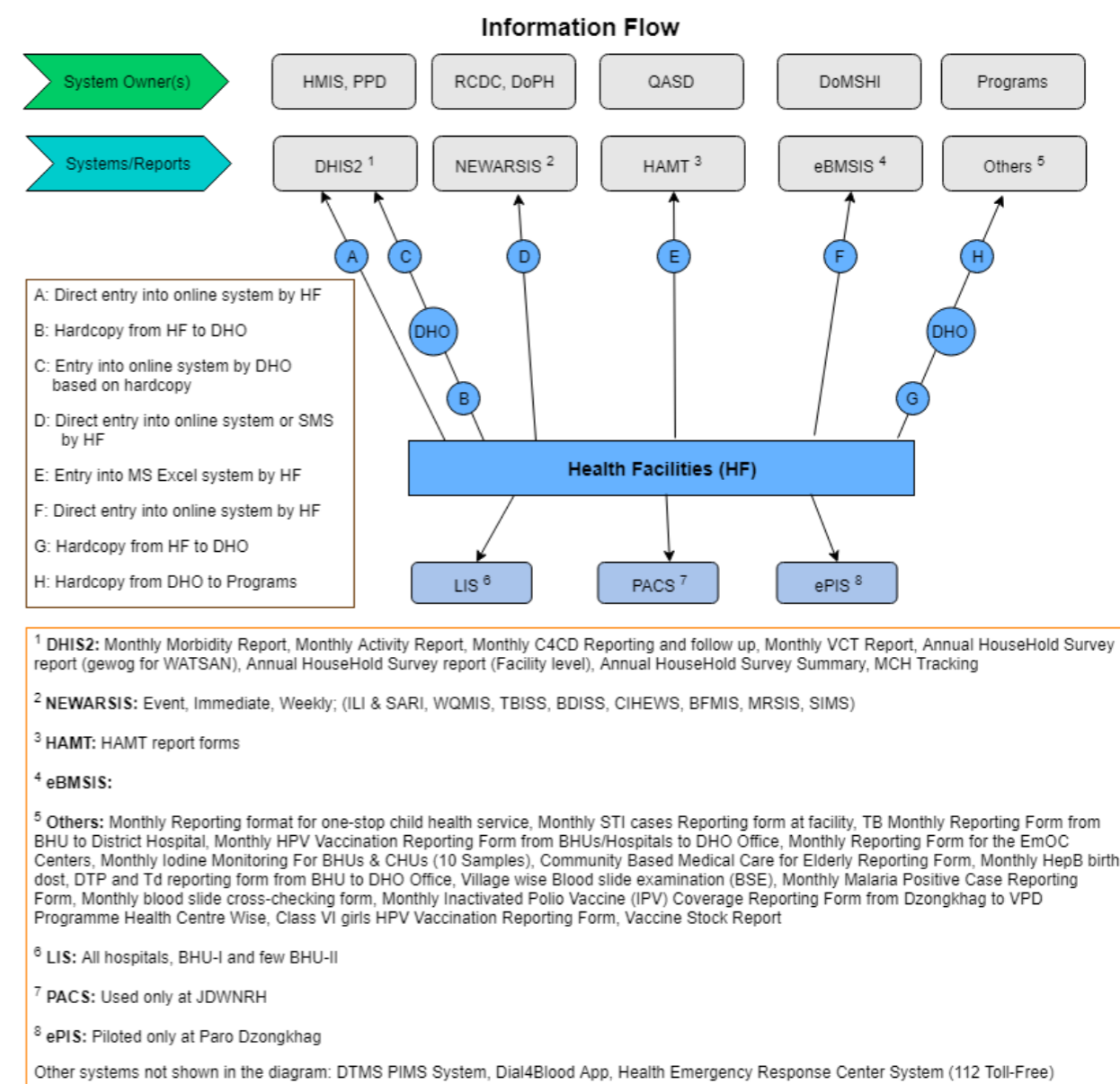
The Health system in Bhutan is unique where state provides free basic public health care to its citizens. Both allopathic and traditional medical services are free through various levels of health facilities in the country and if a particular treatment service is not available in the country, patients are being referred abroad for the treatment. A recent review of the health system of Bhutan[4] acknowledged the progress made in developing this predominantly public financed and managed health system, which has primary, secondary and tertiary levels of organisation.

### 1.3 eHealth status

The eHealth Strategy has benefited from the Healthcare ICT Master plan drafted back in 2014. Though not formally implemented, its assessment of the health information system has provided the basis for the review and work of the ehealth Technical Working Group. Essentially its findings were that there was:

- Lack of infrastructure and connectivity
- Limited skilled human resource and capital to run all the required projects
- Islands of Automation
- Weak data collection and reporting in public health system
- Integration is not achievable due to lack of data standards and unique patient identifier
- No control over ICT resources over inter-ministry transfer.

A recent review[5] of the status of health information systems in Bhutan showed that the MoH has a number of different functional information systems, meeting different purposes. Figure 1 below shows a complex network of information flows.



Starting from the bottom, there is the outreach clinic or health sub-posts, which are supported by Health Assistants(HAs). The BHUs work with about 17 manual registers and are expected to send about 22 reports on a monthly basis, about 5 reports on quarterly basis, and about 4 reports on annual basis to the District Health Office (DHO) from health facilities without internet connectivity. Health facilities with internet access can directly submit some of the reports reports/punch data into the system. Besides these routine reports some of the districts have additional reports for monitoring the Annual Performance Agreement (APA) targets. The HHC is an ICT-enabled initiative for delivering round the clock (24x7) services in emergency response (Ambulance Service) and as a health helpline. The HHC can also monitor all the ambulances in the country through a vehicle-tracking system and deploy ambulances at the right site at the time of emergency. The Health Help Centre (112 toll free) is managed at the national level under Emergency Medical Services Division, Department of Medical Services. HHC also activates Helicopter service for airlifting of the patient.

The two systems, DHIS2 and eBMSIS are hosted in Government Data Centre, while NEWARS, LIS & PACS are hosted in different office/hospital premise. The operation and system maintenance (including data backup) is the responsibility of the Ministry of Health while the space, physical security, power supply etc. in the GDC is taken care by the DITT, MoIC. The holding of identifiable individual patient data in a data center designed to support government agencies raises concerns about confidentiality and security that will need to be addressed. A legal basis also has to be established to govern the exchange of patient information by health care providers via mobile phones and social media apps.

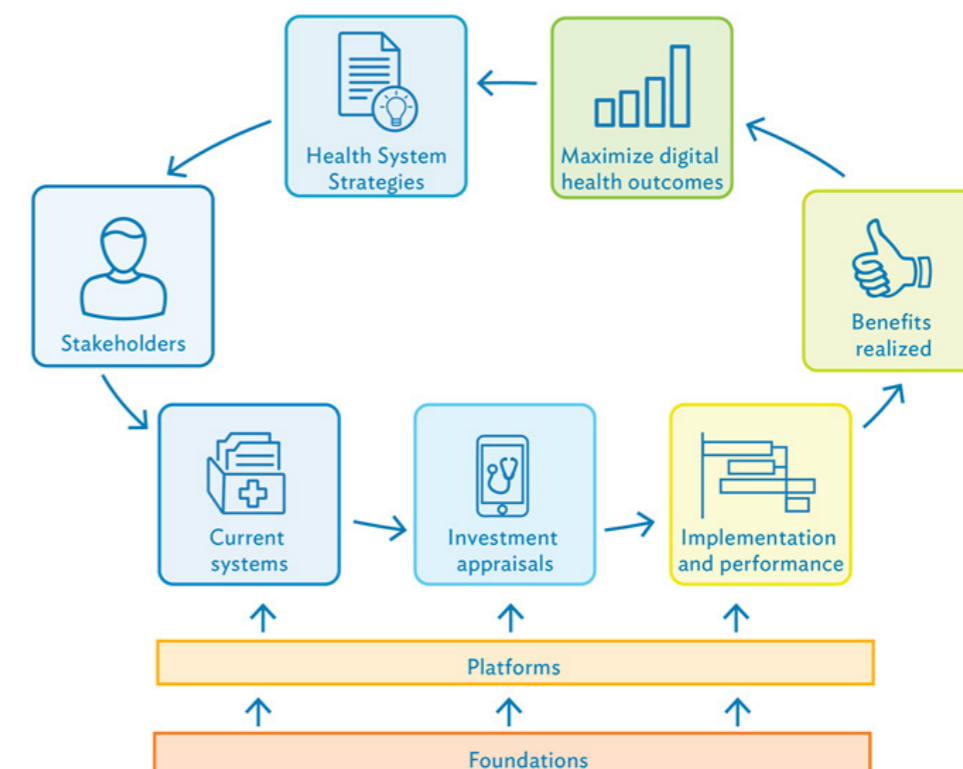
Multiple systems are working in the health center, DHIS2 is used for entering aggregate data on activities, including morbidity data by health centers. Health facility without internet connectivity sends reporting forms to District Health Office to punch data into DHIS2. NEWARS is accessed over the web to enter disease surveillance related data or data is sent through SMS (Short message Service) wherever internet connectivity is not accessible. The electronic Patient Information System (ePIS) is being pre-piloted at Paro District hospital and in some BHUs. The Laboratory Information System (LIS) is used in hospitals for generating lab results and it is linked with certain lab equipment. The eBMSIS, which is hosted at the GDC, is used by the health centers for indenting, receiving supplies and stock monitoring.

At the national level, the DHIS2 is managed by the HMIS Unit in the MOH, and the application is hosted in the Government data center. The NEWARS application is managed by RCDC and is hosted in servers at their premises. The ePIS which is pre piloted in Paro Hospital, Dawakha BHU and Drugyel BHU is only hosted in the local server in their facilities at present. The current ehealth systems are siloed and needs to be integrated to reduce the workload of health care providers and to avoid data duplication.

#### 1.4 Implications for eHealth

How can use of ICT support improvements in health systems? The strategic context shows health systems are inherently complex. The spectrum of ill health is constantly changing, and requiring new or improved clinical responses (that are evidence-based). The 12th FYP recognises the cross-sectoral nature of the challenge to improve health systems. The eHealth strategy also recognises that to support the development of a knowledge-based society requires learning to learn and adapt to new evidence and data. The organisation and management of health systems in Bhutan has important issues to address, including lack of capacity, connectivity and a challenging terrain. In addition, the application of technology to support both modern and traditional medicine is a challenge seldom addressed elsewhere. And then the technology itself is evolving rapidly. In the last few years as connectivity has improved and mobile technologies become more affordable so the scope of eHealth has increased. But to enable applications and services to exchange information, whether concerning individual patients, populations, or aggregated data for management, planning and research, requires a technical and policy environment that supports interoperability.

In short, developing eHealth solutions for complex health systems has to be framed as an ongoing cyclical process. The diagram below<sup>4</sup> illustrates this.



eHealth, then, has firstly, to consider the health systems strategies and policies. Then it needs to consider what the broad groups of stakeholders require. These include:

- The Public (and patients)
- Healthcare providers
- Health Managers
- Planners and policy-makers

Researchers and donors are examples of other stakeholders.

eHealth also has to consider the current systems and how they are, or are not, supported by foundations (both social and technical). Where significant investment is going to be required a detailed investment appraisal will be needed. A monitoring and evaluation framework is then used to assess progress and to learn where improvements in the delivery of projects and systems can be made. The focus then has to be on realising the benefits from the investment. The eHealth outcomes that are delivered need to be measured and used to inform the next iteration of improvements to the health system.

<sup>4</sup> Source: ADB Guidance for Investing in Digital Health 2018 (forthcoming)

## 2. VISION FOR E-HEALTH

### 2.1 eHealth Vision

ICT enabled health system for making Bhutan 'a Nation with the Best Health'

### 2.2 Mission

By 2023 eHealth solutions are used to;

1. support the provision of better health in communities,
2. provide better person-based care to individuals,
3. empower healthcare providers with their use of technology, and
4. enable the exchange of individual and aggregate data to help health managers take better informed decisions.

"Health Managers" includes planners, researchers and policy-makers, and the role Development Partners play in assisting delivery of the mission will need to be in alignment. The mission to deliver the vision will require a number of foundational investments, which are then used to develop, deliver and support the eHealth solutions required. The output from these eHealth solutions should deliver the desired eHealth outcomes.

### 2.1 eHealth Outcomes

eHealth outcomes result from the adoption and use of eHealth by stakeholders.

1. eHealth enables increased access to quality healthcare for all.
2. For the public, use of eHealth solutions improves health knowledge and behaviour change.
3. Patients experience more integrated and timely provision of quality healthcare services.
4. For healthcare providers, use of eHealth solutions improves health knowledge, behaviour, and practice change.
5. Health managers have the information they need to manage services timely, efficiently and effectively.
6. Researchers, planners and policy makers have better information to support their decision-making.
7. The public, patients and the whole health workforce values the use of ICT to enable them to improve their health-related decisions and work.

