Asia-Pacific Telecommunity

"Report on APT Expert Mission in the Field of National Emergency Telecommunications Plan for Bhutan"

Field Survey Period: 24th to 28th September, 2018

JTEC

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Foreword

This APT expert mission in the field of "Emergency Telecommunications Plan of Bhutan" was carried out as per APT authorization letter "APT/CB-4.2.1/2018/BTN-JTEC" dated 25th June 2018.

Bhutan's telecommunication/broadband network is based on terrestrial communication systems, existing network infrastructure is vulnerable to disasters and emergency situation. In near future, there is a plan to use GSAT-9 (SAS) satellite to improve broadcasting and ICT services by establishing backup channels for communication in disaster management and recovery needs.

Therefore, Bhutan's Expected Outcome from this mission as stated was as follows:

(1) Establish National Emergency Telecommunication Plan

(2) Establish Emergency/Disaster Telecommunication Network in Bhutan

(3) Identification of suitable technologies (disaster communication equipment) to be used for emergency communications

(4) Capacity building in relation to emergency telecommunications and disaster preparedness

(5) Mechanism for sharing information and best practices on utilizing ICTs for disaster preparedness, disaster response /relief and reconstruction

Considering all the needs and available facts, the expert mission was carried out from 22nd September to 3rd October 2018.

Upon arrival in Bhutan an inception report was presented in the form of a presentation.

After completion of the planned activities, a final presentation was done in the presence of the stakeholders in disaster management in Bhutan. The outcome is compiled in this report.

For busy executives, a concise Executive Summary is made available in the beginning where, if desired, interested chapters may be scanned at a later time.

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Executive Summary

The Disaster Risk Management Strategy, is formulated as mandated under clause 11 of the Disaster Management Act of Bhutan 2013. The NDMA is responsible for, among other things, allocation of DM related funds; directing agencies to mainstream disaster risk reduction into their development plans, policies, programs and projects. The Royal Government of Bhutan established National Fiber Network connecting its districts and villages with fiber optics down to the block level.

The telecommunication/broadband network is based on terrestrial systems, and existing network infrastructure is vulnerable to disasters and emergency situation. The Govt. has a plan to use GSAT-9 satellite to improve broadcasting and ICT services by establishing backup channels for communication in disaster management and recovery needs.

The Govt. is to guide industry in the restoration of telecommunications services using emergency telecommunication network in the disaster affected areas, and thus requested APT for technical experts' services assistance to establish robust Emergency Communication Network.

Therefore a preparatory survey is carried out where the experts collect information on the existing telecommunication systems, and survey on the establishment of emergency/disaster information network including satellite systems. A national emergency communication needs outline as well as technical personnel training needs also surveyed.

The team proposed an ICT networks with affordable services indispensable for Emergency Telecommunications in Disaster Management monitoring and day to day observation for public safety.

Capacity development for national and local Govt. staff is essential to achieve the vision as developed by the Govt. of Bhutan. Consequently, trainings of local population to develop knowledge on preparedness and response needs, and practical trainings for transferring knowledge into practical skills is necessary.

In this report the process of Information Gathering from remote areas, disaster emergency communication satellite network applications, capacity building for emergency and disaster preparedness as an essential part of knowledge development is described. Finally new technologies & equipment for disaster emergency communications is included for future reference and uses.

Glossary

ABCO	Association for Bhutan Cable Operators
AFD	Administrative and Finance Division
APT	Asia-Pacific Telecommunity
AWSS	All Dielectric Self Support cable
BBS	Bhutan Broadcasting Service
BHU	Basic Health Unit
BICMA	Bhutan InfoComm & Media Authority
BCAA	Bhutan Civil Aviation Authority
BW	Bandwidth
BTL	Bhutan Telecom Ltd
BTCL	Bhutan Tourism Corporation Limited
CPS	Country Partnership Strategy
DDM	Department of Disaster Management
DDMC	Dzongkhag Disaster Management Committee
DHMS	Department of Hydro-Met Services
DITT	Department of Information Technology & Telecom
DM	Disaster Management
DMIS	Disaster Management Information System
DOAT	Dept. of Air Transport
DOIM	Dept. of Information & Media
DRMS	Disaster Risk Management Strategy
GFDRR	Global Facility for Disaster Reduction and Recovery
GNH	Gross National Happiness
HRD	Human Resource Division
GSM	Global System for Mobile Communications
HVCA	Hazard, Vulnerability and Capacity Assessment
ICT	Information & Communication Technology
ICTD	Information and Communication Technology Division
IT	Information Technology
JICA	Japan International Cooperation Agency
Kbps	Kilo Bits per second
LAN	Local Area Network

MB	Megabytes
MDRU	Mobile and Deployable ICT Resource Unit
MoIC	Ministry of Information and Communication
NAPA	National Adaptation Program Action
NDMA	National Disaster Management Authority
OPGW	Optical Grounded Wire cable
PPD	Policy & Planning Division
RSTA	Road Safety & Transport Authority
SAS	South Asian Satellite
Tashi Cell	Tashi InfoComm Limited
UNDP	United Nations Development Program
VoIP	Voice over Internet Protocol
WBG	World Bank Group
WHO	World Health Organization

Acknowledgements

The experts would like to acknowledge the contributions of all partners and Govt. officials in Bhutan as well as in other international organizations. The various dimensions and categories are based on input from individuals during the survey. In particular, we would like to thank Mr. Karma Jamyang, Mr. Karma Sangay for their seamless effort to make this mission very successful.
The team acknowledges the following officials for their valuable time with this mission in taking part in discussions and meetings to attain a very fruitful outcome.

