Healthcare ICT Master plan
Ministry of Health
Kingdom of Bhutan

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1 FOREWORD

Information Communication Technology (ICT) has shaped the way individuals, societies, and the world communicate/interact. ICT has transformed the way government delivers its services to its citizens. The potential of ICT is limitless and is constrained only by limits of human imagination.

Royal Government of Bhutan has prioritized ICT as the principal enabler for a knowledge-based society. The government of Bhutan is mandated by the Constitution of the Kingdom of Bhutan to provide free health care services to its citizen. The Ministry of Health has this constitutional mandate to be fulfilled.

On the other hand, the Ministry of Health is faced with shortage of Human Resources in all areas of health care services. Constantly rising cost of resources coupled with inadequate health care professionals continues to pose a stumbling block to provide quality health care services to our citizens.

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

A paradigm shift in the future of Healthcare delivery is anticipated, with ICT playing an increasingly bigger role in it. This is a great opportunity, one that will also ensure health care resources are used more effectively and efficiently.

However, the great potential of ICT in health care can only be realized through a comprehensive and well planned ICT Master Plan. Consolidation of efforts and resources, creating conducive environment for ICT adoption, integrating systems and applications are some of the prequistique to leverage ICT to provide quality health care services to our citizens.

This ICT Master plan for Ministry of Health is developed through inclusive consultative processes involving stakeholders from across the Department, Division, Services, Unit and Jigme Dorji Wangchuk National Referral Hospital and District Hospital to understand their requirements, challenges and feedback.

I thank all the stakeholders for their meaningful and constructive contribution in developing this very important Master plan, which will be the core for development of ICT initiatives in the next five years. I am optimistic that this co-operative spirit will continue during the implementation phase.

Tashi Delek!

(Tandin Wangchuk)
Minister

2 EXECUTIVE SUMMARY

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

To continue fund free healthcare, 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 health care ICT master plan seeks to deliver/take health care services closer to the citizen at their door step. It aims to provide accessible, convenient and cost-effective health care services to the citizen.

The ICT master plan for MoH is in line with the overall objectives and programme of the 11th Five Year Plan and with the e-Gov plan of the Ministry of Information and Communications. The programmes and projects in the ICT master plan are holistic and coherent covering all aspect of health care system.

The ICT master plan is ambitious like any other plan and therefore requires a strong management commitment, user support and collective effort of all the stakeholders. There are several critical success factors that we should be mindful of while implementing the ICT master plan.

3 ACKNOWLEDGEMENTS

Stakeholder engagement is a crucial component of any plan as it involves changes to the way they are going to operate in the future. In order for the stakeholders to be fully engaged, the master planning processes adopted a very inclusive and participative approach.

Conducted 1st stakeholder's roundtable meeting on 29 July 2013 to inform participants about the objective of the MOH ICT Masterplan and seek suggestions/feedback on improving the master planning process/define scope.

Interview/bilateral meeting with key stakeholders were held between August-September 2013 to help identify key priority ICT initiatives for the next five years and seek consensus on common initiatives, which cut across whole of government agencies. During the bilateral discussion, the team met with the officials from Department, Division, Services, JDWNRH and Dzongkhag health officials.

Conducted 2nd stakeholder roundtable meeting on 22 November 2013 to validate the content of the Masterplan and seek endorsement.

The participants who took part in the roundtables provided valuable feedback to guide team members in the subsequent phases.

The Ministry would like to thank the MOH Core team members, all the participants who attended the bilateral meetings as well as the Roundtable meetings, the list of which is as below. The feedback and contribution made by the participants to the entire MOH ICT Masterplan discussion has been invaluable.

MOH Core Team

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15.	Sangay Tenzin	ICT Unit, Ministry of Health
16.	Karun Giri	DIT&T, Ministry of Information & Communications

Roundtable Meeting Participants

S/N	Name	Designation	Organisation
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2	Nima Wangdi	Hon'ble Secretary	Ministry of Health
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4 APPROACH

4.1 Overview

A 5-stage consultative approach was adopted for the master planning exercise.

Guided by the tenets of good and effective governance, roundtable discussions and interviews with officials from various department, division, services, JDWNRH and dzongkhag health officials were conducted. The comments and recommendations were taken into account in the development of the final version of the Plan.

4.2 Masterplanning Methodology

The 5-Stage Masterplanning Methodology adopted by the Core Team is summarised below. The processes are:

4.2.1 Stage 1 – Planning

The "Planning" Stage is when the project kicks off with the establishment of governance structures and related processes to oversee and guide the entire planning exercise.

The Team had the first Roundtable event when the initial thoughts on the Strategic Framework were presented to the senior officials of MOH. It was the lessons learnt and the experience through this process that the Team used to re-construct the Framework. It is also through the Roundtable event that the Team has first hand interaction with and soliciting valuable insights from the senior officials.

For better management of the entire project, the Project Plan and detailed project scheduled were developed. The Project Plan provides governance and guidance in terms of project scope definition, timeline, methodology, terms of reference, communication matrix, risk management and other good practice for project management.

4.2.2 Stage 2 – Discovery

The "Discovery" Stage analyses the present state – its strengths, weaknesses, opportunities and threats, and feedback from engagement of key stakeholders from the Government, businesses and community. It is also when the survey form and questionnaires are devised to collect data.
For the purpose of serving the objectives and meeting the goals of MOH in general, the team decided to use the Questionnaire and interview method. Where time and opportunity permits the team will have face-to-face interview with the stakeholders in various department and division within MoH as well as those in healthcare service providers.

Towards the end of this stage, the Strategic Framework was finally crystallised where the Desired Outcome and Strategic Thrusts were put in context. This serves as important pre-requisites in advancing to the next stage.

4.2.3 Stage 3 – Design

The "Design" Stage looks at the performance measurement. The Discovery and Design phases under Stage 2 and Stage 3 are iterative and result in validated concepts that form the basis for the development of the draft Plan.

After the data collection using Questionnaire was completed, the team perused the input from stakeholders and compiled the data into a unified format for easy analysis. When necessary, the team had gone back to the respective stakeholder to validate some of the feedback to ensure accuracy and clear understanding of the information.

4.2.4 Stage 4 – Implementation

The "Implementation" Stage is when compiled information is put together into a draft Plan. This is when new programs and projects are identified and they are also matched against existing and on-going initiatives by MOH and across ministries and agencies.

The priorities, complexity and budgeting of the programs and projects are some of the criteria used in planning and rolling out in the 5-year roadmap and implementation Gantt chart. There are also inter-dependencies and the needs to breakdown complex projects into smaller and manageable sub-projects, to be taken into consideration.

4.2.5 Stage 5 – Consult and Roundtable

The "Consult and Roundtable" Stage opens the draft Plan for consultation via roundtable reviews and via email poll for feedback in order to hear and incorporate the concerns and recommendations.

The input and feedback is invaluable to ascertain the Strategic Thrusts and recommended programs and projects are in line with the overarching objectives and goals for the 11th FYP.
With the conclusion of the second Roundtable event, the team proceed to fine tune and officiate the final ICT Masterplan for MoH.

5 TAKING STOCK

5.1 Bhutan's MOH ICT Achievements To-Date

Bhutan MOH has come some ways in terms of leveraging on ICT as an enabler in improving healthcare services and care delivery to its citizens. Within a short span of time and manageable funds, the healthcare sector made leaps and bounds in terms of computerisation and modernisation.

To-date, some of the noticeable achievements is highlighted as below:

- Implementation of a Hospital Information System at the country's main referral hospital, Jigme Dorji Wangchuk National Referral Hospital (JDWNRH), which is meant to include patient management, pharmacy, inventory, billing and clinical modules.
- Internally-developed Public Health Surveillance System that collects information such as disease outbreaks and epidemic.
- Implemented Bhutan Health Management Information System (BHMIS) to collect aggregated health data on morbidity, mortality and activity reports for evidence based planning and decision makings.
- Rolled out Computer Aided Dispatch System (CADS) that provides both emergency response in sending out ambulances and logs telephone calls for medical advise in Health Help Centre.

5.2 Key Findings

The information collected in this section is primarily a result of the questionnaire sessions conducted by core team members with decision-makers as well as key users of systems. Guided by a structure of questions, the Core Team collected information in specific areas such as the current system landscape, existing challenges and desired improvements. The returned information was analysed and categorised into useful guidelines. Where required, Core Team members contacted/met interview respondents for additional information or clarifications.

The questionnaires use to facilitate this fact-finding exercise was designed by the Core Team members as part of the project.

Some of the key findings are outlined below:

i. **Lack of infrastructure and connectivity**

Due to the unique terrain of the country, the improvement of ICT infrastructure and connectivity across the nation is still underway.

Except for the major hospitals, most district hospitals do not have proper Local Area Network (LAN) setup, which hinder the progress of implementing any applications systems which allow collaboration of work, data collection and processing, and reporting purpose.

Basic LAN infrastructure is only available in 3 out of 26 hospitals hampering introduction of any connected applications into the organisation and connectivity to a centralised system.

ii. Limited skilled human resource and capital to run all the required projects

Human resource still remains as one major of the many challenges for Bhutan due to its comparatively small population and in the process of cultivating the knowledge worker in the technology advance age. This is particularly acute in the Ministry of Health where domain knowledge is requisite to support successful implementation and ensuing management of systems.

As a result, the current ICT human resources in MoH (both numbers and capacity) are not able to run the existing projects. When the projects identified in this master plan are executed, the MoH will require skilled ICT human resources to successfully develop and run all the projects.

iii. Islands of Automation

Due to the way ICT typically projects rolled out in Bhutan, it has formed islands of automation and pockets of stand-alone systems which cannot work cohesively and many instances, data collection is duplicated across systems. There is lack of interoperability due to the data standardisation constraint and systems running on various platforms.

iv. Weak data collection and reporting in public health system

Notwithstanding routine data collection through Bhutan Health Management and Information System (BHMIS), there are numerous surveillances or vertical reporting systems adopted by the public health programs to collect program oriented or disease-specific data such as TB, Malaria, HIV/AIDS, ARI, notifiable/outbreak diseases, among others. These practices of various vertical reporting formats have resulted to proliferation of forms and burden/ overloads of routine health service data collection for health facilities, besides their clinical mandates. Reviewing such vertical reporting systems and harmonizing with the BHMIS is deemed crucial in consolidating and making BHMIS more robust and effective system.

v. Integration is not achievable due to lack of data standards and unique patient identifiers

The MoH has number of applications that are developed decades ago. Some of the system such as DEVD system and HMIS are legacy system developed in old technology while others such HIS are recent implementation. Since the ICT projects were rolled out discretely in MoH, data standards were not followed/were not present at the time of developing the systems.

On the other hand and most important there does not exist a unique patient identifier across different application system. HIS is using a different number and LIS is using its own identifier.

Therefore, the integration of these silo systems will be challenging and not possible due to lack of data standards, interoperability and unique identifier leading to an island of applications.

vi. **No control over ICT resources over inter-ministry transfer**

With Department of Information Technology & Telecom taking over the parenting role of all the ICT professionals in the Civil Service, the concerned ministry/agency do not have any control over the inter-agency transfer of ICT professionals. In the past there are incidences where ICT professionals were cross-transferred between MoH and other agency without the prior consultation of MoH hampering the ICT initiatives and projects in hand.

5.3 Addressing the Gaps

Based on information collated during the stock take and analysis of key findings, the execution of the following mechanisms will address the gaps that have been identified. These mechanisms are incorporated in the ICT Masterplan.

i. The delivery of healthcare ICT projects in Bhutan has reached a point where structural changes must take place to coordinate and manage these projects to ensure alignment to the ministry's goals and priorities. In order to achieve this, a high level conceptual plan identifying the important projects and programmes is necessary. This ICT master plan aims to achieve these goals.

ii. Easy accessibility to healthcare has become ever more pressing and critical. Availability of real time data and information is critical for formulating evidence based policies and decisions by the management. Sharing of information amongst the health care centre is vital for providing quality healthcare services to the citizen. In order to achieve this goal, the most remote areas and health centres will need to be equipped with some forms of Internet connectivity. This is to enable access to patient information on a timely and highly available manner.

iii. Availability of real time online data and information is critical and vital for formulating laws and policies that are backed by evidence and statistics. The availability of real time information is also important for providing necessary intervention and guidance by health authorities in times of disaster and endemic. This will be achieved through a robust health management information system know as District Health Information System (DHIS2).

iv. The groups of ICT professionals in various ministry need to be re-grouped and re-structured to achieve synergy of sharing common resources, and yet to allow specialisation into a few major categories. This will help the ICT professionals to grow in their roles with more depth in specific skills of their inclination.

v. Besides, there should be cross training of healthcare workers to become more conversant with ICT to produce health informatics. This also inculcates the appreciation of ICT and to leverage on ICT solutions and achievable outcomes.

vi. Sharing of patient information across health facilities can be possible only if there is a unique patient identifier. Besides, in order to integrate the different ICT system for interoperability, there should be standard data. This will be possible through standardizing the data and implanting unique patient identifier.