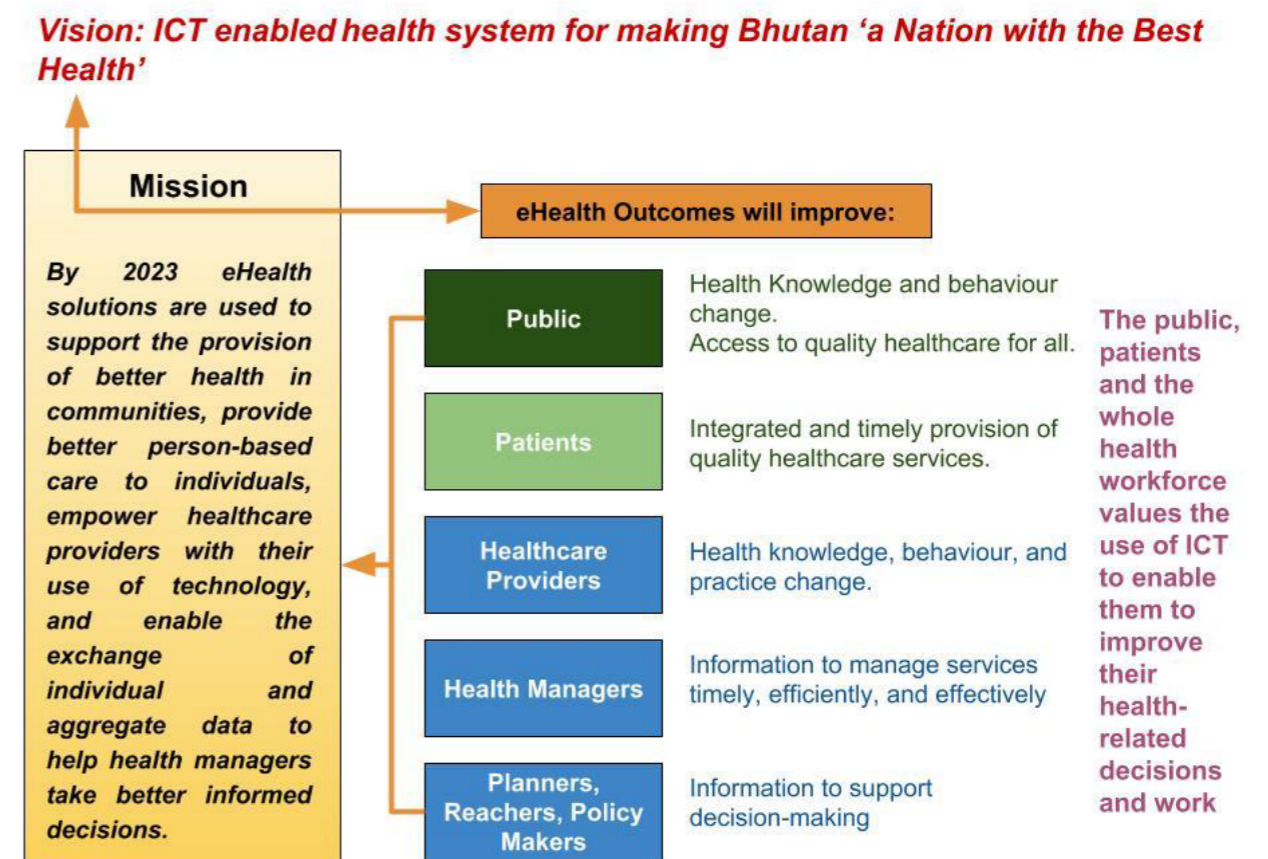
### 2.4 Changes and impact on stakeholders

For each of the major stakeholder groups the eHealth strategy needs to deliver benefits. For the public the impact should be seen in improved health behaviours (e.g. avoiding health risks, having immunizations, eating healthily), and when they are sick (no matter who or where

they are) they can get access to quality health care. For health care providers, the eHealth solutions help improve not only their own continuing professional development and training, but also the availability of information that enables them to deliver integrated and timely care to their patients. A most welcome benefit for health care providers will be if the use of eHealth solutions helps reduce rather than increase their workload. For managers, more information is not necessarily required. What is of most value is near real-time intelligence that enables them to take good decisions in good time. Similarly, for researchers, planners and policy-makers having information to explore alternative scenarios based on aggregate data, and (anonymised) individual data if required, offers significant improvements for them.

All of the stakeholders may need to change and improve current working practices, and the effective management of change is vital for successful implementation of the strategy.

### 2.5 Strategic Framework at a Glance





## 3. ACTION PLAN

### 3.1 Overview

To implement this eHealth Strategy a detailed action plan has been developed (see Appendix 2) in accordance with the WHO-ITU National eHealth Strategy Toolkit<sup>5</sup> guidelines, which sets out what is to be delivered by when. Because there will be changes in priorities, resource availability, progress in implementation, and other risks and issues to be addressed as they arise, continuous refinement of the action plan is an ongoing process.

#### 3.1.1 Overview of the action plan

The action plan has four main thrusts. Underpinning each of these thrusts are detailed activities under individual action items organized in accordance with the cross-cutting *seven components* of an effective eHealth strategy.<sup>5</sup>

##### 1. Get the eHealth governance arrangements in place.

eHealth *Governance*[6] structures will be put in place so that the appropriate leadership (with the appropriate support) can guide the development of the strategy, ensure there is an agreed process for developing an eHealth architecture, and ensure that the necessary *investment, legislation, policy and compliance mechanisms* are in place.

##### 2. Focus on the foundations.

With a Governance structure in place, plans to develop the foundational *infrastructure* will be refined. Improvements in health facility-based infrastructure, and the networks to connect them, will be made and eGovernment services fully leveraged. In developing the technical foundations, agreed *standards* that enable progressively better *interoperability* of services will be introduced. Without addressing the high priority data standards, e.g. for national health identifiers for patients, facility identifiers and health data exchange standards, it will not be possible to deliver integrated services.

##### 3. Selectively improve the current systems.

Given the resource gaps, priority areas should be identified after reviews of workflows and performance. The eHealth Strategy distinguishes between *ICT Services and applications* where significant impact can be made in Years 1 and 2 (because the systems are not complex, expensive or require legislation) and those that require the foundations to be in place before real progress can be made (in Years 3-5).

##### 4. Prepare the workforce for use of ICT skills and knowledge.

Healthcare providers are becoming familiar with ICT skills including improved personal mobile

<sup>5</sup> National eHealth Strategy Toolkit. WHO and ITU. 2012.

phone use among others. Over the next five years of the strategy, and beyond, developing a more ICT literacy among all cadres of the health *workforce* and their skills will help them value the use of ICT in improving their learning, competencies and behaviour change (and the contributions they can make to a knowledge-based society).

#### 3.1.2 Implementation of the Action Plan

Implementation of the eHealth strategy is planned in two phases. The first phase of the action plan, 2018-2019, is concerned with making some demonstrable progress, but at the same time preparing the ground for the Phase 2 when the major implementations take effect with accelerated scale-up and sustainability. Each phase has four parts spanning all 7 components of the eHealth strategy. For some key investments, a more detailed investment appraisal (such as the Digital Health Investment Case Framework from the ADB[7]) of the detailed costs and benefits will need to be undertaken in Phase 1 and also impacts associated with specific eHealth solutions.

##### 3.1.2.1. Phase 1: 2018- 2019

###### 1. Select and prepare current systems for improvements in years 3-5 (2020 - 2023)

The Action Plan, and the recent review of current systems (see above) shows that there are developments underway or being planned in projects which, while complex and high risk, offer significant benefits in delivering integrated and quality services, such as ePIS. There are projects that are underway where nationwide implementation is hampered by the lack of connectivity, such as DHIS2, and other eHealth solutions and projects that are dependent on donor support, which is a risk to be managed. One of the early tasks of the new Governance arrangements is to review, with the relevant stakeholders of current or planned systems, the extent to which they have funding secured for the next five years, their implementation plans, and the extent to which they are dependent on which standards and what aspects of the technical infrastructure.

Much useful work has already been done by the Ministry of Health. A 2018 report by ADB consultants recommended that:

1. DHIS2 should serve as the core platform of a national data warehouse or facilitate a health data clearing house for linking data from multiple data sources that could feed into and extract data from a national data repository;
2. DHIS2 should serve as the base platform or application to support different program areas, including but not limited to HIV, TB and malaria case base reporting; reproductive, mother, child and adolescent child health (RMNCAH) tracking, water, sanitation, and hygiene (WASH) program monitoring, and other areas in the future;
3. NEWARS could also be linked to DHIS2 as it has strong capabilities to be used as a system for individual-level case reporting and disease surveillance;
4. The ePIS system for longitudinal patient monitoring through electronic shared health records should be further developed and linked to DHIS2, NEWARS, etc.

The review of existing systems will help to improve the definitions of the next two aspects of the work of the first Phase. Further, this review will help understand the current and potential requirements for eHealth standards and solutions of the private health sector in Bhutan.

## 2. Deliver low-risk, low-cost eHealth services to large numbers of people

In undertaking the systems review, the team will pay particular attention to solutions that can be implemented quickly at scale because they are low cost and simple. Examples of these applications are those intended to improve health knowledge and behaviour change for both citizens and health care providers. For example, SMS alerts are already part of the NEWARS system, but citizens also value these reminder services being provided by other services. Another example is the planned upgrade of the health emergency response programme so that it can provide a wider range of call-based services to the population, and lay the basis for providing engaging, downloadable or web-based information about health issues. Another opportunity is for health care providers, particularly those with smartphones, specific apps and knowledge support systems can be downloaded and used based on a central licensing arrangement with content provider(s).

## 3. Prepare for the long-term with focus on enablers: identifiers/ standards/ networks

Though delivery of good eHealth outcomes from investment in eHealth can be delivered with simple solutions, those requiring the integration and transmission of data, particularly if it concerns identifiable individuals, requires some key enablers. These include, but are not limited to:

- Implementing a master patient index (MPI) platform linking existing IDs with a national health services ID
- Adopting open standards for health data (to be agreed, with training and implementation programmes), such as:
  - » Messaging (HL7, FHIR)
  - » Diagnosis (ICD10)
  - » Radiology (DICOM)
  - » Facility codes
  - » Location standards (Geographical Information Systems)
  - » Interoperability with Government systems (e-GIF standards)
- Internet connectivity and networking, in particular the last mile to reach all health facilities.

Because the OpenMRS software on which ePIS is based is not designed to support aggregate reporting, nor as a data warehouse, the requirements for moving towards collection of management information from operational clinical systems in primary health care settings will need to be clarified and resolved during Phase 1. An analysis of alternatives will be warranted to optimize investment in the best available solution.

## 4. Build capacity

During both Phases capacity will need to be built. A particular and immediate concern for the new Governance arrangements will be to establish how an appropriate level (numbers and expertise) can be assembled to provide the support that the leadership will need to oversee the detailed planning and implementation of the strategy. There should be an institutional support structure for management and coordination of eHealth established in the MoH by 2019. Immediate requirements are:

1. Establish an eHealth National Steering Committee (High Level Committee with inclusion of few more members and revised ToR) which has overall responsibility for delivering the eHealth strategy.
2. To undertake a proper assessment of ICT staffing needs for all upcoming ICT projects and ensure there is an effective Programme Management Unit. This will build on the existing work of the ICT Division in the Ministry of Health (which provides networking and security services, website management and system development) with the capacities needed for running systems. These competencies will be assembled from university departments of computer science and public health, global communities, such as of open source software developers, and private organizations.
3. Training programmes and educational apps/audio-visual materials (including CMEs and behaviour change communications) will be sourced for use by individual health care provider as well those suitable for use by patients and citizens.

### 3.1.2.2. Phase 2 (2020-2023)

In Phase 2 the foundations should be in place for the key systems to begin the long-term process of delivering more integrated and better quality health and care services to the people of Bhutan.

#### 1. Maintain and develop the momentum from Phase 1 Years (1 and 2)

In Phase 1 solutions introduced to support improvements in knowledge will, if successful, need to be maintained and indeed developed. The same will be true of developments in current systems and in the development of key identifiers and standards. The focus in Phase 2 is to enable these foundations to support key improvements in the more complex systems.

#### 2. Roll out key identifiers, standards and upgrade networks

By the end of 2019, there should be agreement on all the health data standards that will be used. Whilst many will have already been incorporated in clinical and administrative systems (from Phase 1), the introduction of the following will need to be taken to scale in Phase 2:

- Identity management for the health workforce
- Implementation of a master patient index that links existing IDs.
- Setting up of some channel of network services to all health facilities to access systems.

### 3. Implement key improvements in the more complex systems

By 2020 if the network has been extended so that all facilities are connected, then:

- National scale up of DHIS2 implementations can begin.
- Tablets will be used by frontline health care providers for data entry to DHIS2, and other systems, with management information being derived as a by-product.
- The way forward for NEWARS in terms of storage with DHIS2 and interoperability with ePIS will have been determined and implemented in at least 3 Districts, with further deployment to 2023.
- Initial ePIS deployment to be extended once web-service and connectivity are in place.
- A web-service will offer interoperability between DHIS2, NEWARS, ePIS (and other services, such as Helpline and Blood Transfusion) and will be rolled out to District Hospitals by June 2020, Western BHUs and ORCs by June 2021, Southern BHUs and ORCs by June 2022, and Eastern BHUs and ORCs by June 2023.

### 4. Continue capacity building

Based on the experience from Phase 1, plans to strengthen the technical capacity needed to support systems at both national and local levels will be implemented. These will include:

- Training programmes ready to improve general ICT capacity and fill specific eHealth gaps will need to be developed and implemented for the current and new cadres of digital health experts necessary to implement the eHealth strategy successfully.
- For the workforce as a whole, the training and development on issues that are of concern to them should be available online. They should value the use of ICT because it helps them do their job rather than because they have attended an IT Literacy class.
- For patients and the population, the eHealth programme should continue to source appropriate apps and audio-visual materials.

## 3.2 Delivering the Action Plan

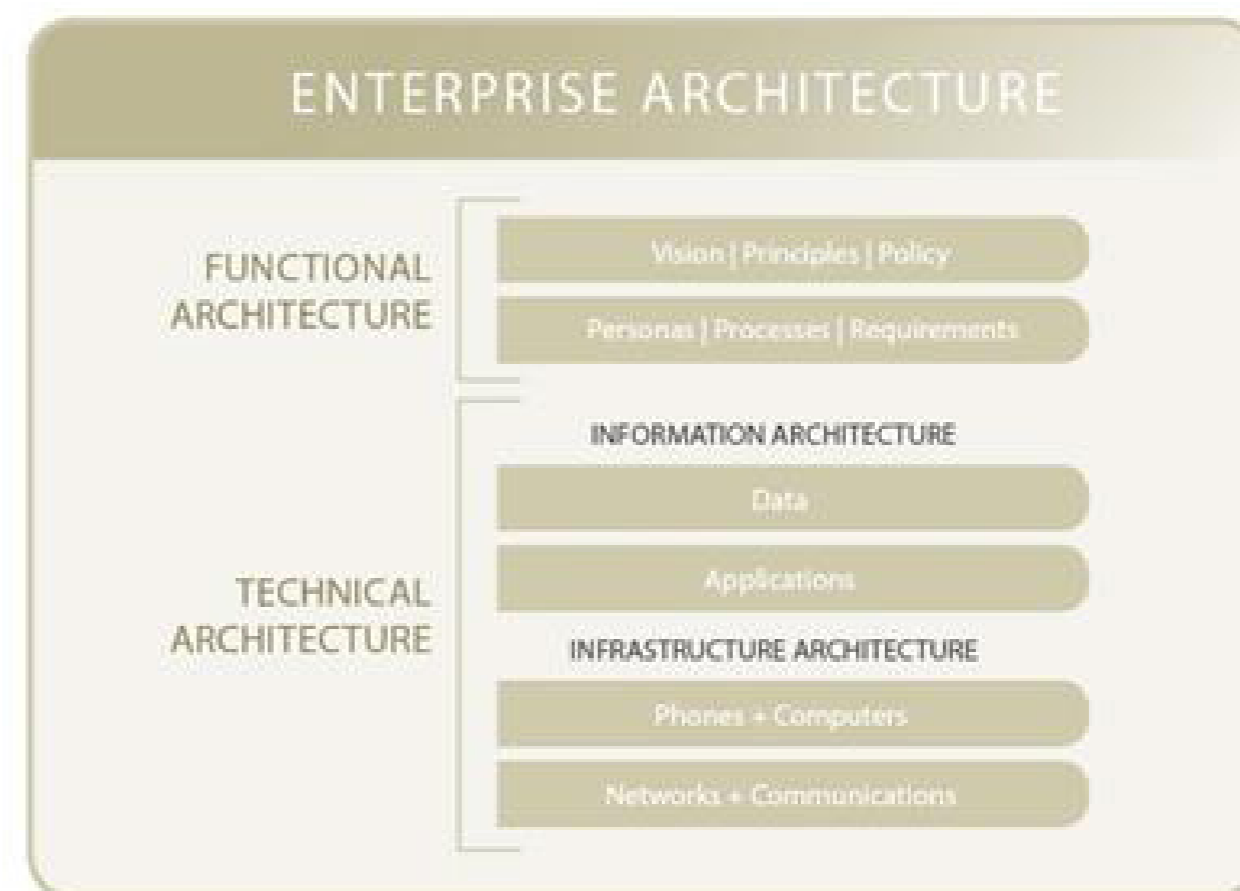
### 3.2.1 High-level resource requirements

Strong advocacy and high-level commitment with adequate resources for effective implementation of the eHealth strategy and action plan is essential. The fully functioning eHealth governance structure with accountability and oversight can maintain momentum to achieve the key performance indicators (KPIs) and successful use of eHealth. Through each phase, it will be necessary to ensure stakeholder needs and assessments of the current eHealth situation and requirements are continuously evaluated and incorporated into next steps. The eHealth governance mechanism shall continuously prioritize and support all of the eHealth action plan activities, sanction necessary approvals and designated authorities, mobilize resources for, and monitor performance of implementation of the eHealth strategy and plans.

### 3.2.2 Development and adherence to an eHealth architecture framework

Many health facilities, health programme departments, divisions, and units are heavily engaged in all phases of eHealth implementation--from planning and design of proposed systems to engaging in pilot projects or initial rollout, to scaling up to routine operation and maintenance. These systems have been implemented in isolation to meet specific patient-level and programme monitoring and evaluation needs, without planning for standards and interoperability with other eHealth systems. All of this has led to the incomplete, inaccurate and untimely availability of information for longitudinal patient monitoring and care as well as insufficient or unreliable data for programme management and policy decision making.

The use of an eHealth architecture (EA) framework will greatly help departments, programmes and divisions in the Ministry of Health, as well as donors and partners, to align investments in information systems with the missions, goals, and strategic objectives of the country. Generally, there are layers or viewpoints that describe various aspects of EA such as those depicted in Figure below, including the Functional Architecture describing the national vision, principles, and information policies; the Information Architecture containing the data and application standards; and the Infrastructure Architecture documenting the hardware and the network and data exchange protocols.



Necessary steps and standards needed to fully specify a comprehensive eHealth or HIS architecture blueprint are outlined in the detailed action plan (see Appendix 2, “standards and interoperability” section). The enterprise architecture blueprint will aid with moving from the current state-of-affairs to a less fragmented and increasingly more interoperable eHealth system of systems.

### 3.2.3 Approach to securing skills and expertise

Managing change and risks of the eHealth action plan activities is necessary. It is inevitable issues will arise, and most likely across most if not all aspects or components of the eHealth strategy implementation. Building the skills and expertise within the Ministry of Health to effectively manage risk and change on a day-to-day basis can be achieved through training and adherence to good ICT programme management practices, such as but not limited to the use of COBIT5, PRINCE2, and TOGAF techniques for eHealth governance, programme management and architecture, respectively. These techniques shall be learned and applied wherever feasible at the programmatic and project level. It is anticipated that technical assistance with developing these skills will be required, and these are also reflected in the action plan.

## 4. MONITORING AND EVALUATION OF THE EHEALTH STRATEGY AND ACTION PLAN

The M&E plan provides a link between the vision and the action plan (which is presented in detail in Annex B), and the desired results. For each of the four parts of the Action Plan (and covering both its phases) it shows the eHealth outcomes desired, along with the indicators for the relevant (seven) components. To achieve these outcomes, the outputs of the Action Plan are also summarised and presented with their output indicators. For some indicators a % is presented; for others simply whether a particular action was achieved. Where the 2018 baseline is shown with a Y, it is taken that the achievement measure of this same indicator also applies to 2020 and 2023. Indeed, the National eHealth Strategy Steering Committee should set annual targets. The objective is to be able to have the appropriate leadership and governance arrangements so that these indicators and targets enable progress towards achievement of the Vision and Mission to be tracked and evaluated and inform whether the implementation is giving the intended results and outcomes. The timeline mentioned in this strategic document are subject to change based on priorities and need.



## REFERENCES

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# ANNEX A: INDICATORS AND TARGETS FOR M&E

Outcomes	Outputs	Indicators	2018 Baseline	2019 Target	2020 Target	2023 Target
<b>Getting the Governance Arrangements in Place</b>						
<i>Leadership and Governance</i>						
Governance structure overseeing strategy development and implementation	National eHealth Steering Committee and eHealth governance structure established (Yes/No)	Core Group	June 2018	NA	NA	NA
			% of planned quarterly meetings of eHealth Steering Committee held	NA	100%	100%
Functioning TWG	eHealth TWG, and appropriate sub-groups established (Y/N)	eHealth Strategy TWG	June 2018	NA	100%	100%
			% of planned meetings of eHealth TWG held	NA	100%	100%
Broad stakeholder engagement achieved	% of identified key stakeholder groups engaged (attending meetings)	NA	80%	80%	80%	80%
			Sustained Government Commitment secured	NA	Yes	Yes
eHealth program management capacity strengthened	Established PMU with a) technical capabilities and (Y/N) b) implementation capabilities (Y/N)	NA	Yes	Yes	Yes	Yes
			Yes	Yes	Yes	Yes

<b>Strategy and Investment</b>						
Increased funding for delivering eHealth strategic objectives	% of Action Plan costs per year met by A) RGoB B) Development Partners	NA NA	30%	30%	30%	30%
			70%	70%	70%	70%
Develop eHealth strategy and costed action plan	eHealth strategy and costed action plan a) developed and updated	NA	Developed	Updated	Updated	Updated
			Prioritize activities	Phase 1 (Short Term) activities identified, prioritised and endorsed by NESG	NA	100%
Mobilize resources	Annual eHealth plan and budget request and approved (Y/N)	NA	Yes	Yes	Yes	Yes
			75%	90%	90%	100%
<b>Legislation, Policy and Compliance</b>						
Regulatory Framework in use to guide eHealth investment and application	eHealth investment and applications guided by regulatory framework (%)	NA	30%	70%	70%	90%
			% current relevant laws and policies complied with.	100%	100%	100%

Outcomes	Outputs	Indicators	2018 Baseline	2019 Target	2020 Target	2023 Target
	eHealth legislation and policy functions designed and established	% of new requirements designed and established	NA	20%	70%	90%
	eHealth-related legislation and policy adopted and complied with	% of available eHealth related legislation and policy adopted and complied with	20%	50%	70%	90%
	Procedures for authentication, authorization, and accountability of health data implemented	% of relevant SOPs available and implemented	Not Available	50%	70%	80%
<b>Focus on the Foundations</b>						
<i>Infrastructure</i>						
Connected Health System in use		% of at least some channel of connectivity for health facilities	49%	50%	60%	90%
Improved systems management		Facilities with disaster recovery procedures in use	0%	50%	90%	100%
		% of facilities with currently adequate hardware and software		25%	50%	75%
		% of facilities with currently adequate WAN	??			
		% of facilities with currently adequate LAN		20%	50%	100%
		No. of facilities with currently adequate VPN	5	10	25	50