6 HEALTH ICT MASTERPLAN

6.1 Health ICT Vision

Using ICT to improve health system for better accessibility, efficiency and decision-making

6.2 Desired Outcomes

The 5 desired outcomes that the Ministry of Health (MoH) of Royal Government of Bhutan (RGoB) hopes to achieve in order to realise the ICT Vision are as follows:

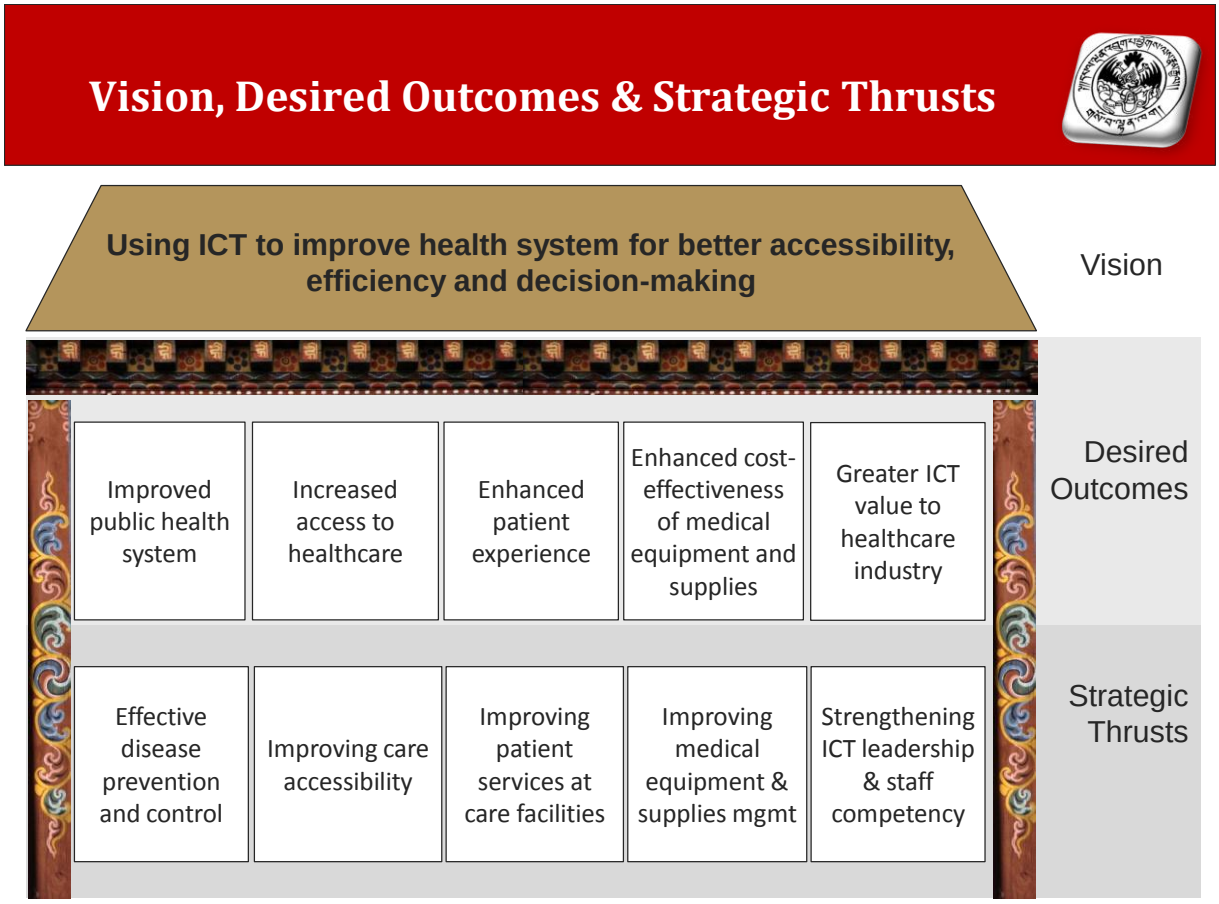
1. Improved public health system
2. Increased access to healthcare to all citizens
3. Enhanced patient experience
4. Enhanced cost-effectiveness of medical equipment and supplies
5. Greater ICT value to healthcare industry

6.3 Strategic Thrusts Overview

Strategic Thrust articulate, at a high-level, the priorities or focus areas for the period of the Masterplan in order to attain the vision and desired outcomes. The strategies to be adopted are as follows:

1. Effective disease prevention and control
2. Improving care accessibility
3. Improving patient services at care facilities
4. Improving medical equipment & supplies management
5. Strengthening ICT leadership & staff competency

6.4 Strategic Framework at a Glance



6.5 Strategic Thrusts #1 – Effective Disease Prevention and Control

6.5.1 Program 1.1 – Improve System of Data Collection, Analysis and Reporting for Health Indicators

This program covers the activities carried out to improve data collection, analysis and reporting to provide timely gathering of crucial health indicators. These indicators and growing trends help the Ministry to monitor and make informed decisions when planning new and upgrading of existing care facilities.

6.5.1.1 Project 1.1.1 – Upgrade HMIS to DHIS2

Background

Realizing the importance of health information or data as the lifeblood of any health system by the health planners and management, the Health Information Unit (HIU) was introduced in 1985 in the central ministry. However, the system of collecting morbidity data has evolved almost parallel to the establishment of modern health care system around 1960s in the country. The unit's main functions then was to collect, compile and disseminate the health information through publications, such as Quarterly Morbidity & Activity Report (QMAR) and Annual Health Bulletin (AHB). The information collected then was mainly on routine data on morbidity and mortality of patients in hospitals and Basic Health Units (BHUs), bed occupancy in the hospital, public health services like immunization, nutrition, maternal & child health, reproductive health etc.

The purpose of such information collection was basically anticipated to enhance the management of health services. The decision makers and the management team could use the collected information for undertaking situational analysis, setting priorities, or implementing a programmed activity. Most of these noble purposes have been imprecisely accomplished and needs further review and enhancement. The unit has been later renamed in 2003 as the Health Management and Information System (HMIS) and functions under the Policy and Planning Division (PPD), Ministry of Health (MoH).

Objectives

The prime goal of the unit is to increase evidenced-based decision making at district, regional, and national levels through strengthening health information systems. The unit also endeavors to achieve "improved availability, quality, and use of health information for enhanced efficiency and effectiveness of health programmes" (WHO, 2006).

Mandates & Strategies

The current mandates which were adopted since 2009 of the unit are guided by following objectives and strategies recommended by the WHO for strengthening health information systems:

i. To compile, validate, analyze and disseminate information on the national health situation and trends
ii. To enhance national capacity and capability in health planning and management by strengthening health information systems

iii. To ensure sound evidence available for use in developing efficient and effective health policies.

Strategies

i. Development of policy, regulation and legislation on Bhutan Health Management & Information System (BHMIS)-related issues
ii. BHMIS system analysis – system design/development and maintenance
iii. Promotion of data quality
iv. Appropriate application of Information and Communication Technology (ICT)
v. Enhancement of mechanisms for effective communication, cooperation and coordination
vi. Development and allocation of BHMIS resources (human, physical, financial)
vii. Strengthening data sharing, analysis and utilization, at all levels
viii. Strengthening data collection and utilization in decentralized systems
ix. Effective dissemination of health information
x. Strengthening linkages between BHMIS and Health Research Unit (HRU) System

HMIS Software based on District Health Information System, ver. 2 (DHIS 2)

Health Management and Information Systems in Bhutan are coordinated from the HMIS Unit in MoH through the Bhutan Health Management & Information System (BHMIS). The current BHMIS is a distributed set of applications (MS Access-based) that are provided to districts to enter paper records from facilities into the application. The databases files from the applications are then forwarded to the Central level at the ministry for integrating into the National database. Districts currently do not perform any local analysis and instead analysis is mainly done at the national level. Data at the district level is entered into BHMIS on a monthly basis but the database files are sent to the national level on pen-drives or via email on quarterly basis.

Importing data into the national database is often a simpler task compared to data entry that has to be done at the district-level. Thus, districts have less time for analysis and the MS Access™-based BHMIS tool does not have adequate built-in reports or easy analytics in the software. For analysis at the national level, data is exported from BHMIS into MS Excel™ sheets. Graphs and Charts are created based on indicators that are calculated from the data copied into Excel sheets. Using these BHMIS data, an annual health bulletin series are published by the HMIS Unit. This analysis forms the key basis on which policy decisions and actions are taken in the subsequent year.

Current Challenges

i. Timeliness is a major issue because data comes in quarterly from the district
ii. Districts become units of data entry, where as they should be points of analysis and decisive action based on already defined National policies
iii. Completeness is an issue because data entry is time-consuming task for the districts

Current BHMIS system is a standalone MS Access™2003-based tool which frequently requires program updates with change in MS Office (Access) version. With periodic updates in MS Office version by the Microsoft has often lead to no-compatibility issues of MS Access with the

previous version of BHMIS. The HMIS Unit has planned to upgrade BHMIS to web-based District Health Information System, version 2 (DHIS2), a globally recognised and adopted HMIS system.

Future Plan

i. Upgrade BHMIS to DHIS2 – interactive and robust web-based health management and information system.

ii. Legacy data starting from the year 2010 should be imported from the MS Access™ system into DHIS2. This requires more work than just direct mapping because of the changes in the data model between the two systems.

iii. A training of trainers should be organized for further customization and integrating other programs datasets into DHIS2 at the national level. These national-level trainers after customizing DHIS2 should train district level, especially focused on data analysis and data quality. The district-level users should further train the facility-level users on data entry.

iv. Initially aggregate data should be entered into DHIS2 for multiple programs and datasets. Later, a pilot on DHIS2-tracker for patient-level data should be initiated. A complete implementation plan should be created by the HMIS Unit in consultation with different programs and relevant stakeholders.

v. There are multiple Human Resource and Financial datasets that are captured through other systems. These datasets should be integrated into DHIS2, so that analysis can be further streamlined at the district-level.

vi. A secure, online, cloud-hosted system is recommended. This is recommended over local hosting because the internet backbone and infrastructure management at the hospital level or ministry level is limited.

6.5.2 Program 1.2 – Strengthen Health Promotion

This program covers the projects that will be implemented to strengthen public health promotion. By implementing projects such as notifications and alerts during the time of emergency and endemic, a possible disaster could be averted and public will be sensitized and educated on health issues.

6.5.2.1 Project 1.2.1 – Develop Health Broadcast Notification and Disseminate educational information

Background

The availability of a system to disseminate health information and health broadcast notification to the public in times of outbreak of diseases will save lives of the people and help in containing the outbreak before it becomes widespread. It will also help educate our public on does and don't during such time.

Current Situation

Currently when there is an outbreak, the public is informed through print and broadcast media, usually BBSC radio, television and/or print newspaper. There is no ICT system to broadcast such information and provide educational information to the public.

While the Ministry of Health website is also being used to disseminate such notifications and educational programs to the general public, it is a passive approach. It has limited success as the people need to connect to the website to be able to receive these updates.

Current Challenges

i. Since majority of our population are involved in agriculture sector and many are illiterate, the educational information and notification renders print media ineffective.
ii. The print newspaper also takes time to reach the population on time thereby undermining the very urgency of immediate alerts needed in times of endemic.
iii. The broadcast media such as BBS radio and television are often depended on the provider's time schedule and also the affordability by our people, especially television.
iv. Most of the time the majority of the population, considering them to a farmer, will be on the farm and not by the site of radio or TV.
v. Notifications and information posted on official website is limited to only to connected citizens and excludes most rural population where the digital divide is a much bigger gap.

Future Plans

In order to effectively disseminate educational information and health notification in times of epidemic, it is important to have system which can relay and broadcast bulk information and notification to the public during such time. Given that Bhutan today has almost 100% mobile coverage, a simple Short Message

Service (SMS) based application with voice will address the current challenges and provide effective intervention during the outbreak and epidemic.

6.5.2.2 Project 1.2.2 – Develop maternal and child health tracking system

Background

The Reproductive Health (RH) program, Department of Public Health (DoPH), MoH currently follows a manual system or paper-based approach by using Mother and Child Health (MCH) Handbook (recently revised in 2013) to record the details of mother and child during the entire pregnancy period of the mother and up until the child attains six years of age.