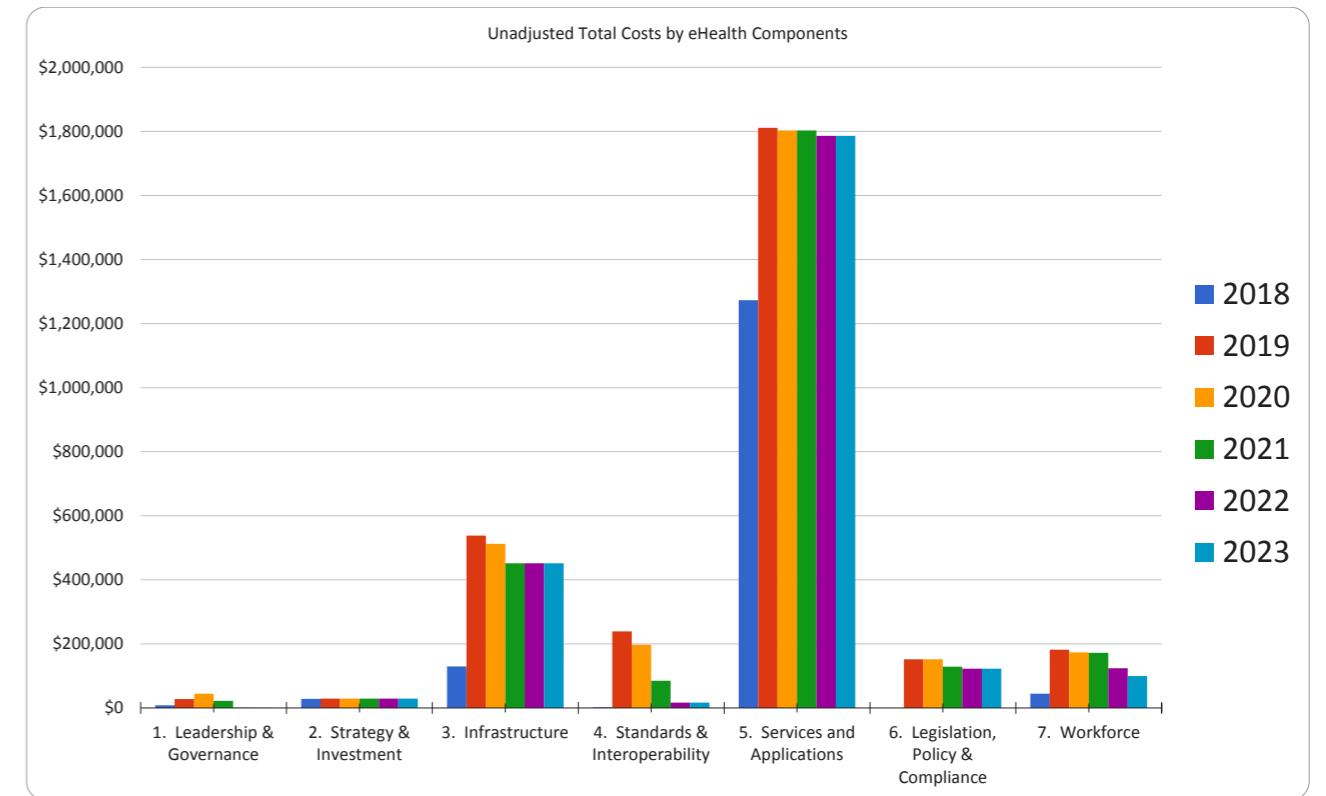
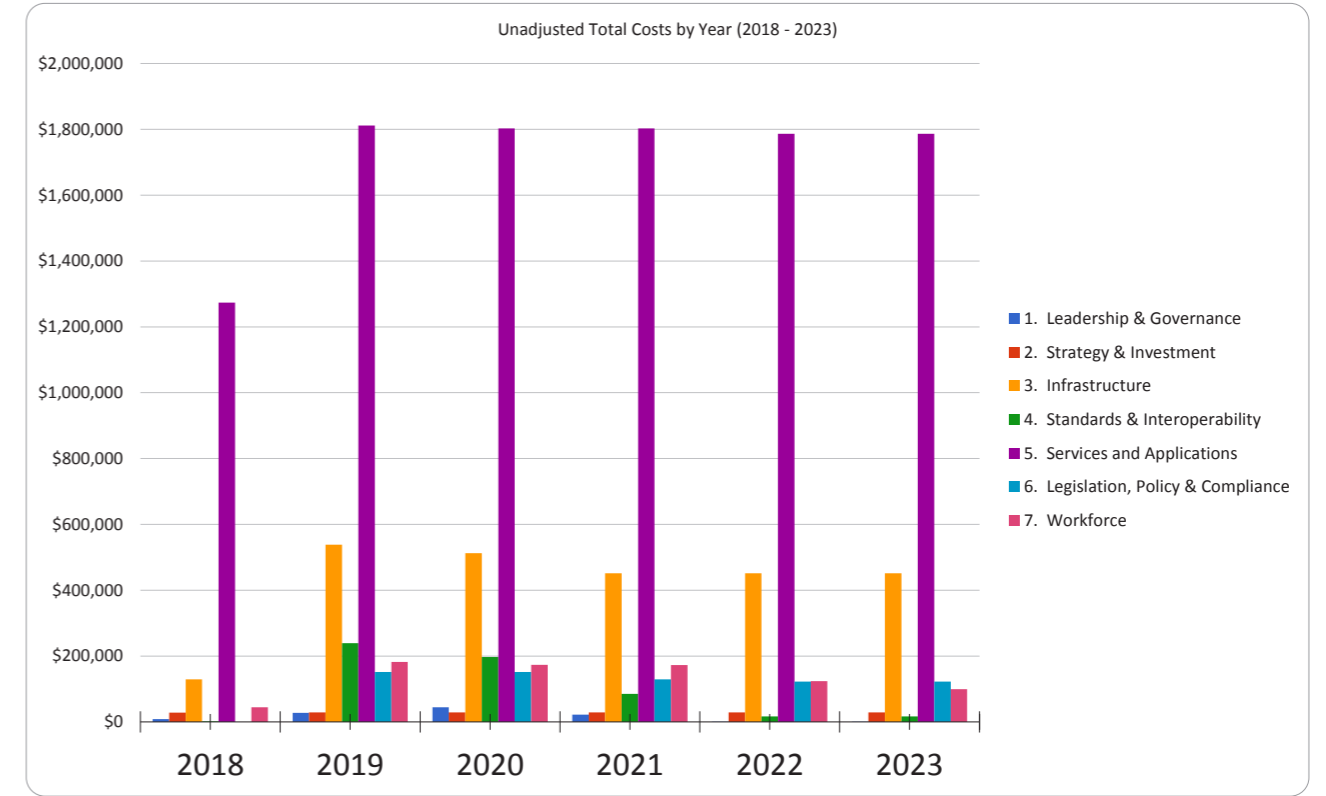
<b>Standards and Interoperability</b>						
Standards for eHealth information exchange defined and in use	Programme for developing Health Data Standards agreed	Health Data Standards Group established	NA	Yes	Review	Review
	Core public health indicator and metadata standards agreed		NA	Yes	NA	NA
	Master Patient Index established		NA	Yes	NA	NA
	% of population with a unique national health ID		0%	25%	50%	75%
	% Health facility IDs and registries implemented		0%	100%	100%	100%
	eHealth information architecture framework developed	eHealth standards and interoperability requirements aligned with eGIF	NA	Yes	Update	Update
	Interoperability profiles for data sharing and use (e.g., patient-level data aggregated into HMIS) developed		NA	Start	Complete	Enhance
<b>Selectively improve the current systems</b>						
<i>Services and Applications</i>						
Barriers to use and opportunities for improving uptake of current systems identified	Periodic analyses conducted and strategy updated accordingly		No	Yes	Yes	Yes

Outcomes	Outputs	Indicators	2018 Baseline	2019 Target	2020 Target	2023 Target
	Health information and workflow analysis	Analysis conducted	Yes	Yes	Yes	Yes
	Status of private sector eHealth systems assessed	Analysis conducted	No	Yes	Yes	Yes
	health care provider views established on burden of reporting and opportunities for innovation and changes	Study conducted	Yes	Yes	Yes	Yes
	Systems' performance, vulnerabilities, adherence to standards and policies, assessed	Assessments undertaken	No	Yes	Yes	Yes
NEHSC keeps strategy for implementation and development of specific systems under review		Specific systems M&E targets agreed for: "Simple systems" B) "Complex systems"		System specific targets to be decided by NEHSC		

Selectively improve the current systems	
Workforce with skills that they value to improve their learning and work	<p><i>Workforce</i></p> <p>Sample survey of eHealth skills conducted</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
IT literacy improved	<p>% of IT literate healthcare providers</p> <p>30%</p> <p>50%</p> <p>70%</p> <p>100%</p>
Health Systems literacy improved	<p>% of Health information systems training modules and programmes delivered to appropriate cadres of health care providers as planned</p> <p>40%</p> <p>60%</p> <p>80%</p> <p>90%</p>
Enhance engagement of healthcare providers and management in use of eHealth	<p>Use of eHealth as included as mandatory IWP in the Ministry and across all the Healthcare Providers</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
Develop culture of monitoring and evaluation and use of data	<p>% who use information to improve the M&amp;E for the services they are responsible for:</p> <p>A) health managers and B) healthcare providers.</p> <p>NAV</p> <p>NAV</p> <p>50%</p> <p>20%</p> <p>70%</p> <p>50%</p> <p>70%</p> <p>90%</p> <p>70%</p>

Bhutan eHealth Action Plan Costing Summary

eHealth components	2018	2019	2020	2021	2022	2023	Total (USD)
1. Leadership & Governance	\$8,281	\$27,645	\$44,155	\$22,353	\$552	\$552	\$103,538
2. Strategy & Investment	\$28,400	\$29,012	\$29,012	\$29,012	\$29,012	\$29,012	\$173,459
3. Infrastructure	\$129,266	\$538,291	\$512,438	\$451,706	\$451,706	\$451,706	\$2,535,114
4. Standards & Interoperability	\$1,829	\$239,364	\$197,145	\$84,864	\$16,323	\$16,323	\$555,849
5. Services and Applications	\$1,273,296	\$1,811,296	\$1,802,585	\$1,802,585	\$1,786,351	\$1,786,351	\$10,262,464
6. Legislation, Policy & Compliance	\$0	\$151,809	\$151,809	\$128,982	\$122,639	\$122,639	\$677,877
7. Workforce	\$44,276	\$181,854	\$173,337	\$172,387	\$123,789	\$99,491	\$795,134
<b>Annual Total (USD)</b>	<b>\$1,485,348</b>	<b>\$2,979,271</b>	<b>\$2,910,481</b>	<b>\$2,691,890</b>	<b>\$2,530,372</b>	<b>\$2,506,073</b>	<b>\$15,103,435</b>
Adjustment for risks and uncertainty	\$222,802	\$446,891	\$436,572	\$403,784	\$379,556	\$375,911	
<b>Annual Total Adjusted Cost (USD)</b>	<b>\$1,708,150</b>	<b>\$3,426,161</b>	<b>\$3,347,053</b>	<b>\$3,095,674</b>	<b>\$2,909,928</b>	<b>\$2,881,984</b>	<b>\$17,368,950</b>



Component 1: Leadership and governance

Action Item	Activities	Timeframe (% cost allocation)						Indicator or Deliverable	Responsible agency or unit	Funding source	Inputs, assumptions, and cost considerations	Comments	Total Estimated Cost (USD)	Technical Assistance					Meeting Support				Communications Materials			Training			Infrastructure, ICT & Equipment	Monitoring & Evaluation	Other or Fixed					
		2018	2019	2020	2021	2022	2023							International Days	International Trips	Int. Trip Length (days)	National-Days	Nat. Local Trip(s) (days)	Small	Medium	Large	National Workshop	Low Print/ Distribution	Med Print/ Distribution	High Print/ Distribution	Small	Medium	Large								
<b>1.1 Establish and implement eHealth governance structure</b>													\$0	\$0					\$0				\$0			\$0										
a)	Review current governance mechanisms and propose new steering committee or structure	x						National eHealth Steering Committee	PPD and ICTD	NA	internal and no funding required. To be finalized and linked with eHealth TWG and programme management improvements	inputs:																								
b)	Develop terms of reference and propose membership	x																																		
c)	Implement new eHealth governance mechanism including core competencies	x																																		
d)	Ensure linkages with eGovernance and architecture framework		x																																	
<b>1.2 Continue eHealth TWG and form sub-groups as needed</b>													\$0	\$0					\$0				\$0													
a)	Modify terms of reference for standing eHealth TWG	x						National eHealth Technical Working Group and Sub-group(s)	PPD and ICTD	NA	Internal and no funding required	inputs:																								
b)	Meet regularly	x	x	x	x	x	x																													
c)	Oversee eHealth strategy and action plan implementation																																			
d)	Implement eHealth implementation monitoring and evaluation plan (key performance indicators (KPIs))	x																																		
e)	Implement eHealth risk and change management plans	x																																		
f)	Implement sub-groups as needed	x	x																																	
g)	Submit regular progress reports of eHealthTWG	x	x	x	x	x	x																													
<b>1.3 Engage stakeholders</b>													\$11,041	\$0					\$9,685				\$856			\$0			\$500							
a)	Regularly solicit user needs and inputs for current and planned eHealth solutions	x	x	x	x	x	x	Stakeholders Consultation	PPD and ICTD	WHO	Consider meetings, website, briefing notes, etc. 75% of costs in Y1. 5% each in Y2-Y6	inputs:					2	1			1															
b)	Incorporate input on personal data issues (security, privacy, and confidentiality)	x	x																																	
c)	Disseminate the eHealth strategy and action plan with stakeholders	x																																		
<b>1.4 Sustain high-level commitment for eHealth</b>													\$5,291	\$0					\$3,291				\$0			\$0			\$2,000							
a)	Sensitize new government senior officials on eHealth strategy and action plan	x						Stakeholders Consultation	PPD and ICTD	WHO	Recommended to development of dashboard may be warranted for high level. Dashboard included in M&E component as cost in Y2	inputs:					2																			
b)	Explore incorporation of eHealth KPIs into annual performance agreement	x	x																																	
c)	Report KPIs regularly (e.g., dashboard, quarterly reports)	x	x	x	x	x	x																													