The MCH handbook aims to:

i. Encourage all pregnant women to attend all antenatal care visits
ii. Encourage all pregnant women to give birth in a health facility
iii. Encourage all mothers and their newborn babies to receive post-natal care
iv. Ensure completeness of the immunization regimen till the child is six years of age;
v. Monitor nutritional status of the child by regularly checking the infant/child's weight and height
vi. Promote better nutrition and development of the infant/child
vii. Facilitate parental screening for missed developmental milestones of the infant/child to identify concerns at an earlier age
viii. Develop a system for early detection and intervention of complications during pregnancy, illness of the mother or infant/child, and development issues

The MCH handbook is designed to integrate all the required cards such as Antenatal (ANC), Postnatal, Family Planning, Immunization, Growth monitoring into one system approach to save space, cost and most importantly to make it user-friendly.

It is meant to track every mother and child from the 1st day of the pregnancy until the delivery and child up to 5 years of age. Along with it is intended that mother has adequate information and counseling for adoption of some method of child spacing: it is designed that the child is followed through full primary immunization to 2nd year of life and monitored its growth; both in terms of height and weight by ensuring follow-up until 5 years of age, so that malnutrition (stunting) and any other abnormalities are detected early and treated.

The handbook also serves as guide for strict monitoring of services received by the mother and child during the entire life course of the child, up to 5 years including ANC period. It is meant to avoid duplication of registering in different health centers for the services by the same mother and child.

Functional Modalities (current)

Being mindful that "Once a mother first register with the initial health center it becomes responsibility of 1st contact center to complete entire services required by the mother and child until mother registers for next pregnancy and the child is five years of age."

The current MCH handbook has features of coding system which helps health workers to track every mother and child.

The district/dzongkhag and health center coding are given in each MCH register maintained at the health facilities. Each Home/ initial Health center, on receiving a new pregnant woman or child for ANC, Delivery, PNC and Immunization must allot a unique number to each. Irrespective of where the mother is from, the health center where she is initially of first registered will be the health center in-charge of following up with her up through her pregnancy, delivery, child immunization till the child attains 5 years of age.

In case a woman or her child who has already been registered in the Home/ Initial health center receives services in another health center, this/current health facility MUST report to the Home/ Initial health facility to update the MCH register. This is to ensure that no mother or child is lost to follow up care, and also to avoid any kind of duplication for recording and reporting. Every health facility should maintain a visitor register to keep record and to report the information to their respective Home Health centers.

Current Challenges

i. MCH tracking is a paper-based system that is plagued with lack of timeliness and incomplete data
ii. With a manual system, it is difficult to track or follow-up care for mother and child
iii. Double counting/ duplication of mother and child records. Currently there is no tracking or follow-up system adopted for mother and child health care. Ex: If a mother first gets her 1st ANC check up in health facility A, and then the 2nd in health facility B, she is counted in B, actually the A should have recorded her entire ANC visits. Such leads to double counting and duplication of records.

Future Plan

i. Incorporate MCH tracking component (mostly relates to the current HMIS activity reports which includes ANC, PNC, Family Planning, and child Immunization reporting) into the DHIS2 web-based application. This will be a long-term goal of DHIS2 implementation process. Most of the MCH data are currently reported in our existing ACTIVITY report of BHMIS. This MCH tracking component will be a extension module of DHIS2.
ii. Develop MCH tracking system as a DHIS2 package component.
iii. Train Reproductive Health Units' (RHU) focal staff in hospitals and BHUs on the use of application.
iv. Roll-outs of MCH tracking application (a component of DHIS2) in all Reproductive Health Units.

6.6 Strategic Thrusts #2 – Improving Care Accessibility

6.6.1 Program 2.1 – Enhance Local Infrastructure & Connectivity

This program comprises of projects aimed at improving/establishing infrastructure and connectivity across all the health facilities in order to improve communications and sharing of resources. By implementing project such as establishing Local Area Network and internet connectivity, the health facilities could have access to HMIS and could serve as foundation for ICT applications such as Telemedicine, HIS etc.

6.6.1.1 Project 2.1.1 – Set up LAN in Hospitals

Background

In order to fully leverage on the ICT and to deliver ICT enabled services, a good infrastructure is prerequisite. Besides delivering ICT enabled health care services, a good infrastructure is also must for sharing of resources and materials.

The Ministry of Health has implemented several systems such as Laboratory Information System (LIS), Bhutan Health Management and Information System (BHMIS), Bhutan Medical Supply Chain System (BMSCS) Hospital Information System (HIS), Telemedicine amongst others. In the future, many more systems and applications will be developed and deployed. Most of these systems will be web-based applications.

These systems will be hosted centrally in Ministry of Health or any other location as decided by the government. For these systems to be accessed remotely by our health care providers and administrators, a good connectivity and a network infrastructure is required at the district level and facility level.

Current situation

Except for the two regional referral hospitals of Mongar and Gelephug (excluding JDWNRH), rest of the general hospitals in the country does not have any ICT infrastructure (LAN and internet connectivity). Some of these hospitals are using either dial up connection or broadband connection based on the availability and affordability. These connections are often unreliable and are confined to few users. Besides, resource sharing is not possible presently due to the lack of a LAN in the hospital.

On the other hand, Department of Information Technology and Telecom under the Ministry of Information and Communications has set up fibre optic cable to all the 20 dzongkhags which will further enhance the internet speed to these locations.

Current Challenges

In absence of good and reliable ICT infrastructure in the district hospitals, several challenges are faced by our health care professionals;

i. Information and resource sharing is not possible

ii. Real time data is not available for informed decision making and reporting
iii. Systems and applications are stored in a locally on desktop PC which doubles up as the server. When there is a hardware failure, loss of data can be expected.
iv. Systems and applications have to be installed in multiple computers for different users wasting time and resources.
v. E-learning for continued medical education (CME) is limited as connectivity is an issue.

Future Plans

A resource hub will be created by setting up of Local Area Network (LAN) and internet connectivity for the remaining hospitals. The current and future applications will ride on these infrastructures. A real time information sharing will be possible both horizontally and vertically.

Local Area Network (LAN) roll-out is planned for 3 general hospitals in each financial year. Progressively, therefore by the end of the 5-year period, a total of 15 hospitals will enjoy LAN connectivity.

6.6.1.2 Project 2.1.2 – Set-up Bhutan Health Network Connectivity in District Hospitals

Background

Communication and sharing of resources and information among the health facilities is vital for providing effective and timely health care to the citizens. A network to connect all the district hospital is vital for establishing good communication link and sharing of resources and information across the health facilities that are located across different geographic location.

Current Situation

The hospitals and health facilities are located across different geographic location. There is no network that connects all this health facilities. Communications and real time data sharing is not possible currently due to infrastructure.

Current Challenges

Some of the current challenges are:

i. No real time, fast and secure information sharing
ii. Communication and resource sharing not possible

Future Plan

In order to facilitate fast, secure and reliable information sharing across health facilities, a secure network known as Virtual Private Network (VPN) will be established to connect all the district hospitals in the country.

In order to enable the health centers and clinicians to exchange and share information, the health centers will have to be connected. This can be achieved though establishing health network connectivity via Virtual

Private Network. All the health facilities will be connected via VPN to facilitate information sharing both horizontally and vertically.

Key performance indicators

VPN to be set up to connect Mongar Regional Referral Hospital, Gelephu Regional Referral Hospital, JDWNRH and district hospitals.

6.6.1.3 Project 2.1.3 – Last mile Bhutan Health Network Connectivity from Gewog Center to All the BHU's.

Background

Basic Health Units' are located at far flung places from the District head quarters. Some of these BHUs' are days walk from the nearest road point. However, they are the primary health care providers and play an important role as a basic health care provider.

Besides providing primary health care services, they are also the primary source of information for decision making.

Current situation

None of the BHU's currently has any internet connectivity or ICT infrastructure. In the past, it was virtually not possible to provide all the BHUs' with internet access given the huge cost implications. However, through the initiative of some of the local health workers, some of the BHU's do have computers and some even have dial-up internet connection or broad band internet connection.

The BHUs submit monthly reports as required by HMIS in hardcopy to the District Health Officers, who then compiles and enters into the MS-Access based tool, BHMIS. On a quarterly basis, the DHO send the database file to HMIS unit via email or thumb-drive. Besides reporting and routine work, the BHUs' have no access to information and other ICT enabled services such as Telemedicine, HMIS and PHL.

Current Challenges

Some of the challenges faced by BHUs' are;

i. Real time data is not available for informed decision making and reporting as data is submitted quarterly to the districts.
ii. Duplication of efforts as data has to be entered at multiple source (district and at HMIS)
iii. E-learning for continued medical education (CME) is limited as connectivity is an issue.
iv. No or limited access to ICT enabled health care services such as Telemedicine, HMIS, PHL etc.

Future plan

The departments of Information Technology and Telecom under the Ministry of Information and Communications have taken a fiber optic network to more than 180 gewogs. The remaining gewogs will be connected in the near future. The fiber optic network terminates at gewog administration's office/Community centers.

Therefore, there is an opportunity for the Ministry of Health to leverage on this fiber optic network to connect to the BHUs' from the gewog center. This so called last mile connectivity can be achieved through two options depending on the location and distance of BHUs' from the gewog administration office/community centers.

i. Wired cable connection
ii. Wireless connection

6.6.2 Program 2.2 – Improve Call Centre Service

Operating round-the-clock, the Health Help Centre (HHC) essentially is a call centre that assists citizens that seeks emergency services or basic medical advice over the telephone.

6.6.2.1 Project 2.2.1 – Upgrade and Enhance HHC's Computer Aided Dispatch Systems

Background

HHC is an Information Communication Technology (ICT) enabled health care service which delivers services round the clock (24/7). The services delivered include Emergency Response Services and Healthcare Helpline Services. The services is delivered through the toll free number 112 which is accessible from Mobile phones, fixed land lines, and PCOs.

The list of applications presently supporting HHC operations are:

i. Computer Aided Dispatch System (Core) comprising of the following modules:
    a. Communication Agent (CA)
    b. Dispatch Closure Agent (DCA)
    c. Health Management (HM)
    d. Emergency Physician (EP)
    e. Supervisor
ii. Computer Aided Dispatch System (Support) comprising of the following modules:
    a. Access Management System (AMS)
    b. Fleet Management System (FMS)
    c. Emergency Response Service Report
    d. Healthcare Helpline Report
    e. V-Track
    f. DCA Track Application
    g. Factsheet

Current Situation

As part of the service, the HHC call centre is manned by paramedics round-the-clock, over 3 shifts. In brief, the paramedics use Computer Aided Dispatch System (CADS) implemented in HHC since 2011 from the Procreate Techno System, India to:

i. Log calls as well as dispatch ambulances in cases where it is needed
ii. Record calls for basic medical queries and advice given by paramedics

At implementation, the CADS was insufficiently configured for 60 ambulances and due to growth in the recent years, the inadequacy to support the present fleet of ambulances exceeding hundred has become more acute. Due to this, system is not able to log all the incoming calls and thus cannot be depended on to generate accurate statistics.

Current Challenges

i. Paramedics lack basic ICT skills and application training to effectively operate HHC
ii. High-turnover of paramedics, requiring new recruits to be trained in the applications
iii. Lack of application & system administration training of HHC ICT staff responsible for maintaining the system
iv. There are some critical enhancements that are required in the system but no budgets is set aside for such improvements
v. While the CADS system is covered under a maintenance contract, the communication and hardware components are excluded. Failing parts has to wait for long budget approval before they are replaced.

Future Plans

To ensure that HHC continues to provide quality Emergency Response Service, we propose to:

i. Increase the number of user-license to 106
ii. Incorporate enhancements to improve the usefulness of the system, such as inclusion of prescription reports and inclusion of user-defined date range.
iii. Integrate with Vehicle Tracking System

6.6.2.2 Project 2.2.2 – Incorporate Vehicle Tracking System for Ambulances

Background

The dispatch and tracking of ambulances in response to emergency calls is one of the important functions of the HHC. Implemented in 2011, the Vehicle Tracking System (VTS) which utilizes GPS tracking technology to monitor the fleet of ambulances in the whole country for effective utilization and to reduce inefficient deployment of the vehicles.

Currently, HHC has 106 ambulances in service and of which, only 60 are equipped with Automated Vehicle Live Tracking (AVLT) devices. However, Google Maps previously provided by the project under a one-year

subscription has since lapsed in mid-2012 and the quoted annual renewal fee of Nu 800,000 is prohibitive[1]. This has rendered the VTS essentially non-functional.

In a country like Bhutan, mismanaging scarce emergency resources can lead to disastrous consequences. Locating and sending the nearest available ambulance to emergency site without delay is ultimate goal for HHC. This cannot be achieved without a functional VTS.

Current Challenges

i. The subscription of the Google Map has expired, leaving the system without the mandatory base map for positioning and tracking of ambulances.
ii. The subscription renewal cost of Google Maps is unaffordable
iii. Lack of application & system administration training of HHC ICT staff responsible for maintaining the system.

Future Plans

~~Ever since MoH provide **Emergency Response Services** 24x7 via HHC, we comprehend~~ Having Vehicle Tracking System will ~~further~~ assist MoH to provide services to its citizens in a needy circumstances.
HHC would like to have a system where all the ambulances can be tracked in "**real time"** with proper Land marks and track even the history with the help of VTS. This should as well help HHC to get the accurate odometer readings for each and every ambulance. The accident rates of ambulances by over speeding shall bring to a minimal with the VTS by having the feature of over speeding alarm systems.
Initialy, we had been using other means of Tracking System with only 60 user license (i.e only 60 ambulances) out of more than 100 ambulances distributed in Health Centers throughout the nation. This was stopped due to expiry of Google Map license since early 2012. Although VTS feature is available, almost 56% of the vehicles were unable to track as it was not configured to the system.
Therefore, this Project shall overcome the existing pain points and we shall indulge in the forthcoming vehicle tracking system.

By having VTS, we can achieve the followings:

i. Real Time tracking of ambulances 24x7
ii. In case one hospital had no vehicles for some reasons then, the nearest hospital's ambulance must be viewable via map and assign it in order to relieve the emergency case.
iii. Should be answerable to anyone with the land mark where the ambulance has reached if moving.
iv. To be tracked in border towns (India) where our Cellular network coverage is there.
v. To monitor and lessen the misuse of ambulances
vi. To monitor and get the patient to nearest Health center as sooner as possible by not letting drivers to waste time in between.
vii. Reduce the call cost – need not have to call the drivers for the location of ambulance if moving.
viii. Control the speed with the help of over speeding alarm system
ix. To have reports as desired

[1] MOIC is currently negotiating with Google for their applications and MOH will request that MOIC include GoogleMap in their discussions with the vendor.

6.6.3 Program 2.3 – Improve Care Accessibility

This program comprises of projects aimed at improving overall accessibility of health care services, especially at reaching the unreached ones. By extending the use and coverage of telemedicine, it will ensure that people need not travel long distance to avail health services. Through initiatives such as mobile app to send reminders and appointment date etc, patient need not have to wait long and take medication on time.

6.6.3.1 Project 2.3.1 – Mobile Health Application to Send Alerts/Reminders/ Appointment Date

Background

Keeping track of patients and keeping them informed regarding their medications, visits and making appointments will go a long way in improving our services to the patient. A simple SMS base application to send reminder for example a TB patient to take medicine continuously for 6 months will help both patient and health service providers towards eliminating TB.

It will help provide faster service and help improve patient service and contribute towards better management of patients and improving administration in the hospitals.

Current Situation

There is no such system to send reminders and alerts to the patients. Once the patient's visits hospitals, there are on their own and nobody reminds them of what they are supposed to do. In case they forget to take their medicines or forget to turn up for review, there is no way to remind them and make them take medicine or turn up for review.

Appointments are made with doctors/specialist at JDWNRH at the either personal level or from the front desk and are given a date and time for consultation. However, there is no way of reminding the patients about such an appointment.

Current Challenges

i. Patients forget to take medicine or turn up for follow-up reviews and are not being able to track them rendering the medication not so effective. Considering majority of the population are farmers and uneducated, this is a reality.

ii. Crowding of hospitals as patients wait at the door of the doctor's chamber for consultation and advice. As there is no system for sending appointment date/time, the entire patient load flocks to the chamber and over crowd the hospital.

Future Plans

In order to remind patients to take medicine on time and to turn up for follow-up and review, a simple SMS bases application will be developed and implemented. A patients who requires follow up and medication will be atomically be reminded and alerted through this SMS to take medicine on time and to come for follow up.

Rather than waiting for a long time in queue to see a doctor for consultation, patients after getting appointment date and time need not have to wait. A system will send them their appointment date and time and accordingly they can come to the hospital when their turn comes.

This will improve patients' service and decongest the hospital and improve the management of patients at the hospitals. For patient themselves, this will save their time as they do not have to wait in a long queue.

6.6.3.2 Project 2.3.2 – Upgrade & extend use of telemedicine project

Background

Bhutan has been making sincere efforts to implement Telemedicine since 1997. Since then, with the support of WHO, various technical assistances were fielded in. The tele-linkages between Mongar Regional Referral Hospital (MRRH) and Jigme Dorji Wangchuck National Referral Hospital (JDWNRH), Thimphu was launched on 11 November 2000 through Internet on 64 kbps lease line.

In 2002, the Gelephu General Hospital was included as a Telemedicine site after supply of equipments including X-ray digitizer and digital camera. In March 2003, the East-Bhutan Tele-ECG Project further strengthened the telematic sites whereby, Trashi-Yangtse and Lhuentse District hospitals were also added to the existing telemedicine network through the PSTN dial-up connections. In 2004-2005, the setup of LANs at the telematic sites of T/yangtse and Lhuentse hospitals was undertaken and a survey of basic connectivity in health care facilities was done.

3-Step Approach was Piloted in 6 sites (2000-05) namely Thimphu (Expert hospital), and 5 District Hospitals namely Gelephu, Mongar, Lhuentse, and Trashi-Yangtse as referral hospitals.

i. Step 1: Improve Access to Information (Tele-education): Internet and E-mail at all six sites.
ii. Step 2: Improve Access to Advice (Tele-consultation): At all sites using Web Camera, Digital Camera, Digital ECG, Digital Stethoscope and Document Scanner.
iii. Step 3: Improve Access to diagnosis through Tele-radiology at only Mongar.

In 2007, expansion was done to 10 more sites, none are functioning today. WHO supported desktops with built-in camera's and web-based system developed with the help of JAICA volunteers.

i. 4 Sites provided Desktops and webcam - Bali BHU I, Haa, Bhumtang Hospital, Yebilaptsa Hospital, Trongsa Hospital
ii. sites provided access to web software as they already had Desktops - Punakha hospital, Bajo BHU I, Wangdue, Tsimalkha Hospital, Chhukha, Gedu Hospitalm Chukkah, Samtse Hospital

In April 2009, Rural Telemedicine Project (RTP) initiated in 14 sites, with an average 5 consultations per month from 14 sites in 2011, which indicates a decline in consultations by 12 times since 2005. 10 District Hospitals and 4 Basic Health Units (BHU I), were provided Laptop, Desktop, Portable ECG, and Vital sign recorder. However, the current system does not support Radiology and Dermatology, which is a factor also

contributing to the decline in number of consultations. The sites included: Gomtu Hospital & Sibsoo BHU I in Samtse District, Damphu Hospital in Tsirang District, Dagapela Hospital & Lhamoizingkha BHU I in Dagana District, Zhemgang BHU I in Zhemgang District, Samdrup Jongkahr Hospital & Nganglam BHU I in Sandrup Jongkhar district, Riserboo Hospital in Trashigang District, Pema Gatshel Hospital in Pem Gatshel District, Trashigang Hospital in Trashigang District, Lhuentse Hospital in Lhuntse District, and Phuentsholing Hospital in Chhukha District.

In December 2008, SAARC telemedicine project was established in JDWNRH. 7 consultations happened in 3 years, mostly done in 2009. The setup is used for Continuing Medical Education (CME) from two super-speciality hospitals in India - SGPGIMS, Lucknow and PGIMER, Chandigarh. 105 CME sessions were held from Jan 2009 to June 2011, attended by an average 15 doctors/session. Attendance has dropped from an average of 18 per session in 2009 to 13 in 2010. The consultant at JDWNRH found that the CME sessions are research based and not much practical for their day to day work. The contents of the CME sessions should be re-adjusted and made need driven. Equipment provided includes - VSAT IPSTAR (inbound 512Kbps, outbound 1Mbps: Thaicom4), Digital X-ray machine, Video-conferencing Camera, lights, UPS, accessories for CME etc. The maintenance charges paid by the Bhutan government are 2.2 million Nu to TCIL, New Delhi, a government of India enterprise.

The RTP and SAARC have been in operation during 2009-2011 and these were reviewed in September 2011 by WHO/SEARO and the findings of the review guided this strategy. In parallel to these initiatives categorized as telemedicine projects, there have been other projects that would link closely with the telemedicine initiative. For example: In 2010, the Health Help Centre (HHC) has been established in Bhutan (Thimphu) that serves as a National level call centre to provides Government to Citizen Services for (i) Emergencies health response and (ii) Healthcare Helpline that includes medical advice, medical counseling, health facility information provision, complaint logging. For birth delivery, any citizen can call a number and there will be a response team visiting the home for help with birth delivery.

Over the last decade, the connectivity has drastically improved in Bhutan and it is expected to further improve by middle 2012 with the new project launched by DANIDA to improve bandwidth in the country.

Current situation

Though large amount of resources and efforts has been mobilized for implementation of telemedicine in Bhutan, it was however not as expected. As of today, the telemedicine project is non functional and efforts are under way to revive the project.

Current challenges

i. Numerous challenges have been encountered which resulted in the non functional of telemedicine project. Some of the important challenges are;
ii. Low acceptance/adoption of telemedicine systems/project by health care professionals, particularly the specialist providing the consultation.
iii. Long-term government commitment, based on a strategic plan, is necessary for the successful implementation of telemedicine programme. This commitment should be secured and

sustained by creating a Telemedicine department headed by the Head of the department. A long-term implementation plan should be developed with sustainable financing

iv. Unlike developed countries, adequate ICT resources both in terms of human resources and infrastructure is a huge challenge

v. Lack of health care professionals with adequate ICT knowledge and skills. In other words there is a lack of health care informatics.

Future plan

With assistance from WHO, a proposal to review the telemedicine programme in Bhutan, a plan has been proposed to develop e-mail based telemedicine linked with HIS. The future plan are;

I. Remote Medical Professional will use a customized email based telemedicine solution that is designed with suitable templates in the email system to capture patient details, complaints, diagnostic results such as laboratory test results and X-Ray images and even dermatology pictures for cases of patient suffering from skin diseases. This tele-consultation is received at the expert end as an email in their inbox. The doctors/ specialist can then send back reply through the same email system that will have a template for them to fill in which maybe a diagnosis or prescription or an instruction for further tests.

II. In case the doctors/ specialists are online, the Remote Medical professional can consult cases and share patient details, tests through chat software (LIVEzilla). Such consultations also need to be recorded in the database.

III. The existing web-based system (Bhutan Rural Telemedicine System) can also be used to tele-consult cases from places where it has been installed and such records have to feed into the consultation database.

IV. Remote Medical professional can also call to the HHC centre for instant access to the Specialist doctors and can get the service over phone though HHC call conference facility.

Meanwhile the consultations whether vide web, email, chat or phone are automatically logged in the database with details of who had tele-consulted the case, to whom, about what and the status of response from the expert end.

The Telemedicine focal point located at HQ or HHC can monitor the status of tele-consultations done through web, email, chat or phone through the web portal (data fed from database) that can also generate daily reports.

6.7 Strategic Thrusts #3 – Improving Patient Experience at Care Facilities

6.7.1 Program 3.1 – Improving Patient Experience at Care Facilities

This program comprises of projects aimed at improving overall patient satisfaction at MOH's care facilities through data sharing across its facilities, introduction of initiatives such as queue management and appointment systems to ensure that patients need not go through unnecessary tests and long waiting time.

6.7.1.1 Project 3.1.1 – Standardize Health Data & Identifier Codes

Background

For most national wide ICT initiatives, it is imperative to have some kind of standardization of health data and identifier codes. This is akin to having a common language, or lingua franca, where various systems with their own data set will be able to capture and share information with other third party systems within the Health Network.

Current situation

Bhutan has in the past installed a few systems based on the needs to fulfill a certain groups of users or by institutions. The objectives were to install systems which will help to address some pressing issues and to gain short term gains and visible results. Hence, the sprouting of islands of automation like Hospital Information System (HIS), Laboratory Information System (LIS) and a few more which run well autonomously. The users of such systems enjoy immediate benefits like higher productivity and some form of electronic record as figments of patient's health record. These systems are able to provide useful data for trend analysis and clinical research in their own domain, but post an insurmountable task to ICT if the records need to be linked or analyzed collectively.

For example, there is no common identifier to link the same patients which already have records in two separate systems, say the HIS and LIS.

Current Challenges

i. For the existing systems, as they are implemented and now form islands of automation, each system maintains their own data set.
ii. Currently, most patient centric system will generate its own unique identifier for patient related records. This becomes a challenge when the patient records from the various systems need to be linked in any logical manner.
iii. Any effort to collage the data from these various systems to produce national statistics or trend analysis would be deemed futile and there is no common identifier.