Component 2: Strategy and Investment

Action Item	Activities	Timeframe (% cost allocation)						Indicator or Deliverable	Responsible agency or unit	Funding source	Inputs, assumptions, and cost considerations	Comments	Total Estimated Cost (USD)	Technical Assistance					Meeting Support				Communications Materials			Training			Infrastructure, ICT & Equipment	Monitoring & Evaluation	Other or Fixed						
		2018	2019	2020	2021	2022	2023							International Days	International Trips	Int. Trip Length (days)	National-Days	Nat. Local Trip(s) (days)	Small	Medium	Large	National Workshop	Low Print/Distribution	Med Print/Distribution	High Print/Distribution	Small	Medium	Large									
<b>2.1 Develop eHealth strategy and costed action plan</b>													\$28,400	\$25,140					\$3,260				\$0			\$0											
	Establish eHealth TWG with ToRs to facilitate strategy development	x						National eHealth Strategy and Action Plan	PPD/ ICTD	WHO, ADB	includes TA from 3 international resources persons plus 1 local consultant. Completed March 2018	inputs:	30	3	15	5		1																			
	Convene eHealth strategy development workshop	x																																			
	Draft eHealth strategy and costed action plan	x																																			
	Conduct stakeholder meeting to inform draft	x																																			
	Finalize eHealth strategy and action plan	x																																			
	Disseminate eHealth strategy and action plan	x																																			
<b>2.2 Prioritize activities</b>													\$12,500	\$7,500					\$0				\$0			\$5,000											
	Establish process for prioritization	x						PPD/ ICTD			Assume TWG will be authorized to develop and apply prioritization criteria, review proposals, make recommendations, etc. will need resources for external expert review on case-by-case basis. 20% of costs for each Y2 - Y6. M&E fixed costs added for tracking and monitoring	inputs:	10			10																					
	Establish criteria for determining needs, prioritization, and evaluating proposals	x																																			
	Sensitise stakeholders	x	x	x	x	x	x																														
	Review proposals received and make recommendations to senior management	x	x	x	x	x	x																														
	Develop and implement information systems performance evaluation and expansion or upgrade requirement assessment	x	x	x	x	x	x																														
	Plan for sustainability (full operation and maintainance) of the systems	x	x	x	x	x	x																														
	Obtain clearance for approved ICT projects from DITT	x	x	x	x	x	x																														
<b>2.3 Mobilize resources</b>													\$69,559	\$0					\$19,559				\$0			\$0			\$50,000								
	Sensitize planners and managers (eHealth steering committee) and partners on eHealth needs and priorities	x	x	x	x	x	x	PPD			some proposals and funding requests will still be project specific. Assume use of 1 global resource per year Y2-Y6 at \$10,000 each (\$50,000 total added as "other cost")	inputs:						6																			
	Submit annual eHealth plan and budget request	x	x	x	x	x	x																														
	Develop requests for funding and proposals for eHealth actions and submit to development partners	x	x	x	x	x	x																														
	Leverage global resources available (e.g., online tools, guidance, apps, communities of practice, networks, etc.)	x	x	x	x	x	x																														

Action Item	Activities	Timeframe (% cost allocation)					Indicator or Deliverable	Responsible agency or unit	Funding source	Inputs, assumptions, and cost considerations	Comments	Total Estimated Cost (USD)	Technical Assistance					Meeting Support			Communications Materials			Training			Infrastructure, ICT & Equipment	Monitoring & Evaluation	Other or Fixed	
		2018	2019	2020	2021	2022							2023	International Days	International Trips	Int. Trip Length (days)	National-Days	Nat. Local Trip(s) (days)	Small	Medium	Large	National Workshop	Low Print/ Distribution	Med Print/ Distribution	High Print/ Distribution	Small				Medium
<b>2.4 Implement effective eHealth program management</b>											\$63,000		\$33,000					\$0			\$0			\$0				\$30,000		
	Implement new eHealth programme management plans including all sub-plan components for M&E, risk, change, and communications management			x	x			ICTD/ PPD	adhered to good practices, such as COBIT5 and PMP. Mostly internal support costs. Assume local TA for implementation support starting in Y2. M&E fixed cost assumed \$30,000.	inputs:					220															
	Report risk mitigation issues and resolve as needed			x	x	x	x																							
	Implement change management controls and resolve as needed			x	x	x	x																							
	Share reports and feedback on M&E and systems performance through governance processes			x	x	x	x																							

Action Item Cost Distribution (% per year)						
2.1	100%					
2.2		20%	20%	20%	20%	20%
2.3		20%	20%	20%	20%	20%
2.4		20%	20%	20%	20%	20%

Annual Costs	\$28,400	\$29,012	\$29,012	\$29,012	\$29,012	\$29,012
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Component 3: Infrastructure

Action Item	Activities	Timeframe (% cost allocation)						Indicator or Deliverable	Responsible agency or unit	Funding source	Inputs, assumptions, and cost considerations	Comments	Total Estimated Cost (USD)	Technical Assistance					Meeting Support				Communications Materials			Training			Infrastructure, ICT & Equipment	Monitoring & Evaluation	Other or Fixed		
		2018	2019	2020	2021	2022	2023							International Days	International Trips	Int. Trip Length (days)	National-Days	Nat. Local Trip(s) (days)	Small	Medium	Large	National Workshop	Low Print/ Distribution	Med Print/ Distribution	High Print/ Distribution	Small	Medium	Large					
<b>3.1 Coordinate with MoIC</b>												\$517,063	\$12,630					\$3,291				\$1,142			\$0					\$500,000			
	Improve Internet and cellular data access and connectivity		x	x	x	x	x		ICTD, MoH & DITT	DITT funds	MoH responsible for "last mile" connectivity for health facilities (DITT estimated USD 500,000--proposed in 2018/19 budget). Assume TA for assessment, testing, implementing protocols.	BTN 1/ msg 13K *8 MCH (100K msg)	inputs:	10	1	5	30		2					2	1								
	Access and use the government data centre (GDC) for systems hosting services as required		x																														
	Gather accurate performance data for existing and planned systems and processes			x																													
	Test integration, prepare user acceptance testing scripts		x	x	x	x	x																										
	Implement disaster recovery procedures		x	x	x	x	x																										
	Implement SMS gateway		x	x	x	x	x																										
<b>3.2 Support facility-based ICT infrastructure readiness and development</b>												\$2,000,000	\$0					\$0				\$0			\$0			\$2,000,000					
	Ensure servers, computers, laptops, and mobile devices are used for running multiple applications where feasible		x	x	x	x	x		DHO, MoH ICT & DITT	local district or project specific	budgeted from local funding sources. Assume 20% per Y2-Y6 of total USD \$2mil estimated. Refer to ICT costs worksheet for details (based on ePIS costing)	DITT has some budget estimates	inputs:																				
	Implement LAN and WAN capability where needed		x	x	x	x	x																										
	Ensure operation and maintenance of HW/SW deployed		x	x	x	x	x																										
	Provide sufficient power availability and back-up support			x	x	x	x																										
<b>3.3 Setup Health Sector VPN (Virtual Private Network)</b>												\$18,051	\$14,760					\$3,291				\$0			\$0								
	Develop a design plan, budget, and proposal for the health network			x	x				ICTD		To be set up using existing infrastructure and to be used for health systems (Telemedicine, ePIS and other systems)	inputs:	20	1	10			2															

Action Item Cost Distribution (% per year)						
3.1	25%	25%	20%	10%	10%	10%
3.2		20%	20%	20%	20%	20%
3.3		50%	50%			

Annual Costs	\$129,266	\$538,291	\$512,438	\$451,706	\$451,706	\$451,706
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Component 6: Legislation, Policy and Compliance

Action Item	Activities	Timeframe (% cost allocation)						Indicator or Deliverable	Responsible agency or unit	Funding source	Inputs, assumptions, and cost considerations	Comments	Total Estimated Cost (USD)	Technical Assistance					Meeting Support				Communications Materials			Training			Infrastructure, ICT & Equipment	Monitoring & Evaluation	Other or Fixed		
		2018	2019	2020	2021	2022	2023							International Days	International Trips	Int. Trip Length (days)	National-Days	Nat. Local Trip(s) (days)	Small	Medium	Large	National Workshop	Low Print/Distribution	Med Print/Distribution	High Print/Distribution	Small	Medium	Large					
<b>6.1 Adherence to relevant laws and policies</b>													\$0	\$0					\$0				\$0										
	Review existing relevant laws of the land and policies	x	x					Legal Unit and PPD	n/a	internal review		inputs:																					
	Adopt and implement relevant laws and policies required		x	x	x	x	x																										
<b>6.2 Design and establish eHealth legislation and policy functions</b>													\$518,034	\$431,400					\$56,654				\$19,980			\$0			\$10,000				
	Develop health data privacy, confidentiality, access and informed consent policies and incorporate into the Health Policy and National Health Act where feasible		x	x	x			Legal Unit and PPD	WHO	Incorporation and alignment with RTI and all other relevant laws and policies should also be considered. Assume TA needed, and all support spread evenly over 5 years starting in 2019 (Y2-Y6). No priority set on which areas to focus on first. Assuming multiple TA providers according to various areas of expertise.		inputs:	500	25	150	500	15	5			20	20											
	Develop health data security, usage, disclosure, sharing, storage, and retention policy and incorporate into the Health Policy and National Health Act where feasible		x	x	x	x	x																										
	Develop data audit and compliance policy and incorporate into the Health Policy and National Health Act where feasible		x	x	x	x	x																										
	Address development and use of health identifiers and incorporate into the Health Policy and National Health Act where feasible		x	x	x	x	x																										
	Address licensing agreements and incorporate into the Health Policy and National Health Act where feasible		x	x	x	x	x																										
	Incorporate eHealth-related regulations and policies into health policy and National Health Act where feasible		x	x	x	x	x																										
<b>6.3 Adopt and implement all eHealth-related legislation and policy</b>													\$126,879	\$86,910					\$8,228				\$9,990			\$21,750							
	Sensitize stakeholders on all existing and new legislations and policies		x	x				Legal Unit and PPD				inputs:	100	5	35	100	5				10	10		5	5								
	Implement conformance and accreditation protocols		x	x																													
	Develop and implement eHealth policies in non-government health sector				x	x																											
	Review compliance with regulations and policies				x	x	x																										
<b>6.4 Develop and implement SOPs for all policies for health data and applications</b>													\$32,965	\$27,390					\$3,291				\$2,283			\$0							
	Implement procedures for authentication, authorization, and accountability of health data		x	x				Legal Unit and PPD		TA support needed		inputs:	30	2	15	30	2				4	2											
	Develop SOPs for above policies				x	x																											
	Develop SOPs for eHealth solution evaluations					x	x																										

Action Item Cost Distribution (% per year)					
6.1					
6.2	20%	20%	20%	20%	20%
6.3	25%	25%	20%	15%	15%
6.4	50%	50%			

Annual Costs	\$0	\$151,809	\$151,809	\$128,982	\$122,639	\$122,639
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Develop ToRs and membership