Future Plans

i. For the existing systems, MOH will need to conduct further study on interface methodology on how the systems can communicate electronically. Besides, whether such systems are capable of standard system interface like HL7 (Health Level 7).

ii. A special Body should be formed and tasked to study the local requirement and provide governance and guidelines on Data Standardization.
iii. For example, the Body will set the data standards and guidelines for patient identifier, disease code, drug database, medical alert, etc. These guidelines will be applicable when evaluating systems for future projects and tenders.
iv. As a recommendation, MOH could work with relevant agencies to standardize the use of Citizen ID (CID) as the common patient identifier across all new and existing systems used in MOH. This will follow by awareness campaign to educate the patients to show their CID whenever they seek medical services at the hospitals and BHU.

6.7.1.2 Project 3.1.2 – Implement a Hospital Information System

Background

The use of ICT has been realized by the government having multifarious benefits in the health sector in enhancing early intervention and treatment, improving the quality of services, sharing of patient information among the medical professionals and proper maintenance of patient record. Therefore, in order to improve the service delivery both with respect to time and quality, the Ministry of Health, with support from Department of Information Technology & Telecom came up with a plan to implement Hospital Information System which would integrate all modules of patient care as well as Hospital Management in 350 bedded Jigme Dorji Wangchuck National Referral Hospital (JDWNRH).

If the project in JDWNRH is successful, the services will be extended to other Hospitals in the Country. Thus, the system proposed was a centralized HIS setup housed in a data centre determined by the Ministry of Health, situated within the Country. The system can thus be used by all the Hospitals in the country in future with optimal cost of operation and maintenance

Napier Healthcare partnered with local company iTechnologies and was awarded the work of installation, implementation and commissioning of the Napier Integrated Hospital Information System. The pilot site chosen was JDWNRH.

Current situation

The Napier HIS is used by JDWNRH was launched on December 2012 and was funded by The Government of India (GOI). The current version of HIS system is a web based system hosted within the local network of JDWNRH. It has 30 different modules covering all aspects of hospital activities.

Challenges with Current System:

i. Prescribers find the system difficult to use as there are lots of mandatory fields and is time consuming to navigate across multiple screens pages to enter prescription details. There are also severe workflow limitations, for example the clinical data is not punched into the system by the prescribers, investigation and medication orders are not allowed. Therefore, the pharmacy, radiology or LIS module of the Napier HIS cannot be used.

ii. There are some glitches in the system software itself. For example the modules like billing takes time to load and it is a mandatory module even for the registration. Billing module is used to generate bills for a particular patient with reference to all the services like consultation, investigations and so on. JDWNRH does not have the capability to fix these issues without vendor support.

iii. The system facilitates generating of bills in the following cases:
   a. All OP visits and OP order bookings are sent for billing. Once OP Doctor Visit is created, the same is recorded in billing and for any other diagnostic services requests is also recorded in billing.
   b. Service (Doctor Consultation / Lab /Radiology / others) charges are billed to patient.
   c. While doing registration / visit creation / OP Billing, user has to collect the payer details.
   d. While posting services, patient tariff's service rate has to be considered as the rate and according to the patient payer selection amount is distributed.
   e. When final bill is generated, the amount gets distributed as per the patient payer setup.
   f. Any markup is always billed to patient as default payer.

iv. The vendor support for maintenance and support has expired and there is a budgetary constraint to renew and meet the annual maintenance cost. If there is a severe technical problem in the system, JDWNRH does not have the capacity to fix it immediately.

v. There is not enough competent IT manpower to support the system 24/7. Currently ICT unit at JDWNRH is manned by four ICT professionals. Additional requirement of four ICT professional is anticipated to support HIS 24/7. Moreover, the competency and their skill set too have to be improved through trainings.

vi. Without uniform and strict way to identify patients in the system, maintaining single record for every patient is difficult. The main cause of generating multiple records for a single patient is because while they are making visits to the hospital, patients do not bring MR no given to them earlier or they do not know their CID no as well. The hospital is unable to deny service if the patients do not produce any of these documents.

vii. Without standardized set of codes or data, sharing patient information between HIS and other 3rd party systems like LIS is not achievable.

viii. Radiology Investigation includes CT scan, MRI, X-ray and so on. As radiology deals with all kinds of patients, the workflow might be complicated. Hence, the integration part in the application should take care of all these needs and make the users life as easy as possible. After the tests are investigated, the images are delivered to the patients/departments and are shared with the concerned people (inside the hospital or outside) for proper treatment. For this, images should be stored in a way where all people from various departments can view and report them. All this cannot happen through a hard copy. There is a possibility for the hospital or the patient to lose the images which can hinder his/her treatment in case of chronic diseases.

ix. Picture Archiving and Communication System (PACS) is a central repository that manages the storage and retrieval of digital images created by radiological modalities. The PACS application is part of the Napier-HIS (within the RIS module) for transfer of information and images from

the HIS to PACS. This allows the radiologists to retrieve images and report on them. However, the HIS project has not sufficiently catered for infrastructure to operate a PACS solution. The PACS project is moved to a separate initiative – Project 3.1.5 – Implement PACS at JDWNRH.

Future Plans

i. To conduct an assessment of the current HIS implementation in JDWNRH.
ii. To adopt a workable HIS.
iii. The plan is to further roll out the selected solution to other hospitals (at least to 3 regional referral hospitals) after piloting at JDWNRH. The implementation should cover minimally:
    a. Phase 1
        i. Registration
        ii. Inpatient Management
        iii. Medical Records
        iv. Radiology
        v. Laboratory modules
        vi. Integration with Queue Display System
    b. Phase 2
        i. Doctor Consultation
        ii. Nursing
        iii. Integration with LIS
iv. Related matters:
    a. Improve JDWNRH infrastructure – LAN and increase number of computers
    b. Conduct user trainings – users need to be trained thoroughly before the roll out
    c. Include maintenance and support costs of the HIS.
    d. Migrate the application and database to Government Data Center (GDC)
v. To have a backup server at JDWNRH or MoH. Currently, both HIS application and database are backed up on a weekly basis manually. Both the backup copies are kept in the same room where the live system exists. If some unforeseen incidents happen, there is a chance that everything is being lost at once. Thus, to have at least secure both application and database, a copy of it may be backed up at different location than JDWNRH.

6.7.1.3 Project 3.1.3 - Implement Patient Information Management System for Traditional Medicine

Background

Traditional medicine in Bhutan is one of the oldest surviving medical traditions in the world. Even today, traditional medicine is a very common alternative western medicine for Bhutanese. It is an integrated and recognized part of the formal health care services and is administered through Department of Traditional Medicine.

Current landscape

A web-based Patient Information Management System for Department of Traditional Medicine (TM-PIMS) is being developed in Dzongkha. The purpose of having this system is to collect and share medical information electronically, expedite clinical communication and curtail errors in recording and reporting. The TM-PIMS has six modules to support activities such as recording of patient medical information and medical reports.

The system was developed using Java Script, PHP My SQL and SQL Server 2005

Current Challenges

i. No dedicated ICT personal to provide support services to the system
ii. Low ICT literacy among the traditional medicine practitioners which leads to frequent incorrect usage of application
iii. No integration with other systems such as Health Management Information System (HMIS) to provide data for reporting
iv. No tools to auto-translate final reports from Dzongkha to English
v. Lack of basic infrastructure such as computers and network connection at BHU level Traditional Medicine Units
vi. As the usage of this system grows, the need for a server to house the application is needed as it is currently installed on a PC.

Future Plans

i. Upgrade the current TM-PIMS as the current system was developed using basic functionality which does not support the high end technology.
ii. Engage dedicated ICT personal for TM-PIMS
iii. Provide user training for PIMS and basic computing skills for staffs
iv. Integrate TM-PIMS with other system like DHIS and HMIS for direct reporting
v. Establish basic ICT infrastructure such as computers and network connection at BHU level Traditional Medicine Units
vi. A proper IT Unit to be in-charge of future implementation of the PIMS and any other information systems
vii. Migrate the application to a server-class machine to handle the usage growth.

6.7.1.4 Project 3.1.4 – Upgrade & Centralise LIS

Background

Before 2009, the medical laboratories in all the health centres in Bhutan (except JDWNRH) manages the laboratory information (patient test results) using a book register. The laboratory test results of the patients were written by hand and dispatched. This system has many disadvantages such as increased workload yet led to many transcription errors and missing data.

Therefore, in 2009, realizing the need for systematic laboratory data collection and management in the health centres and also a centralized data bank to provide information for medical research and studies, the Public Health Laboratory with a financial support from World Bank initiated and implemented the Laboratory Information System (Polytech™ version 8.3.7h) developed by US-based company called CompPromed. Excluding PHL (central databank for LIS), a total of 25 health centers with laboratory facilities were supplied with complete set of desktop computers installed with LIS software along with all necessary hardware's like UPS, printers and barcode printers (Monggar Hospital). At least one laboratory staff from each site where trained on operating LIS system and refreshers course provided to those sites having difficulty in operating LIS at later stages.

Current Challenges

The off-the-shelf Polytech™ LIS system implemented in Bhutan is designed to operate through an intranet network using client-server architecture where each work station maintains a copy of complete set of data without requiring dedicated server.

i. In such system set-up, each health centre functions as an independent LIS repository and therefore, preventing the sharing of test results between the health centres. When a patient moves from one health centre to another, re-test is typically required.
ii. Without direct linkage between the LIS systems at the health centres and PHL, the process of laboratory data transfer from the sites to PHL to maintain central laboratory data bank is done manually which is a very tedious procedure.
iii. Also without a nationally accepted unique identification code for the citizens, maintaining a single record for each patient is not possible.

Future Plans

i. To address the above challenges, the current LIS system needs to be customized (or upgraded) to suit our requirement where the LIS systems at each health center will connect with central PHL server to synchronize the data at the end of each working day. If patient moves from one health center to another, say from A to B, the center B can connect to central PHL server to pull out the laboratory data of a patient which has been updated to central server by center A.
ii. To maintain single entry of record for every patient at the central server, National Patient Master Index (NPMI) can be adopted by deploying an interface between the LIS system and the NPMI system where LIS system pulls out patient demography for every patient from NPMI.

iii. As of year 2013, some additional health centers not covered by LIS network has laboratory facilities established. To make all laboratory uniform in terms of operation and maintain laboratory data of all labs in Bhutan, the LIS network need to be expanded to this additional sites by procuring LIS software packages along with complete set of desktop computers and printers for these sites.

iv. As laboratory staff in Bhutan gets transferred from one lab to another in regular intervals and new staffs are recruited each year, there is a need to provide training on LIS operation at regular intervals and provide refreshers courses when new modules or updates are added to the LIS package.

v. As an alternative to HIS (for those health centers not covered by HIS), LIS can be upgraded from current version to latest version (8.5.1d) which has Patient Medical Record module added and use partly as a HIS by extending LIS network from laboratories to medical receptions and doctors chambers wherever feasible depending on availability of ICT infrastructures.

6.7.1.5 Project 3.1.5 – Implement PACS at JDWNRH

Background

The objective of the PACS initiative is to implement a Picture Archiving and Communications System (PACS) that is integrated Radiology Information System (RIS), a module under the Hospital Information System (Project 3.1.2) at JDWNRH. The PACS component is a computer system that interfaces with the medical imaging devices (i.e. X-ray, CT Scan, MRI, ultrasound, etc.) to capture images in a digital format. Once captured, the image can be stored, manipulated and transmitted over a computer network.

Current situation

The RIS component interfaces with the existing hospital information systems like Napier HIS to capture patient demographic and study (digital exams) orders. Once the information is captured, authorized health care providers in Medical Imaging departments use the information to schedule and complete the exam. As exams are completed they are interpreted by an authorized radiologist and the results are recorded in the RIS/HIS. The RIS interfaces with the PACS component to link images from the study and the interpreted results making them available to authorized users - typically referring physicians.

Current Challenges

Though the current Napier-HIS implemented at JDWNRH supports PACS, there is a requisite need to ensure the infrastructure is adequately configured for a PACS solution. Due to the size of digital images, e.g. each CT scan is between 0.6-1.0 MB and for CT64 multi-slice scans, it can increase significantly up to 1.5GB per case, special attention is needed for the infrastructure that PACS need to operate on:

i. The PACS application typically runs on a separate backbone segregated from the rest of the hospital LAN to avoid degradation of network performance of other systems running on it.

ii. Viewing stations for DICOM images require high-resolution workstations, not the regular PC monitors.

iii. Due to PACS demand for vast storage, the infrastructure needed to support PACS storage is advisably separated from HIS infrastructure.

Future Plans

When designing and implementing a PACS it is important to give detailed thought to storage, management and acquisition of both image and non-image data (e.g. patient demographic data, examination details, clinic appointments, etc).