Action Item	Activities	Timeframe (% cost allocation)					Indicator or Deliverable	Responsible agency or unit	Funding source	Inputs, assumptions, and cost considerations	Comments	Total Estimated Cost (USD)	Technical Assistance					Meeting Support			Communications Materials			Training			Infrastructure, ICT & Equipment	Monitoring & Evaluation	Other or Fixed		
		2018	2019	2020	2021	2022							2023	International Days	International Trips	Int. Trip Length (days)	National-Days	Nat. Local Trip(s) (days)	Small	Medium	Large	National Workshop	Low Print/Distribution	Med Print/Distribution	High Print/Distribution	Small				Medium	Large
<b>4.1 Create health data standards working group</b>							Health Data Standards Working Group	ICTD & PPD	Dev. Partners	Small TA for review		\$9,146	\$7,500					\$1,646			\$0			\$0							
Develop ToRs and membership	x															inputs:	10			10		1									
Review global open health data standards		x																													
<b>4.2 Implement minimum core data sets and standards</b>							Core public health indicator and metadata standards	ICTD & PPD	Dev. Partners	TA required plus training support for implementation and use		\$239,895	\$171,300					\$21,142			\$10,704			\$31,750				\$5,000			
Develop and adopt core public health indicator and metadata standards		x														inputs:	200	10	50	200		5	2	1		5	5	2	5	5	2
Identify and adopt health data standards (e.g., ICD-10, DICOM, HL7, FHIR)			x																												
Adopt ICT standards (e.g., geocodes, facility IDs, etc.)			x	x																											
Implement health facility IDs and registry (based on HMIS)		x	x	x																											
Implement health workforce IDs and registry		x	x																												
<b>4.3 Develop health information architecture framework</b>							Health information architecture framework	ICTD & PPD	ADB, WHO or other partner	refer to "task for Interoperability" document for further preliminary recommendations and steps	We need about \$160000 for setting up Web service for interoperability. The cost estimation was based on the web service of DITT	\$143,574	\$122,280					\$11,299			\$4,995			\$0				\$5,000			
Align eHealth standards and interoperability requirements with eGIF		x	x													inputs:	150	4	30	150		1	1	1		5	5				
Conduct stakeholder consultations and study the systems to understand what data needs to be shared across the systems		x	x																												
Create technical protocols to enable data sharing and use * including but not limited to: ePIS & DHIS2, ePIS & NEWARS, ePIS & eBMSIS, eBMSIS & DHIS2, ePIS & HERCS/PACS/LIS		x	x	x																											
Identify different use cases to define logic of data sharing and develop interoperability profiles (i.e., system flow diagrams, interoperability layer, and APIs)		x	x	x																											
Design, develop and implement the 5 architecture building blocks for interoperability		x	x	x																											
Design and develop of an operational interoperability framework or health information exchange (HIE) by identifying the different system linkages, and the means to achieve them			x	x	x																										
Develop and test interoperability layer (plus APIs)		x	x	x	x	x																									

Action Item	Activities	Timeframe (% cost allocation)					Indicator or Deliverable	Responsible agency or unit	Funding source	Inputs, assumptions, and cost considerations	Comments	Total Estimated Cost (USD)	Technical Assistance					Meeting Support			Communications Materials			Training			Infrastructure, ICT & Equipment	Monitoring & Evaluation	Other or Fixed		
		2018	2019	2020	2021	2022							2023	International Days	International Trips	Int. Trip Length (days)	National-Days	Nat. Local Trip(s) (days)	Small	Medium	Large	National Workshop	Low Print/Distribution	Med Print/Distribution	High Print/Distribution	Small				Medium	Large
<b>4.4 Utilize national health IDs</b>							National health IDs	PPD & ICTD	ADB, WHO or other partner	assume MPI is needed and could serve as client registry. assume planning in 2019 and implementation beginning in 2020.	work permit numbers, passport numbers	\$163,234	\$149,292					\$8,228			\$714			\$0			\$5,000				
Review current systems and databases using unique IDs relevant to health	x															inputs:	200	6	42	100		5				5					
Develop/adopt/implement a national unique ID scheme for health (perhaps using CID plus IDs for non-citizens)	x	x																													
Design and develop a "master patient registry system" in order to create a common platform for data entry based on a master patient index (MPI) protocol linking existing IDs	x	x																													
Implement master patient registry system (i.e., client registry)	x	x	x																												

Action Item Cost Distribution (% per year)						
4.1	20%	80%				
4.2		60%	40%			
4.3		50%	25%	25%		
4.4		10%	40%	30%	10%	10%

Annual Costs	\$1,829	\$239,364	\$197,145	\$84,864	\$16,323	\$16,323
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Component 7: Workforce

Action Item	Activities	Timeframe (% cost allocation)					Indicator or Deliverable	Responsible agency or unit	Funding source	Inputs, assumptions, and cost considerations	Comments	Total Estimated Cost (USD)	Technical Assistance					Meeting Support			Communications Materials			Training			Infrastructure, ICT & Equipment	Monitoring & Evaluation	Other or Fixed						
		2018	2019	2020	2021	2022							2023	International Days	International Trips	Int. Trip Length (days)	National-Days	Nat. Local Trip(s) (days)	Small	Medium	Large	National Workshop	Low Print/Distribution	Med Print/Distribution	High Print/Distribution	Small				Medium	Large				
<b>7.1 Assess and improve IT literacy</b>												\$199,772	\$7,500					\$0			\$14,272			\$178,000											
a)	Implement basic ICT training programme that has been developed.	x	x	x	x	x		DITT, ICTD & KGUMSB	Dev Partners	Assume DITT piloted course will be improved and implemented across country. Add 3 courses at 100 pax in Y4-Y6. include the receptionist and others who are not health workers but use the ehealth or ePIS		inputs:				50						100			100	20	3								
b)	Implement appropriate eLearning and training modules tailored to various cadres of health workers		x	x																															
c)	Adapt and use existing health information systems training modules and programmes (e.g., RIHS short course)		x	x																															
d)	Utilize CME-credited training modules where feasible	x	x	x	x	x																													
<b>7.2 Enhance engagement of health workers and management in use of eHealth</b>												\$0	\$0					\$0			\$0														
a)	Acknowledge and include eHealth activities in the job descriptions (RCSC) of health workers		x				PPD and ICTD	n/a	Mostly internal function to change the culture of eHealth literacy and use	the ePIS once installed should be all or none and not a mixed mode.		inputs:																							
b)	Develop simple eHealth primer or briefing note		x																																
c)	Promote capturing and using user feedback for development and enhancement of eHealth solutions		x	x	x	x																													
d)	Ensure recurrent costs of eHealth use is supported by program and not added burden to individuals		x	x	x	x																													
e)	Eliminate duplication of effort whenever eHealth solutions are deployed and replace paper-based systems		x	x	x	x																													
f)	Include use of eHealth as mandatory APA in the Ministry and across all the health facilities		x	x	x	x																													
g)	Develop recognition programme for eHealth champions and users			x	x	x																													
<b>7.3 Implement eHealth institutional capacity building and individual training programmes</b>												\$485,977	\$175,560					\$0			\$11,417			\$174,000					\$125,000						
a)	Assess institutional and individual eHealth capacity needs and gaps	x	x				PPD, HRD and ICTD	Dev Partners	10 pax/2 trainings/1 in-country, 1 out of country; system user trainings (4 systems per year, 80 people per year (20 districts) 3 days on average (40 small and 40 medium trainings or 20/year). External training as "other cost" of \$25,000 per year. TA for training programme development and implementation.		inputs:	240	12	60	40						80			40	40										
b)	Recruit and retain new human resources for eHealth to increase and maintain institutional capacity		x	x																															
c)	Implement eHealth specific training for ICT leaders and personnel		x	x	x	x																													
d)	Develop and implement eHealth training programme, including e-Learning package		x	x	x	x																													
e)	Develop certification programme for eHealth training programmes		x	x	x	x																													
f)	Engage academic insitutions in development of health informatics and related eHealth courses in existing curriculum, develop certificate and diploma programmes		x	x	x	x																													
g)	Engage in knowledge sharing and peer-to-peer learning and technical assistance with other countries	x	x	x	x	x																													





## GENERAL COST INPUT INFORMATION

Country	<b>Bhutan</b>	
Start year	<b>2018</b>	
Currency	USD	
Conversion factor	0.016	63.5 Bhutanese Ngultrum (BTN) =1 USD

## NOTES

## Meetings

Cost of room rental for this meeting (per day)		(Thimphu or Paro average hotel conference room)
Room for 0 - 10 persons	\$79	BTN 5000
Room for 11 - 30 persons	\$126	BTN 8000
Room for more than 30 persons	\$126	BTN 8000
Cost of consumables (refreshments) (per person & per day)	\$15	BTN 950 (includes 2 am snacks, lunch, paper and pencil)

## Per Diems

National		
Per Diems	\$16	BTN 1000 Bhutan Civil Services Rules 2018 - BCSR 2018)
Local travel (per kilometer)	\$0.25	In addition BTN 16/KM (for mileague claim). based on RGoB Financial Rules & Regulations

## Air fare

FLT1: Flight (South Asia--e.g., India, Nepal)	\$250	
FLT2: Flight (Asia)	\$1,000	roundtrip
FLT3: Flight (intercontinental: AUS/NZ)	\$1,500	roundtrip
FLT4: Flight (intercontinental: USA or EUR)	\$2,000	roundtrip

## Consultancy Fees

National		
NAT1: Daily fee A (not including per diem)	\$150	
NAT2: Daily fee B (not including per diem)		
NAT3: Daily fee C (not including per diem)		
Per Diem	\$16	BTN 1000

## International

INT1: Daily fee A (not including per diem)	\$400	
INT2: Daily fee B (not including per diem)	\$500	Based on illustrative WHO daily rates for P3/P4/P5 level support (HQ Information Note 19/2012)
INT3: Daily fee C (not including per diem)	\$600	
Per Diem	\$126	Based on Thimphu, Bhutan WHO per diem ( <a href="http://apps.who.int/bfi/tsy/PerDiem.aspx">http://apps.who.int/bfi/tsy/PerDiem.aspx</a> )

## Printing Distribution

Printing of 50 page B&W document	\$0.79	BTN 1/page for A4 (based on MoH Annual quotation 2017-2018)
Printing of 100 page B&W document	\$1.57	
Printing of 50 page color document	\$2.17	BTN 2.75/page for A4 (based on MoH Annual quotation 2017-2018)
Printing of 100 page color document	\$4.33	
Distribution of 100 documents/books	\$26	BTN 60/20g Normal Post and BTN 70/20g registered post (depends on the weight). Assume 500g @ BTN 65/20g

## Training (for national)

Per diem (average per person & per day)	\$16	BTN 1000
Overnight per diem (hotel accomodations)	not applicable	
Cost of transporation (per participant)	\$25	BTN 16/km (assume 100 km average)
Per diem or fee (per facilitator & per day)	\$16	BTN 1000
Cost of transportation (per facilitator)	\$25	BTN 16/km (assume 100 km average)
Cost of hotel (per person & per day)	not applicable	
Cost of refreshner and lunch (per person & per day)	\$15	BTN 950 (includes 2 am snacks, lunch, paper and pencil)
Cost of room rental (per day)	not applicable	
Cost of room rental (per day) > 30 pax	not applicable	
Cost of guidelines/training material (per copy)	\$4	BTN 253/copy (Up to 1000 copies) based on MoH annual quotation 2017-2018

**Transport**

One-way national to district	\$126	For National participants mileage claim is entitled - BTN 16/KM assume 100km average
One way province to district	\$13	50km average
One way district to facility	\$6	25 km average

**Hardware**

Laptop computer	\$567	BTN 35,980 Based on MoH quotation (Dell)
Desktop computer, monitor	\$614	BTN 38,990 Based on MoH quotation (Dell)
Printer	\$279	BTN 17,690 black and white (HP lazerjet - based on MoH quotation)
USB thumb drive	\$68	BTN 4,300 (8GB)

Other cost estimate references

**COST CALCULATIONS (USD)**

  = user defined parameters

**Technical Assistance**

Calculated based on estimates number of days to perform work

Meeting Profiles (national counterparts)	Small	Medium	Large	National Workshop
Average # participants	10	20	40	80
Average # days	1	1	1	3
Participant per diem-day	\$157	\$315	\$630	\$1,260
Participant per diem-overnight	\$0	\$0	\$0	\$0
Transportation stipend	\$1,260	\$2,520	\$5,039	\$30,236
Room	\$79	\$126	\$126	\$0
Meals, snacks & stationery	\$150	\$299	\$598	\$3,591
<b>Total</b>	\$1,646	\$3,260	\$6,394	\$35,087

Communication Materials	Low	Medium	High
Number of copies	50	300	1000
Printing	\$79	\$472	\$1,575
Distribution	\$64	\$384	\$1,280
<b>Total</b>	\$143	\$856	\$2,854

Training Profiles (national counterparts)	Small	Medium	Large
Average # participants	10	20	40
Average # days	1	3	5
Participant per diem-day	\$472	\$1,575	\$4,409
Participant per diem-overnight	\$0	\$0	\$0
Transportation stipend	\$1,260	\$2,520	\$5,039
Room	\$0	\$0	\$0
Meals/Snacks	\$150	\$898	\$2,992
Training Materials (docs)	\$40	\$80	\$159
<b>Total</b>	\$950	\$3,400	\$5,000