Much, if not all, of the non-image data required by a PACS is available on external systems such as Radiology Information Systems (RIS) or Hospital Information Systems (HIS). The standards described above should be used for the sharing of this data and the sort of information required includes aspects of examinations on RIS, current patient location and forthcoming appointments (HIS or RIS)

The advantages of integrating hospital information systems with a PACS include:

i. A single point of entry for data means consistency, and avoids duplication of effort
ii. PACS can obtain information on patient status and location from the HIS, and use this to present useful work lists to radiologists and clinicians. For example, a list of examinations for all patients on a particular ward can be created.

Medical imaging can create large amounts of image data, both in terms of the number of images generated and the size of the image files. It therefore follows that large amounts of storage are required for the image files.

Computer networks can be attached to two types of networked storage topologies, known as Network Attached Storage (NAS) and Storage Area Network (SAN). These storage topologies are becoming increasingly common in PACS.

6.8 Strategic Thrusts #4 – Better Visibility of Medical Equipment and Supplies Usage

6.8.1 Program 4.1 – Better stock/ equipment management to optimize distribution and reduce wastage

This program comprises of projects aimed at improving overall management, distribution and visibility of medical equipment and supplies. By implementing these projects, there will be reduction in the wastage of resources and better distribution of supplies. Health facilities can view the stocks across other facilities and accordingly place requisition from other facilities where is surplus.

6.8.1.1 Project 4.1.1 – Integrate to drug inventory system at hospital level.

Background

The Drug Vaccine and Equipment Division (DVED) under the Department of Medical Services have implement drug inventory system called Bhutan Medical Supply Management System (BMSMS) also known as DigBY. The system is build on Microsoft Access as a standalone desktop application and is being used for both procurement and inventory of drugs and non drugs (medical equipments).

The system was developed sometimes in 2005 with the financial support from DANIDA. A consultant was hired to develop the system and IT staffs from Ministry of Health were involved in the development.

Current situation

The dug inventory system is currently used at DVED for procurement and management of both drugs and non drugs items. The system is housed at DVED and is being manned by one IT person. The systems capture the entire tendering process till the final stage of procurement and the physical delivery of the products.

Once the products are delivered, it is entered into the system for inventory management. Various reports can be generated from the system. Since it is not a web based application, the system is installed in individual computers in the districts. The reports generated from the system are send either via email or secondary storage device such as drive and CD to the DVED and is accordingly updated into the system at DEVD.

Besides entering the inventory into the system and report facility, a physical hard copy is also maintained by the DEVD staff.

Current Challenges

The Bhutan Medical Supply and Management System (BMSMS) faces a lot of challenges owing to it being a desktop application. Some of the major challenges facing the BMSMS are:

i. Physical installation of application in all the computers that often results in wastage of time and resources by travelling.
ii. Frequent break-down of client computers leading the re-installation of application.

iii. Monitoring of drugs distribution, usage and availability is not possible as it is not a web-based application.
iv. Information and reports are generated not real time.
v. No standard coding for equipments often leading to erroneous reports.
vi. Lack of training for the users.

Future plan

In order to overcome the current challenges and shortcoming in the present system:

i. BMSMS will be upgraded to a web-based application with additional features and functionality.
ii. To ensure that the drug usage is accurately monitored, it will be integrated with the HIS at the district level.
iii. Monitoring of drug usage to reduce wastage and misuse of drugs and medicine is important for reporting purpose as well as for proper management and distribution of drugs and medicine. However, it is not possible with the current system. By integrating drug inventory with HIS, monitoring of drugs and medicine will be possible at the hospital level. It will help reduce misuse and reduce waste.
iv. The hospitals will know the status of inventory of drugs and medicine at their level and also across other hospitals. It will help re-appropriation of drugs and medicine amongst hospitals in case of excess and shortage at one hospital or other.
v. For MoH, it will be a good tool for monitoring and evaluation of movement and use of drugs and medicine. It will curtail misuse and wastage of drugs and medicine.

6.8.1.2 Project 4.1.2 – Implement Asset Management System for Medical Equipment

Background

The Ministry of Health procures and distributes large amount of medical equipments to health facilities around the country. The equipment procured varies from simple and not so expensive to a complex and expensive equipments.

The equipments are procured through competitive bidding process centrally and are distributed to the health centers around the country.

Current Situation

The Bhutan Medical Supply and Management System (BMSMS) commonly known as DiBGY is used to manage the inventory of medical equipments. The system is housed at DVED and is being manned by one IT person. The systems capture the entire tendering process till the final stage of procurement and the physical delivery of the products.

Once the products are delivered, it is entered into the system for inventory management. Various reports can be generated from the system. Since it is not a web based application, the system is installed in individual computers in the districts. The reports generated from the system are send either via email or

secondary storage device such as drive and CD to the DVED and is accordingly updated into the system at DEVD.

Besides entering the inventory into the system and report facility, a physical hard copy is also maintained by the DEVD staff.

Current Challenges

Since there is no separate system to manage the inventory of medical equipment, it is maintained together with the drug item in DiGBY system and therefore faces the same challenges as encountered in the present DiGBY system.

i. Physical installation of application in all the computers that often results in wastage of time and resources by travelling.
ii. Frequent break down of client computers leading the reinstallation of application.
iii. Monitoring of medical equipment distribution, usage, depreciation, utility etc is not possible as it is not a web-based application.
iv. Information and reports are not real time.
v. No standard coding for equipments often leading to an erroneous report.
vi. Lack of training for the users
vii. Design issues

Future plan

In of the important reason why DiGBY system becomes complicated is because it is used to manage the inventory of both drug and non-drug items. Therefore in order to overcome this issue and to make the DiGBY system more manageable:

i. Implement separate system for managing medical equipment (non drug).
ii. DiGBY system to manage the inventory of just the drug supplies, distribution, monitoring.
iii. Medical equipments being fixed assets have lifetime and depreciation and unlike drugs and medicine it is non consumable. It depreciates over time and finally has to be replaced or repaired. By implementing separate assets management system for medical equipment, it will allow for better management of both the medical equipment and the drugs and medicine.
iv. Currently, as both equipment and drugs are managed through single system, it becomes complicated. Neither can we properly manage the drugs and medicine, nor can medical equipment be properly managed and monitored. By implementing the assessment management system for medical equipment, we can properly monitor and manage medical equipments as well as drugs and medicine.
v. It is necessary for medical equipment, especially those that require maintenance over its useful life, to have a separate asset management system. That system should track the equipment over its entire life cycle – including all maintenance. – so that there is record of when it was last serviced, how many times it broke down, etc. In order to do so, there must also be an asset tagging process.

6.8.1.3 Project 4.1.3 – Implement Stock Management System for Traditional Medicine

Background

The traditional medicine is manufactured and packed in the country unlike the modern medicine which is procured from other countries. Over the past year, the stock management is becoming increasingly difficult and heavy. The proper stock management system will go a long way in improving efficiency and reducing waste.

Current situation

Stock Management System to maintain and manage raw materials, packaging materials and finished products online.

Current Challenges

i. The application is limited to stock management and status reporting only. It does not cover inventory and other management aspects such as QA system, production planning, quality planning, material requirement planning, sales and marketing planning, etc.
ii. Lacks audit trail and do not comply with regulatory norms like 21 CFR part 11 or EU GMP, annex 11 or any other requirements.
iii. Lacks technical capacity or IT expert to handle IT related systems.
iv. The application user interface is not intuitive.
v. Lacks system to fully support the implementation of such system.

Future Plans

i. The goal is to implement computerized Managing Information System (MIS) or ERP system supporting and mastering procurement, production planning, sales and other enterprise operations.
ii. The proposed MIS computer system should support:
    a. collection of information and data from various modules of MSP at real time,
    b. storing data in convenient format for easy retrieval,
    c. transferring all the necessary data between modules
    d. purchasing
    e. manufacturing planning,
    f. manufacturing management
    g. sales
    h. financial activities
iii. Be expandable with other modules (ex. Financial Controlling, HR etc.) and interfaces to other systems (MES, LIMS) in future.
iv. Include hardware and software component for collection of inputs and analysis from various modules, central data processing units for storing data and logics.
v. Be compliant to 21 CFR part 11 and/or EU GMP, annex 11, in particular it should assure traceability of materials and products and data security and integrity.

6.9 Strategic Thrusts #5 – Greater ICT value to healthcare industry

6.9.1 Program 5.1 – Build a MOH-centric ICT organisation (MOIC)

This program comprises of projects aimed at improving overall ICT management in MoH and leverage on the ICT resource available to MoH. For instance, by setting up ICT division under MoH, it will help provide better coordination of efforts and projects. Other project such as upgrading the skills of health workers and technical skills of ICT staff will go a long way in increasing their productivity thereby realizing greater ICT value to the MoH.

6.9.1.1 Project 5.1.1 – Set-up a full ICT Division under leadership of a Chief ICT Officer to be appointed to consolidate and manage all MOH ICT projects

Background

Bhutan joined the ICT revolution with the formal launch of internet in 1999. Since then steady progress has been made to leverage ICT for all round development of the nation. The Royal Government's ICT Vision is to create "An ICT-enabled, knowledge-based society as a foundation for Gross National Happiness".

The government also declared ICT as an "integral strategy" for good governance. A number of systems have been implemented and continues to ICTise its functions. The Royal Civil Service Commission (RCSC) approved the set-up of ICT unit in each Ministry during the 10 FYP. In order to better organize the ICT Human Resources under the Civil Service, the RCSC approved MOIC's proposal to make MOIC the parent organization of all ICT professionals in the Civil Service in 2009. The main objective of the proposal was to enable Ministries and Agencies to fully leverage ICT to deliver excellent services to the people of Bhutan by improving the capacity of the ICT professionals and professionalizing ICT management practices.

ICT implementation in the Royal Government continues to gain maturity and also complexity by the year. The expectations on ICT and the responsibilities of ICT professionals have correspondingly increased both in depth and coverage. This situation calls for specialized skills in varied areas and high level of professionalism.

Current situation

Currently, only one or two ICT professionals manage the entire requirement of an agency from day-to-day operations to development of new systems, with limited planning work. In addition, other requirements such as information and system security have become new imperatives as more and more information are put online. The current system of managing ICT in the RGoB is increasingly challenged and is fast becoming ineffective to provide the range and quality of services demanded. The set-up is also far from conducive for the ICT professionals themselves who often work in isolation. There is limited career development, and often they do not have anyone who is ICT-trained in their agency to mentor them. On the other hand, despite RGOB's efforts, uncoordinated and redundant efforts still remain, mainly attributable to the current set-up.

Some of the key challenges are that the ICT professionals are too involved in operational work and they lacked the opportunity and capability to plan and strategize. As a result, the agencies have the perception that ICT are not adding value and to a certain extent, underutilised. ICT professionals, on the other hand, do not find the work challenging.

As the ICT professionals are thinly spread even within the agencies, they have no choice but to end up doing all kinds of ICT work, from trouble shooting to application development. As a result, they do not have a chance to focus and specialize on specific areas of ICT. As a result of all these factors, the ICT professionals in RGoB are generally not very motivated.

Current Situation - ROLES AND RESPONSIBILITIES OF ICT PROFESSIONALS

Currently, the roles and responsibilities of the ICT professionals are not defined properly against each roles/position levels and are grouped in general for each position. As such, the ICT professionals end up doing more of operation and maintenance work. In some cases, they might even be assigned non-ICT responsibilities due to lack of proper roles defined for them. In other situations, there is a mismatch between the skills and knowledge they acquired from their studies, eg., a person with a Masters in Computer Science is currently responsible for trouble shooting, training of clerks, software development, updating of website and server maintenance at the agency he is working in.

At the moment, due to lack of proper job responsibilities, there is no defined career path for ICT professionals and they do not have the opportunity to specialize in their field of interest. The current set-up has limited training opportunity and exposure due to lack of proper Human Resource management and the high dependence on availability of project funds. Moreover, some Agencies are under the impression that the parent organization is already taking care of the training and development aspects of the ICT professionals and they are therefore not sending the ICT professionals for training.

Current Situation - ICT MANAGEMENT PROCESSES

There is generally no consistent practice in the way ICT projects are being managed today. Reason being that the project teams are working mostly in silos and there is no central body to define standard process and practices for the management of ICT projects. As a result, the quality of project delivery is impacted adversely.

Likewise, there is little emphasis placed on the development of ICT plans at the Ministry and Agency level. This is because ICT is generally not recognized as an important tool that could help achieve the goals of the Ministry / Agency and are therefore seen as low priority. This is exacerbated by the fact that ICT professionals are too involved in operational work, and as such they lack capability and opportunities to strategize and plan for ICT initiatives that can help their agency realize their goals.