Item	Cost/unit (BTN)	Cost/unit (USD)	No of units	Total cost (USD)	Notes
Tablet		300		0	?? District/region/state secondary hospital +?? tertiary/specialist hospitals = (81+36) * ? tablets
Laptop		700		0	??
Internet plan for health facilities		287		0	
Router for wifi				0	Estimated cost from WHO ICT service contractor (dongles instead of routers)
SMS gateway (1M SMS)		0.045	1000000	45000	0.015 euro (MPT), 0.050 (Ooredoo) and 0.055 (Telenor and others). Use average 0.04 euro= 0.045 USD per SMS <a href="https://www.msgateway.to/en/">https://www.msgateway.to/en/</a>
Mobile phone				0	
SMS allowance per month				0	2usd/month * for 5330 mobile phone users. (Equivalent to 182560 months From 2016: 1066*2*52 2017: 1066*2*48 2018: 1066*2*36 2019: 1066*2*24 2020: 1066*2*12 REMOVED
Basic computer training		34	838	28492	DITT provides for free
DHIS2 fundamental and advanced training		3638	4	14552	Training fee=1170 per diem [12 days (164/day)]=1968 flight in asia=500
Prince, cobit, togaf, openmrs training		5000	8	40000	2 pax per course (AeHIN to provide trainings)

Health data hub					
Server (plan for scale)		14000	1	14000	<a href="http://www.dell.com/us/business/p/poweredge-r930/pd">http://www.dell.com/us/business/p/poweredge-r930/pd</a>
Server rack		90	1	90	<a href="http://accessories.us.dell.com/sna/productdetail.aspx?c=us&amp;l=en&amp;s=dfb&amp;cs=28&amp;sku=A1703098">http://accessories.us.dell.com/sna/productdetail.aspx?c=us&amp;l=en&amp;s=dfb&amp;cs=28&amp;sku=A1703098</a>
Aircon		350	1	350	Unit to purchase depends on the room size?
Generator		2000	1	2000	<a href="https://www.alibaba.com/showroom/10kw-diesel-generator-price.html">https://www.alibaba.com/showroom/10kw-diesel-generator-price.html</a>
Generator diesel		500	1	500	? Get average hours power outage in Thimphu per year and diesel needed to run generator for said hours
UPS		524	1	524	<a href="http://www.dell.com/us/business/p/ups/pd.aspx?&amp;c=US&amp;l=EN&amp;s=bsd">http://www.dell.com/us/business/p/ups/pd.aspx?&amp;c=US&amp;l=EN&amp;s=bsd</a>
Internet 1 (fibre)	8840000	7687	1	7687	200k(setup fee)+60k(Annual fee)+ 100k(monthly fee)=160*54months+200
Internet plan 2 (satellite) - 54 mos		7109	1	7109	60usd(annual) x5years, 145k(kyat monthly)x54months
				32260	Total cost for data center infrastructure for 5 yrs

Level	Cost/unit (BTN)	Cost/unit (USD)	No of units	Total cost (USD)	Notes
NRH	2402000	\$37,827	1	\$37,827	ePIS costing estimates for complete infrastructure support package by health facility level
RRH	5681750	\$89,476	2	\$178,953	
Hospital I	1975750	\$31,114	4	\$124,457	
Hospital II	1483750	\$23,366	7	\$163,563	
BHU I	988100	\$15,561	23	\$357,894	
BHU II	356100	\$5,608	179	\$1,003,809	
Sub-Post	91950	\$1,448	49	\$70,954	
				\$1,937,457	Total equals approximately USD \$2 million

## ANNEX C EXISTING SYSTEMS

### 1. DHIS2

District Health Information System was started with the support of WHO and launched in 20th May 2014 with intention of the system collection, validation, analysis and presentation of aggregate and patient-based data.

The system is managed by HMIS, PPD and used by DHOs, Hospital Adm Officers, Record Assistants, Data Assistants, Office Assistant, Medical Record Officer, Medical Record Technician, HAs, Nurses, Program Officers, Planning Officers.

Some of the advantages of the system are as follows:

- a. Customization and adaption
- b. Flexible and dynamic data analysis (pivot table, GIS, Charts)
- c. Easy reporting and data sharing
- d. Offline data entry (Apps)

Disadvantage of the system is that it require internet and hardware.

Future Scope possible scope could be :

- a. SMS alerts
- b. Interoperability with other Open software
- c. Cost reduction
- d. User friendly
- e. Easy management

### 2. ePIS

- a. History
- b. ePIS was initiated by Department of Medical Services, MoH followed by consultative workshop engaging In-charges/staff from BHU-II, BHU-I, Dzongkhag and Referral Hospitals, ICT, KGUMSB. Upon several levels of discussion and recommendation on modules or features, internet facilities, ICT equipment, HR capacity on ICT, technical assistance, level of awareness on ePIS, WHO Country Office fielded ThoughtWorks (TW) as a Technical Consultant for the development of ePIS from May 2015. TW conducted pro-bono inception workshop involving in-charges from pre-pilot and pilot sites for ePIS. Upon inception, APW (Agreement Performance of Work) between WHO country office and TWs was signed. Thereafter, the Pre-piloting, Piloting and Roll-out to the Paro Hospital, Drugyel, BHU II, Bitekha BHU II, and Dawakha BHU II was carried out.

### c. Purpose of the system

- i. Digitize all health facilities across Bhutan including referral hospitals
- ii. Patient's health information is available in a central repository and can be shared with health facilities
- iii. Support for efficient processes for health care delivery
- iv. A longitudinal collection containing health information of an individual patient; electronically recorded by healthcare providers at the point of care over the patient's lifetime
- v. Have information readily available and accessed by all healthcare providers attending to the patient
- vi. Promote a more holistic view of patient records where a continuum of care is the key aspect
- vii. Support for efficient processes for health care delivery
- viii. Promote transparency and accountability in delivering health care

### d. System Owner

Department of Medical Services, MoH

### e. System User

Clinicians, pharmacist, lab, receptions, radiology, imaging

### f. Advantage of the system

- Better health outcome for patients
- Decision making based on data gathered through systems
- Ensure continuity of care and manage referral and utilization
- Assist in research and development in health informatics
- Patients do not have to carry medical prescriptions and documents: paperless
- Improve transparency and accountability
- Adopt ICT solutions appropriately in the healthcare sector of Bhutan.
- Open source and simple to use and adapt for end users

### g. Disadvantage of the system

Integration with Lab devices was a challenge

### h. Future Scope

Lab integration and scaling to other facilities were planned for the future.



**3. eBMSIS****a. History:**

Project contracted was awarded on 24th June 2016. Fund supported are from RGoB and GFATM.

**b. Purpose of the system:**

c. The system mainly take care of all the medical supplies both Drugs and Non-Drugs procured through RGoB. It caters to following features:

- i. Preparation of Annual Indentation by all store Incharges across the country..
- ii. Generation and finalization of Bill of Quantification (BoQ).
- iii. Placement of Purchase Orders to awarded suppliers.
- iv. Track of supplies from the respective supplies.
- v. Putting requisition and issue of supplies to respective units/ wards/ section within that health facilities.
- vi. Mobilization of excess supplies among health facilities using notification mechanism.
- vii. Information/ notification on supplies which are of short expiry date.
- viii. System alertness on minimum stock balance and request for additional/ reorder level.
- ix. Generation of various reports.
- x. Import and export of data using excel files especially on generation of BoQ and loading purchase order of the selected supplier.

**d. System User:**

Department of Medical Supplies and Health Infrastructure (DMSHI), Ministry of Health.

- i. Medical store incharges
- ii. Procurement officers of medical supplies
- iii. District Health Officers
- iv. Health Care and Diagnostic Division (DMS).

**e. Advantage of the system:**

- i. Real time monitoring of medical supplies.
- ii. Limit and control wastage of medical supplies.
- iii. Assessment of requirement of medical supplies.
- iv. Easy record tracking and reporting.
- v. Web based system with centralized database

**f. Disadvantage of the system:**

- i. No internet no availability of the system.
- ii. Need very good internet connection.
- iii. Data backup is necessary.
- iv. Insecurity on system hack.
- v. Allocation of budget.

**g. Future Scope:**

The provision for the system enhancement is always needed. Linking with other relevant health system.

**4. NEWARS (National Early Warning, Alert and Response Surveillance)**

**a. History:** The system was developed in-house initially at 2010 as National Notifiable Disease Surveillance by RCDC. After revising the national notifiable disease list and guideline in 2014, National Notifiable Disease Surveillance was upgraded as National Early Warning Alert and Response Surveillance

**b. Purpose of the system:** It involves reporting of cases and deaths of priority diseases and conditions by health centers across the country, It involves reporting of any 'unusual' event, unusual cluster of cases or suspected outbreak. Reporting of immediately reportable diseases of public health concern.

**c. System Owner**

Royal Center for Disease Control (NADSAE)

**d. System User**

Focal person for NEWARS from Hospitals, BHUs, Subpost and Satellite Clinic and Laboratory staffs, DHOs, programme people and Surveillance Focal persons RCDC

**e. Advantage of the system**

- i. NEWARS is both indicator and event based surveillance
- ii. Real time reporting
- iii. Cost effective
- iv. Convenient for reporting (either web based and SMS)
- v. Included both disease and syndromes
- vi. Monitoring trends of endemic diseases
- vii. Detecting outbreaks and events
- viii. Providing an adequate and timely response

**f. Disadvantage of the system**

SMS reporting is perplexing at the beginning.

**g. Future Scope**

h. Mobile app for easy reporting and offline reporting.

i. To develop additional features.

**5. WQMIS (Water Quality Monitoring Information System)****a. History:**

Initially Water Quality Monitoring Information System (WQMIS) was established in 2010. It was revived and upgraded in 2015 with inclusion of SMS reporting system for the user from rural health centers.

**b. Purpose of the system:**

Collection and validation of water quality reports from both Urban and rural health centers on water quality.

**c. System Owner:**

NWRL, RCDC

**d. System User:**

HAs (for rural health center) and Laboratory staffs (for urban) DHOs (both urban and rural system)

**e. Advantage of the system**

- I. Can be customized easily (by ICT, RCDC based on users feedback)
- II. Cost effective
- III. User friendly
- IV. Web reporting system is easy to use.
- V. SMS reporting needs no internet connection enabling reports availability from remote health centers.

**f. Disadvantage of the system**

SMS reporting is cumbersome.

**g. Future Scope**

- I. Easy management
- II. More user friendly
- III. Mobile app for easy reporting and offline reporting.

**6. MRSIS (Measles and Rubella Surveillance Information System)****a. History :**

The system was developed in-house in October 2016 and first batch training for clinicians was conducted in October and November 2016, and was operational in January 2017 with support from WHO.

**b. Purpose of the system:**

It is an integrated active surveillance to report any suspected measles or rubella cases from health centers in the country. Through surveillance, all cases are followed-up for their health outcome in addition to identification of close contacts.

**c. System Owner:**

RCDC

**d. System User:**

DHOs, Clinicians, Health assistants, Data Assistants, Medical Record Technician, Nurses, Program Officers

**e. Advantage of the system:**

- I. Customization to our setting
- II. Easy reporting and data sharing
- III. Fast response

**f. Disadvantage of the system:**

Require internet and Hardware

**g. Future Scope:**

- I. Interoperability with other health system
- II. User friendly
- III. Easy management

## 7. TBISS (Tuberculosis Information and Surveillance System)

### a. History:

- I. 2013: Developed TblISS v1.0 in-house in collaboration with NTRL and piloted at JDWNRH, Phuntsholing, and Gelephu by providing onsite training.
- II. 2013-2015: Gradually expanded to other centers by sensitizing whenever possible with other workshops/ training
- III. Early 2016: First 3 days formal training provided to all TB In-charges and Labs with support from NTCP
- IV. January 2017: Conducted 3 days workshop to review TblISS v1.0
- V. January – March 2017: Redesign and redevelopment of TblISS v2.0 in line with revised DT-TB and MDR-TB guideline
- VI. April 2017: Second 5 days formal training provided to all TB In-charges and Labs with support from NTCP
- VII. December 2017: Upgraded to version 3.0 and made it more user-friendly  
System development and training to users funded by Global Fund under NTCP

### b. Purpose of the system

For online documentation, monitoring, and reporting of registered TB patients in pursuance of Drug Resistance Surveillance (DRS) and Quarterly TB report

### c. System Owner

NTRL, RCDC

### d. System User

- I. 36 AFB microscopic centers,
- II. 32 TB reporting centers,
- III. NTRL
- IV. NTCP and few doctors

### e. An advantage of the system

- I. Timely recording and reporting
- II. Can track the status of the sample shipped to NTRL
- III. Cost effective
- IV. Paperless
- V. shows the status of incomplete laboratory examination and TB registration
- VI. Can monitor TB treatment and determine treatment outcome
- VII. Easy to get TB quarterly report for NTCP

VIII. Can determine the patients TB type based on laboratory results and clinical judgments

IX. Anti Tb drug stock management

### f. The disadvantage of the system

- I. Users find it cumbersome
- II. Need strong and stable Internet connectivity
- III. Need complete patient data from both microscopic centers and TB reporting centers to get a complete patient profile, history, and laboratory results

### g. Future Scope

- I. TblISS User Manual review and TblISS Video tutorial
- II. Follow-up SMS & Email reminder notification alert to the patient and TB In-charges
- III. SMS & Email notification message to the patient, TB In-charges and Lab on updating GeneXpert, LPA, Culture and DST result
- IV. SMS & Email notification message to NTCP and TB In-charges on detecting new MDR case
- V. TB NEQAS Module for Blinded rechecking and proficiency testing
- VI. Linking TblISS with Department Of Civil Registration & Census system
- VII. Routine TblISS data validation
- VIII. Regular user(Lab & TB In-charges) training

## 8. Influenza-Like Illness and Severe Acute Respiratory Infection System (ILISARIS)

### a. History:

It is a standalone program developed in 2013 by IT unit under RCDC in consultation with Virology and Molecular Laboratory (VML). Since then there has been a continuous training, with the support from CDC project, for the relevant health workers from the Influenza surveillance sentinel sites on the operational aspects of the system. In 2016, some additional features were incorporated upon the need of the unit especially to auto-generate graphs and charts to facilitate timely reporting of the weekly feedback (FluView). It is an open online system wherein changes/modifications of features can be changed depending on the need of the users. However, this can be done only upon consultation with VML and IT unit in RCDC.