Current situation - COMMUNICATIONS

Communications play a vital role in ensuring that work carried out by various parts of the organization can be better coordinated and aligned. It essentially provides a platform to facilitate information sharing and discussion forums for providing technical solutions and problem solving.

At the moment, MoIC do not have a comprehensive set of communications forum to share ICT-related information to both the ICT professionals and to the RGoB leadership. The availability of a comprehensive set of communications forum will provide the RGoB leadership with greater visibility of what ICT can do for the Government and for MoIC to seek leadership support for ICT initiatives. It will also facilitate ICT professionals to work together in closer collaboration, ensure standard practices, and reduce redundancy and thereby optimize resource utilizations.

Future plan

The Royal Government prioritized Information Communication Technology (ICT) with the vision to create an ICT-enabled knowledge-based society. Apart from building adequate infrastructure and ensuring a healthy regulatory environment, Ministry of Information and Communications (MoIC), as the responsible Ministry, emphasizes the need for a team of specialized ICT professionals to serve the needs of the government and the people of Bhutan to achieve the national ICT vision, Department of Information Technology and Telecom (DITT), MoIC was, therefore, given the mandate to organize, train, and manage the ICT professionals in the government system as a skilled team to provide the full range of ICT services.

The "ICT Management" initiative to manage ICT Professionals is a strategy to strengthen the institutional set- up to meet the growing demands placed on the ICT industry and to streamline the Government's ICT planning and responses to the evolving needs. The ICT team will serve as a holistic support mechanism to enable all Ministries and Government agencies to achieve their goals by tapping on ICT as the enabling tool.

ROLES AND RESPONSIBILITIES OF ICT PROFESSIONALS

Key considerations in developing the roles and responsibilities

Creating separate roles and responsibilities for Infrastructure and Application tracks.

The ICT professionals will now have the option to choose between two career paths, Infrastructure Track and Application Track. ICT professionals whose interests are inclined towards programming and software applications type of work could choose the Application Track while those who are interests are inclined towards networks, systems administrations type of work could choose the Infrastructure Track.

Enhancing existing roles in the BCSR

Existing roles for ICT professionals as defined in the BCSR have been enhanced to reflect more specific and clearer job responsibility. The existing roles that are enhanced are:

- ICT Management
- Systems Analysis
- Software Development
- Application Support
- Network Analysis
- Systems Administration
- Security Analysis
- Infrastructure Support

Defining new roles

Recognizing that there are greater expectations from ICT professionals in carrying out a more varied nature of ICT work in the RGoB, it is proposed that five new roles be created to supplement the existing eight roles. The five new roles are:

- Project Management
- Application Specialist
- Business Analysis
- Telecom Analysis
- Infrastructure Specialist

Specialization depending on respective ICT professional's field of interest

With the initiation of new roles and responsibilities structure, there will be more specialization of work done by each ICT professionals, hereon, based on their field of interest and expertise. There will be decrease in the duplication of work.

ICT MANAGEMENT PROCESSES

Areas to be covered in professionalizing ICT management practices

In order to professionalize the way we carry out ICT development activities, it is important to standardize ICT management practices. A standard ICT planning process will help agencies to strategically plan programmes and projects, and make best use of ICT tools to realize the goals of the Ministries and Agencies.

Under the ICT Management System, the following ICT management processes are covered:

- Five Year Planning;
- Annual Work Planning;
- Helpdesk Management
- Infrastructure and Facility Management;
- Problem Management;
- Communications Planning and Management;
- System Change Management;
- Project Management;
- Inspection & User Acceptance Testing;
- Systems Analysis and Design; and
- ICT Procurement

The two planning processes are deemed to be very important as the timing is just right for the Ministries and Agencies to undertake the ICT planning in the coming year.

As for the rest of the ICT management processes, MoIC plans to tap on the collective experience and expertise of the ICT professionals in RGoB to co-create these processes in the coming years.

Five-Year Planning process

This process is in line with the standard five year planning process of GNHC. The only addition is the role of the parent agency. In this process the stakeholders involved, namely GNHC, MoIC, Agency and Agency ICT unit, will have clearly defined roles.

As a leading agency on ICT, MoIC will help determine the Sector Key Result Areas to achieve the overall five-year plans of the government. The role of MoIC also includes issuing ICT advisory to all agencies and reviewing the ICT plans and programmes submitted by the Agencies' ICT units, to check for redundancies and also to determine HR requirement. ICT advisory will contain details on the important ICT initiatives within the government. An important aspect of the process is that the Agencies' ICT units will communicate directly with DITT so as to prevent extra administrative burden on the agency.

This standard process will help align the agency specific plans and programmes to the Whole of Government (WOG) plans and programmes.

Annual Work Planning process

The annual work planning process will contain specific details on the activities to be carried out in one particular year. Here the activities will be a part of the five year plans and programmes. Therefore, through this process we can ensure that the annual plans are aligned with the five-year plans and programmes.

One of the most important components of the annual work planning process is the review of the plans carried out by DITT. The review will be carried out, firstly to make sure that the plans and programmes that are targeted within the yearly work plan are aligned with the five-year plans and programmes. They will also be checked for redundancy and human resource requirement.

DITT will maintain direct communication with the Agency ICT units in order to minimize the administrative burden on the agencies. A standard template will be used by the Agency ICT units to include details on the programmes and projects, including details on budget, HR requirements, and the start and end of the project.

COMMUNICATIONS

Communications forums to be covered

The communications forums have two groups of target audience: ICT professionals and RGoB leadership. Under the ICT Management System, the following communications forums are covered:

For ICT Professionals:

- ICT Conference;
- ICT Head Meeting;
- DITT-level Orientation; and
- Technical Discussions.

For RGoB Leadership:

- Committee of Secretaries (COS) Meeting;
- Dzongdags' Conference; and

- Senior User Management Meeting.

For both:

- Portal

ICT Conference:

The ICT Conference is an important event planned to be organized annually to address the whole of ICT professionals. The objective of this conference is:

- Keeping staff informed and in touch; and
- Acknowledging achievements.

In order to meet the objective of this forum, various agenda items have been proposed as indicated below:

- Review past achievement
- Current status/challenges
- Looking forward
- HR and organizational matters
- Networking

ICT Head Meeting:

ICT Head meeting is proposed for Agency ICT Heads only. This meeting is to be organized once every two to three months1. The frequent meeting for ICT Heads is important to keep them onboard with the following aims and objectives:

Achievement of ICT Alignment government-wide; Ensure uniform ICT development and implementation; in all government agencies; Ensure standard practices are followed; Resolve challenges; and Identify opportunities.

MoIC-Level Orientation:

Existing practice does not address in providing orientation or induction programmes to recruits. Orientation program is important for recruits to understand on the strategic ICT planning, policies and programmes as well as projects and activities being implemented across the agencies. The orientation program also facilitates recruits to clearly understand their roles and responsibilities and prepare them for the job.

Technical Meetings:

The objective of these technical meetings are for the expert groups to provide solutions to common problems faced by Agency ICT divisions and to develop and maintain ICT policies and standard ICT practices/processes eg. project management, infocomm security, helpdesk management. These meetings will take place on a need basis, and agenda of these meeting determined by the expert groups themselves. Members of these expert groups are identified based on their areas of expertise and experience.

6.9.2 Program 5.2 – Develop healthcare ICT capability

This program aims at improving the overall productivity and efficiency of the health care professionals and ICT staff in MoH. Projects such as e-learning and period ICT training for health workers will be implemented to ensure that they keep themselves abreast with technology and new developments in health care sector.

6.9.2.1 Project 5.2.1 – Develop healthcare industry-specific training programs for ICT leaders and personnel

Background

ICT can play increasingly bigger role in delivering health care services to the citizens at a minimal cost. It can overcome the challenges posed by topography and dispersed settlement.

In order to reap full benefit of ICT, Ministry of Health has rolled out number of system such as HHC, HMIS HIS etc. With the development and finalization of ICT master plan for health care sector, it is expected that more and more health care services will be delivered via ICT and ICT enabled services.

To ensure that these ICT applications and systems are built, managed and up graded to meet the requirement of changing time and technology, a healthcare industry specific training programs for ICT leaders and personnel is required.

Current situation

The ICT unit in the Ministry of Health is directly under the Secretariat and comprises of 8 staff. One of the staff is currently on study leave till 2014 to pursue his Bachelors Degree, while one is on extraordinary leave for one year due to domestic reason. One is one deputation to HMIS temporarily upon approval by the HR committee.

The ICT personnel under the department, division and referral hospitals are no reflected under the strength of ICT unit.

The training and qualifications varies from diploma to masters levels with no healthcare industry specific training and qualification. The only specific training they received is during the development of older system such as HMIS, DiGBY etc.

The current pool of ICT human resources therefore does not possess any healthcare industry-specific training.

Current Challenges

i. Lack of understanding and requirement of health systems applications by ICT
ii. Health care professionals and specialist not understanding the ICT and ICT specific applications and system for health care.
iii. No adequate training for ICT staff to manage and troubleshoot systems and applications that are currently being implemented such as HHC, HIS etc.

iv. Ad-hoc transfer of ICT staffs that are trained in certain healthcare industry-specific area such as Telemedicine.
v. Lack of health care informatics

Future plan

To ensure innovation, continuity, sustainability and management of health ICT systems and applications, a healthcare industry-specific training for ICT leaders and personnel is required. This training will equip the ICT professionals in ministry of health to drive health care ICT initiative by designing, developing, implementing and managing the ICT applications and systems in the future and present.

6.9.2.2 Project 5.2.1 –Run periodic ICT trainings for health workers

Background

With the drafting and coming up of health ICT master plan, it is imperative that more and more health care services will be deliver through ICT and ICT enabled services. This implies that our health workers and health care professionals must be up to date with ICT skills and knowledge in order for them to be more effective and productive.

Besides keeping themselves updated with ICT skills and knowledge, they must also be conversant with the ICT systems and applications that will be developed and deployed as result of this ICT master plan.

Current situation

The current composition of health care professionals/health workers consists of mix of people from diverse background in terms of educational qualifications and degrees. At the BHUs' level, the health workers are basically a certificate or diploma holders mostly the graduates of Royal Institute of Health Sciences. In general hospital, regional referral hospitals and national referral hospitals we have a mix of people from certificate holders to a specialist in various fields.

Accordingly the ICT literacy and skills of these people also vary to a large extent. While some have fairly average skills, others are just a beginner. Therefore, there is a need to upgrade the ICT skills of our health workers from time to time.

Current Challenges

i. Due to the lack of ICT skills and knowledge, users are not willing to use the systems effectively leading to a failure of ICT systems and applications.
ii. Health workers, especially at the BHUs' do not have basic ICT skills and therefore becomes inefficient.
iii. Lack of ICT skills compel our health worker to resort to paper work thereby rendering ineffective and monotonous.
iv. A wider communication gap due to our health workers not being able to use ICT for communication.

Future Plan

Periodic training of health workers on basic ICT skills and health ICT applications and systems is a prerequisite to successful adoption and implementation of health ICT application and systems nationwide. Besides successful adoption and implementation of ICT in health, it will also improve the efficiency and productivity of our health workers.

Currently, most of the health workers lack the general and basic ICT skills such as Microsoft office application, basic troubleshooting, surfing websites and using emails for communication. These are some of the essentials skills that our health workers lack. Therefore, comprehensive training on these components will be carried out.

Besides, there are some health specific applications such as HMIS (Health Management Information System), HIS (Hospital Information System), PHL (Public Health Lab), Telemedicine and many such systems and applications will be developed and deployed as a result of this master plan. Our health workers do not have adequate training to use these systems confidently which often results in under use of this systems and application. Therefore, health system specific user training will be carried out for health workers.

There are two levels of training. Basic ICT skills should be for health workers. Some of these can be incorporated into the orientation/induction training for new staff – so that everyone has a level footing. Some can be elective modules that can be done over a period of time. The other level of training refers to specific applications that some users must use – e.g. a lab technician must know how to operate the LIS (Laboratory Information System), the patient service agent must know how to operate the HIS. These are part of the training for someone to be proficient at doing their work, and should be built into their job orientation before they are allowed to operate independently.

The first phase of training should be based on first a catch up phase – how many people are working in the healthcare sector today and need to be 'taught' so that the basic level is attained – that is a project in itself and requires proper funding and planning. After that is the maintenance phase – which is more attuned to this 80 health workers trained in basic skills every year – probably more to cover the new joiners. It may also be necessary to figure how to capture the proficiency levels of all healthcare workers so as not to repeat the same training for a staff more than once.

Key performance indicators

A total of 80 health workers will be trained every year in basic ICT skills

6.9.2.3 Project 5.2.3 – Develop e-Learning platform for health worker

Background

A virtual learning environment (VLE) is a system designed to support teaching and learning in an educational setting. A VLE will normally work over the internet and provide a collection of tools such as those for assessment, communication, uploading of content, return of student's work such as assignments, collecting and organizing student grades, questionnaires, etc. VLEs are often used in schools and

universities in order to make the learning experience more interactive. The VLE/LMS /e-learning of the college has been setup to reduce the network flow and data stored in the college mail server and enhance teaching and learning under the Royal University of Bhutan. Moreover, VLE can also save printing papers and help for long term storage of notes for the students. Royal University of Bhutan's VLE is the online educational platform catering to both online and face-to-face teaching and learning. They want more train and time to time we have to update new version.

Future plan

Web-based technology has a dramatic impact on learning and teaching. A framework that delineates the relationships between learner control and learning effectiveness is absent. This study aims to fill this void. Our work focuses on the effectiveness of a technology-mediated virtual learning environment (VLE) in the context of basic information technology skills training. Students in the VLE environment report higher levels of learning climate than their counterparts in the traditional environment. The implications of this study are discussed, and further research directions are proposed. In the future, the authors will assess the developed product and verify the possibility of using it in VLE.

6.9.2.4 Project 5.2.4 – Develop web-based Human Resource Information System

Background

The MOH recognise the need to have a well functioning HR Information System but the system in place in the HR Division is not yet fully developed. The HR Information systems should eventually be linked and integrated with the Health Information & Management System (HIMS) so that service delivery health and HR data provide a more comprehensive overview of HRH and support health and HRH planning and decision-making.

While the HRIS is producing fairly comprehensive information the consolidation, consistency and utilization of the data could be strengthened. In order to effectively achieve the HR Projections and achieve the short, medium and long-term projections and targets, it is critical that the MOH has robust HR information management systems and capacity. It will need accurate and up-to-date HR information so that it can track recruitment, distribution, skills mix, staff movement, and new requirements.

Objectives

The objective of the HRIS within the Ministry is:

- To enable the MoH effectively implement and monitor the Workforce Plan and ultimately achieve improved standards of care, expanded coverage and higher utilisation of services.
- To provide timely, accurate and reliable HR information for effective decision-making across the health sector and for policy formulation in the training, development and deployment.

Current situation

The Royal Civil Service Commission has a government wide information system for whole of government agencies known as Civil Service Information System (CSIS). It is web based information system that caters to the generic need of whole of civil service.

While CSIS is in place, there are unique requirement for MoH which CSIS does not cater to. In order to meet the unique requirement of MoH, a personal information system (PIS) was developed in-house by ICT unit of MoH. However, the system is not fully functional at the moment.

Current challenges

i. No real time information on health Human Resource both quality and quantity.
ii. The quality and reliability of information on the current and future outputs of the training institutions needs to be improved.
iii. Given the large numbers that will need to be trained and produced through the pre-service and in-service training systems in the coming years to meet the proposed requirements, it is essential that training information systems are in place.
iv. There is currently insufficient information available on the number of trained health professionals currently on training and those coming into the labour market over the next 3-5 years. This will be critical given the significant numbers of highly qualified staff that are required over the next five years.

Future plan

- Develop HRIS within the MoH
- Strengthen the HR information system so that it produces reliable data and monitor the health workforce and meets the information needs of MOH and other key stakeholders.
- Strengthen linkages between the HRIS and HMIS.
- Strengthened HRIS on health workforce including training inventory both for in-country and ex-country training programmes.
- Implement the HRIS

6.9.2.5 Project 5.2.4 – Develop web-based intranet System for office automation (internal web)

Background

Internal communication, sharing of information online and scheduling of events are important tool for cost-effective functioning of MoH in a day to day activities. A robust internal web will be crucial for over all functioning of the ministry and will serve as effective monitoring tool for management. Such a system will serve multiple functions. It can be used a medium for internal communication and scheduling of events and meeting can be done via internal web.
However, the intranet will not be accessible for the outsiders.

Current situation

The MoH website is used to disseminate information and post announcements and events and it is accessible and visible to the general public as well. Besides, different forms and materials are also uploaded on the website on the public domain. Currently, there is no intranet system that will cater to the infernal mater at MoH and the materials which are for internal requirement are also on the public domain

Current challenges

i. Documents and materials meant for internal consumption are on the public domain
ii. No clear visibility of staff movement and their official schedule.
iii. Scheduling of meetings done on ad-hoc basis thereby resulting of too many meetings being scheduled.
iv. Scheduling of activities such as “upcoming events” and other activities done via MoH website in public domain.

Future plan

In order to address the above challenges, following plan is proposed;

i. Develop and implement robust internal website for MoH in support of automating office process
ii. The documents and materials meant for internal consumption to be visible only for MoH staff.
iii. Internal website to be accessible only to MoH staff via unique user id and password
iv. The internal website to have features to schedule meetings and appointments of MoH staff and should be accessible to all the MoH staff
v. The internal website will have features to post events and activities of MoH
vi. The website will capture the staff information such as whether they are on tour, seminar, study or attending meetings etc.
vii. Officer orders, circulars, memo etc to be sent via internal website thereby reducing paper flow and improving efficiency and reducing paper waste.

Key performance indicator

The internal website will be functional by second half of 2014.

7 IMPLEMENTATION ROADMAP

The MOH ICT programs and projects described in Chapter 6 will be delivered over a period of 5 years from 2014 to 2018. The Implementation Roadmap presents these ICT programs and projects by desired outcomes against a 5-year timeline (see Annex A). Details reflected include the Programs and Project Names, Priority, Target Development / Review / Completion Timeframe and Estimated Implementation Cost.

The KPI for each Strategic Thrusts are provided in Annex B.

8 NEXT STEPS

8.1 What's Next

This Masterplan presents ICT initiatives and projects that have been validated through stakeholder engagements comprising bilateral meetings, and roundtable feedback and review sessions. It is aligned to the GNH principles, and leverages the best practices gleaned from the Singapore experience.

8.2 Critical Success Factor

MOH ICT Masterplan is an ambitious and visionary plan for a nation. Like all other plans and successful implementation, there are Critical Success Factors that the Ministry should be aware of.

i. Management commitment
ii. Support from users
iii. Capability development of ICT resources and continued involvement of trained resources – training of ICT resources and working out a procedure with MoIC to ensure that resources are not transferred out, thereby affecting key initiatives.
iv. Implement a structure for good ICT governance – MoIC is currently implementing an ICT Management Systems to facilitate better planning and monitoring of projects. MOH can study the relevance of the IMS to MOH, as adopt the guidelines for their own implementation
v. Close collaboration with MoIC for common interest projects; especially in the areas of network connectivity, capability development and ICT governance.

New strategies that are time tested will work the best. It is critical for the Team to review the strategies outlined in this Masterplan to ensure it is always aligned with the rapid changes happening within Bhutan as well as development around the world. Strategies that are deployed need to be tested to ensure it fits the requirements and expectations.

ANNEX A - MASTERPLAN IMPLEMENTATION ROADMAP

Strategic Thrust 1 Effective Disease Prevention and Control												
	Lead Agency	Projected Implementation Cost (Nu. $,000)	H1 FY2014	H2 FY2014	H1 FY2015	H2 FY2015	H1 FY2016	H2 FY2016	H1 FY2017	H2 FY2017	H1 FY2018	H2 FY2018
Programme 1.1 - Improve system of data collection, analysis and reporting for health indicators												
▪ Project 1.1.1 – Implement a more robust Health Management Information	MoH	**34.23**										
Programme 1.2 - Strengthen health promotion	MoH											
▪ Project 1.2.1 - Develop health broadcast notifications and disseminate educational information (social media etc)	MoH	**10**										
▪ Project 1.2.2 - Develop maternal and child health tracking system	MoH	10										

Strategic Thrust 2 Improving Care Accessibility												
	Lead Agency	Projected Implementation Cost (Nu in Million)	H1 FY2014	H2 FY2014	H1 FY2015	H2 FY2015	H1 FY2016	H2 FY2016	H1 FY2017	H2 FY2017	H1 FY2018	H2 FY2018
Programme 2.1 - Enhance local infrastructure & connectivity												
▪ Project 2.1.1 - Set -up LAN in hospitals	MoH	13.5										
▪ Project 2.1.2 - Set-up Bhutan Health Network connectivity in district hospitals	MoIC/MoH	13.5										
▪ Project 2.1.3 - Last mile Bhutan Health Network connectivity from gewog center to all the BHU's (MOIC)	MoIC/MoH	In consultation with MoIC										
Programme 2.2 - Improve Call Centre Service												
▪ Project 2.2.1 - Upgrade and enhance HHC's Computer Aided Dispatch Systems	MoH	1.5										
▪ Project 2.2.2 - Incorporate Vehicle Tracking System for ambulances	MoH	.25 (implementation) 14.1(14.35)										
Programme 2.3 - Improve care accessibility												
▪ Project 2.3.1 - Mobile health application to send alerts/reminders/appointment date (TB medication 6 months)	MoH											
▪ Project 2.3.2 - Upgrade & extend use of telemedicine	MoH	**1.55**										

Strategic Thrust 2 Improving Care Accessibility											
project											

Strategic Thrust 3 Improving Patient Services											
	Lead Agency	Projected Implementation Cost (Nu. In Million)	H1 FY2014	H2 FY2014	H1 FY2015	H2 FY2015	H1 FY2016	H2 FY2016	H1 FY2017	H2 FY2017	H1 FY2018	H2 FY2018
Programme 3.1 - Improve patient experience at care facilities												
▪ Project 3.1.1 - Standardize health data & identifier codes	MoH	.5										
▪ Project 3.1.2 – Implement a Hospital Information System	MoH	.95										
▪ Project 3.1.3 - Implement Patient Information Mgmt System (PIMS) for Traditional Medicine	MoH	1 mil (to check)										
▪ Project 3.1.4 - Upgrade & centralise Laboratory Information System (LIS)	MoH	To base on quote										
▪ Project 3.1.5 - Implement PACS at JDWNRH	MoH	To base on quote										

Strategic Thrust 4 Better Visibility of Medical Equipment and Supplies Usage												
	Lead Agency	Projected Implementation Cost (Nu. In Million)	H1 FY2014	H2 FY2014	H1 FY2015	H2 FY2015	H1 FY2016	H2 FY2016	H1 FY2017	H2 FY2017	H1 FY2018	H2 FY2018
Programme 4.1 - Better stock/ equipment management to optimize distribution and reduce wastage												
▪ Project 4.1.1 - Integrate to drug inventory system at hospital level	MoH	10										
▪ Project 4.1.2 - Implement Asset Management System for medical equipment	MoH	10										
▪ Project 4.1.3 - Implement Stock Management System for traditional medicine	MoH	2										

Strategic Thrust 5 Greater ICT value to healthcare industry												
	Lead Agency	Projected Implementation Cost (Nu. In Million)	H1 FY2014	H2 FY2014	H1 FY2015	H2 FY2015	H1 FY2016	H2 FY2016	H1 FY2017	H2 FY2017	H1 FY2018	H2 FY2018
Programme 5.1 - Build a MOH-centric ICT organisation (MOIC)												
▪ Project 5.1.1 - Set-up a full ICT Division under leadership of a Chief ICT Officer to be appointed to consolidate and manage all MOH ICT projects	RCSC/MoIC/MoH	5										
Programme 5.2 - Develop healthcare ICT capability												
▪ Project 5.2.1 - Develop healthcare industry-specific training programs for ICT leaders and personnel	MoH	4										
▪ Project 5.2.2 - Run periodic ICT trainings for health workers	MoH	7.5										
▪ Project 5.2.3 – Develop e-Learning platform for health worker	MoH	5										
▪ Project 5.2.4- Develop web-based HRIS	MoH	8										
▪ Project 5.2.5 – Develop web-based intranet for office automation (internal web)	MoH	1										

ANNEX B KEY PERFORMANCE INDEX KPI

Strategic Thrusts	Key Performance Index (KPI)
Effective Disease Prevention and Control	• HMIS measure improve reporting cycle to 4 weeks • 250,000 subscriber to health broadcast notification • 30% increase in institutional child delivery
Improving Care Accessibility	• 15 additional referral and district hospital have LAN • All 106 ambulance are tracked and equipped GPS • >70% patients of identified illness to receive alert
Improving Patient Services	• Ability to share patient identifier and other critical information across systems • HIS implemented in 3 additional referral hospitals • 26 centres with LIS to be upgraded
Better Visibility of Medical Equipment and Supplies Usage	• 3 referral hospitals to have integration of drug inventory • 3 referral hospitals to have Asset Management • Full implementation of Traditional Medicine manufacturer to have stock management system
Greater ICT value to healthcare industry	• Complete ICT profile and leadership model • Develop and incorporate ICT basic into health workers' training schedule in first year course • 5 online courses using e-Learning to be available