### b. Purpose of the system

The overall purpose of the system is to generate real-time flu data across all the sentinel sites, thereby, enabling real-time data analysis and timely dissemination of information to various stakeholders for necessary interventions.



- c. **System Owner**  
VML, EPI , RCDC
- d. **System User**
  - I. 7 ILI sentinel sites and 11 SARI sentinel sites
  - II. VML, RCDC
  - III. EPI, RCDC
- e. **An advantage of the system**
  - I. Timely recording and reporting of flu data
  - II. Cost effectiveness
  - III. Auto-generation of charts and graphs
  - IV. Real-time data analysis
- f. **The disadvantage of the system**
  - I. Require stable internet connectivity
  - II. Require continuous and stable power supply to support server
- g. **Future Scope**
  - I. Expansion to other health facilities if deemed necessary
  - II. Provision to interface with other system (relevant stakeholders) for online sharing of data

#### 9. Bhutan Diarrheal Surveillance Information System (BDSIS)

To improve the quality, completeness and timeliness of study data and for efficient management of laboratory results and study sample shipments, the web-based information system was developed in-house by ICT Unit at RCDC and implemented since 2012.

With further expansion of study sites, inclusion of additional lab test parameters and requirement to capture and manage laboratory results of test performed by Enteric Disease Department, AFRIMS, Bangkok in a same information system, the ICT Unit has completed re-development of “BDSIS Version 2” with many additional features towards the end of 2015. Since the study with AFRIMS was completed and to keep the active surveillance, it was modified in January 2018. The system is owned by EIDL Section at RCDC where the data entry to the system is done by Laboratory personnel across the selected sentential sites and the staffs from EIDL.

#### 10. Salt Iodine Monitoring System (SIMS)

- a. **History:**  
The system was developed in December 2016 by ICT unit, RCDC in collaboration with Nutrition program. First batch sensitization training DHOs was conducted in January 2017.
- b. **Purpose of the system**  
The overall purpose of the system is to iodine content in the salt across the country.
- c. **System Owner**  
Nutrition Program, DoPH
- d. **System User**
  - I. Clinicians and Laboratory Personal
  - II. DHOs
  - III. Nutrition Program
- e. **An advantage of the system**
  - I. Timely recording and reporting
  - II. Cost effectiveness
- f. **The disadvantage of the system**  
Require stable internet connectivity
- g. **Future Scope**  
Development of SMS based reporting or mobile apps for active reporting

#### 11. CIHEWS (Climate Informed Health Early Warning System)

- a. **History**  
System was Developed in 2015 by ICT unit at RCDC in collaboration with the Environmental Health Program, PHED.
- b. **Purpose of the system**  
Monitoring of the trend of climate sensitive diseases.
- c. **System Owner.**  
Environmental Health Program, PHED

**d. System User**

Health Assistants, Program Officials

**12. Bhutan Febrile & Malaria Information System (BFMIS )****a. History**

- I. Late 2012, BIOPHICS(Faculty of Tropical Medicine, Mahidol University) team visit and discussion
- II. Early 2013, System development at BIOPHICS in close collaboration with VDCP
- III. March 2013, Server setup & configuration at RCDC(PHL), Desktop computer distribution and client software configuration at 6 pilot sites
- IV. April 2013-December 2014, System validation & verification, System assessment & evaluation
- V. January 2015, Phase I Expansion Refreshers training for existing sites & New user training for about 37 new sites
- VI. January 2016, Phase II Expansion Refreshers training for existing sites & New user training for new expansion sites
- VII. January 2017, Phase III Expansion Refreshers training for existing sites & New user training for new expansion sites

**b. Purpose of the system:**

Active monitoring of the Malaria cases for its elimination.

**c. System Owner:**

Vector borne Disease Control Program

**d. System User:**

Malaria Technician, Health Assistants, Program Officials

**e. Advantage of the system:**

Data can be entered offline as internet is require at the time of installation of desktop application installation and whenever data needs to be shared with central server.

**f. Disadvantage of the system**

Since it is offline application, chances of data loss if the computer crashes.

**g. Future Scope**

Migrate with DHIS2 Application.

**13. Laboratory Information System (LIS)**

Polytech LIS is client server application used by all laboratory staff, almost all the lab analyzers are interfaced with the system, meaning the analyzer process the blood test and pushes the result to LIS. LIS was introduced in JDWNRH in 2007. The system is donated by Pathology Overseas (NGO based in the US) and till now hospital has been using it for free of costs in JDWNRH.

After installing LIS in Lungtenphu hospital recently, daily work load of 200-300 patients has been reduced in JDWNRH. Lungtenphu hospital enters the details of the patient along with the test that needs to be performed and they also dispense the report from there only.

All the wards have access to reporting/result component of LIS, making it easy for them to print report rather than having to go to lab to get the report printed. This has overall helped in reducing patient waiting time. The system is also being used in other district hospitals across the country.

LIS is deployed in all hospitals with Lab.

**14. Picture Archiving and Communication system (PACS)**

PACS is another donated system that was implemented in November 2015 by Osirix foundation. The system is interfaced all imaging modalities namely, CT, MRI, digital radiology and ultrasound. The images from imaging modalities are pushed to PACS and are stored there. The radiologist and physician access the images from PACS using web portal. The main advantage of this system is to centrally store the medical images so that they can be retrieved easily whenever required. The system is available only in Thimphu (JDWNRH) only.

**15. Blood Transfusion System**

The development of Blood donation system started with the G2C office's initiation of government-wide app development. The app was handed over to DMS without a proper and robust back-end system that could serve both the programs and the public to manage. After the system was handed over, Blood safety Program took the initiative to revised the app with a proper management system from initial basic management that was provided with the system. Further, the app was interlinked with the Blood Transfusion Website which could communicate both with the app and the website.

The system currently serves as a database for managing all the blood donors. The system has the capability to log all the records of registered individuals including deferred cases. A registered user can seek an appointment with the nearest blood centres, get both email and SMS notification for donation whereas the blood bank staff has all the features to manage donors, blood transfers within the blood centers, Manage donors and staffs, and

Generate reports. Initially, the record keeping was done manually on hard papers.

The system is owned by the Blood Safety Program, DMS, MOH.

Currently, the system is owned by the Blood Safety Program, DMS, MOH with support from the ICTD, MOH and it is used by the blood banks and the blood donors for the blood donor data management and the donor registrations by both the blood bank staff and the blood donors (general public).

#### Advantage of the system

- a. Real time data for the programs and the National Blood Center
- b. Prospective blood donors (general public) can set appointment and process blood donations
- c. It can even capture donor history and credit systems for regular donors
- d. Arrange blood donation campaign/event to invite donors across
- e. Keep record of blood transfers within centers and record damaged blood bags
- f. Time saving for the Prospective donors to follow the procedure manually to get registered
- g. Minimizes crowd in the hospitals

#### Future Scope

- a. Incorporation of Hemovigilance program in the system (capturing blood transfusion adverse reactions in the hospitals)
- b. To initiate a Patient Management system in the system
- c. Incorporate inventory system (blood collection and the equipment and reagent in the blood banks)

#### 16. HERCS (Health Emergency and Rescue Center System)

##### a. History

- I. HERCS was rolled out since January, 2018.
- II. The funding source was from RGOB
- III. Developed by Bhutan Telecom

##### b. Purpose of the system

- I. To cater the Health Emergency Response Service to the public on time
- II. With the help of this System we know which ambulances are currently busy and available making HHC call agents to assign ambulance on time.
- III. Maintain proper record of counselling provided to the callers

##### c. System Owner

Health Help Center, Department of Medical Services, Ministry of Health

##### d. System User

Call Center staff (HA, GNM, AN and staff Nurses)

##### e. Advantage of the system

- I. ICT enabled service (services that can be “delivered remotely over ICT networks. Callers can just dial 112 and seek the service and all the records are maintained.)
- II. Data organization at one platform (With this solution, HHC have access to the caller's information and easy for report generation.)
- III. Greater communication and accountability (HHC can communicate with multiple callers simultaneously and records are maintained accordingly. Moreover there is accountability within the call center staffs. Through this system we can have so many reports to see how effectively does our staff works. Ultimate benefit is a fast response to Health emergencies.)
- IV. Provide single window for all operations: (With valuable integrations such as automatic call distributions (ACD), predictive dialer and intelligent skill based routings can be done in a single window.)
- V. Effective handling of communication (As integrated with SMS gateways, the communication between service providers and service seekers are made easy.)
- VI. Improved Caller Experiences (System supports Call center representatives in driving caller satisfaction with timely responses to the caller's enquiry.)

##### f. Advantages of the system

Call center software are expensive

## ANNEX D. LIST OF STAKEHOLDER CONSULTATIONS

1. HIMS, PPD, MoH
2. ICTD, DoS, MoH
3. Legal Unit, DoS, MoH
4. EMSD, DMS, MoH
5. DTMS, MoH
6. JDWNRH
7. RCDC, DMS
8. HHC, DMS, MoH
9. ADB
10. WHO

## ANNEX E. EHEALTH TECHNICAL WORKING GROUP

Sl. No	Name	Designation	Address
1	Garab Dorji	Chief ICT Officer	ICTD, MoH
2	Sangay Tenzin	Sr. ICT TA III	ICTD, MoH
3	Birju Sunwar	Sr. ICT TA III	ICTD, MoH
4	Dr. Dhruptob Sonam	Specialist (GP)	JDWNRH
5	Paldon	Sr. ICT Officer	JDWNRH
6	Jigme Tenzin	Sr. Lab Tech	JDWNRH
7	Pema Lethro	Programme Officer	DoPH
8	Tashi Lhendup	Program Officer	DoMSHI
9	Namgay Lhendup	Menpa-I	DTMS
10	Jamtsho	Dy. Chief Programme Officer	EMSD, DMS, MoH
11	Ugyen Tshering	Programme Officer	DMS, DMS, MoH
12	Pemba	Programme Officer	EMTD, DMS, MoH
13	Tashi Duba	Programme Officer	Telemedicine, DMS
14	Tshering Dorji	Sr. Laboratory Officer	RCDC
15	Govinda Ghimery	ICT TA II	RCDC, MoH
16	Sangay Karpo	Sr. ICT TA III	HHC, MoH
17	Bikash Gurung	Sr. ICT TA III	HHC, MOH
18	Tandin Dhendup	Sr. Planning Officer	PPD
19	Tshering Nidup	Legal Officer	LU, PPD
20	Dorji Pelzom	Dy. Chief Statitcal Officer	HRS, PPD
21	Mongal singh Gurung	Research Officer	HRS, PPD
22	Tashi Dema	Research Officer	HRS, PPD
23	Kinley Dorjee	Assistant Research Officer	HRS, PPD

## ANNEX F. INTERNATIONAL AND NATIONAL EXPERTS

SN	Name	Designation & Office
1	Dr. Mark Landry	Regional Advisor, WHO, SEARO
2	Dr. Peter Drury	ADB Consultant
3	Dr. Sundeep Sahay	ADB Consultant
4	Dr. Suraj Shrestha	NPO, WHO CO, Bhutan
5	Mr. Sonam Drukda	Local ADB Consultant
6	Ms. Dechen Wangmo	Local ADB Consultant