Officials visited and a few interviewed for contribution

Mr. Jigme Thinlye Namgyal	Director General, Department of Information Technology & Telecom, Ministry of Information and Communications
Mr. Jigme Tenzing	Chief of Application division, Department of Information Technology & Telecom, Ministry of Information and Communications
Mr. Sonam Phuntsho	Chief of Division of Telecom & Space, Department of Information Technology & Telecom, Ministry of Information and Communications
Mr. Karma Sangay	Chief of Infrastructure Division, Department of Information Technology & Telecom, Ministry of Information and Communications
Mr.Yeshey Needup	Sr.ICTO, Department of Information Technology & Telecom, Ministry of Information and Communications
Mr. Karma Jamyang	Sr.ICTO, Department of Information Technology & Telecom, Ministry of Information and Communications
Ms. Damchen Zangmo	Sr,ICTO, DITT, Department of Information Technology & Telecom, Ministry of Information and Communications
Mr. Thuenzang Choephel	Engineer, Department of Information Technology & Telecom, Ministry of Information and Communications
Mr. Chencho Dorji	Director General, Bhutan InfoComm and Media Authority
Mr. Wangay Dorji	Chief of License and Compliance division, Bhutan InfoComm and Media Authority
Mr. Lakshuman Chhetri	Chief of Content Management Division, Bhutan InfoComm and Media Authority
Mr. Karma Tshering	Director General, Department of Disaster Management, Ministry of Home & Affairs
Mr. Sangay Dawa	Sr. Program Officer, Department of Disaster Management, Ministry of Home & Affairs
Mr. Yang Dorji	Chief Program Officer, Department of Disaster Management, Ministry of Home & Affairs
Mr. Tshewang Norbu	Department of Disaster Management, Ministry of Home & Affairs

Mr. Yeshey Lodey	Department of Disaster Management, Ministry of Home & Affairs
Mr. Tshering Wangchuk	Department of Disaster Management, Ministry of Home & Affairs
Mr. Pema Singye	Department of Disaster Management, Ministry of Home & Affairs
Mr. Dorji Wangchuk	Department of Disaster Management, Ministry of Home & Affairs
Mr. Karma Tshewang	Technical Director, Bhutan Telecom Limited
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Mr. Sangay Tenzin	Head, Tashi InfoComm Limited
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Mr. Ganga R Sharma	Core Network, General Manager, Tashi InfoComm Limited
Mr. Sonam Dorji	Access Network, General Manager, Tashi InfoComm Limited
Mr. Sangay Dorji	Human Resource General Manager, Tashi InfoComm Limited
Mr. Tshering Wangchuk	Managing Director, Bhutan Broadcasting Service Corporation Limited
Mr. Sherub Tharchen	Chief Engineer, Bhutan Broadcasting Service Corporation Limited
Mr. Tashi Dorji	Head of BBS 2 broadcasting, Bhutan Broadcasting Service Corporation Limited
Mr. Jaga Nath Sharma	Head of BBS 1 Broadcasting, Bhutan Broadcasting Service Corporation Limited
Mr. Kaka Tshering	Head of Radio Broadcasting, Bhutan Broadcasting Service Corporation Limited
Mr. Sherub Gyeltshen	General Secretary, Association for Bhutan Cable Operators
Mr. Dorji Tshering	Dzongdag, Thimphu Dzongkhag Administration
Mr. Ngwang Tashi Dorji	Sr.ICTO, Thimphu Dzongkhag Administration
Ms. Pema Choden	Legal Officer, Thimphu Dzongkhag Administration
Mr. Dorchu Dukpa	Earthquake and Geophysics Division, Department of Geology and Mines, Ministry of Economic Affairs

Program Itinerary of the Expert Mission

Date/Day	Location	Activities
22-Sep/SAT	Travel	Leave Tokyo
23-Sep/SUN	Travel	Arrive Paro
24-Sep/MON	Thimphu	Courtesy call with Secretary, MoIC Discussion with DITT, MoIC Meeting with Bhutan Infocomm & Media Authority (BICMA)
25-Sep/TUE	Thimphu	Meeting and Discussions with DDM Meeting with Bhutan Telecom Ltd (BTL) Meeting with Tashi InfoComm Pvt. Ltd. (Tashi Cell)
26-Sep/WED	Thimphu	Meeting with BBS Meeting with ABCO Meeting with Thimphu Dzongkhag Administration
27-Sep/THU	Thimphu	Discussion at DITT, MoIC
28-Sep/FRI	Thimphu	Discussion at MoIC with relevant Stakeholders
29-Sep/SAT	Travel	Leave Thimphu / Arrive Bangkok
30-Sep/SUN	Travel	Leave Bangkok(Dr. Pramanik, and Mr. Iwasawa) Leave Bangkok/ Arrive New Delhi(Mr. Takahara)
01-Oct/MON	Travel	Arrive Tokyo Meeting with DoT (Mr. Takahara)
2-Oct/TUE	Travel	Leave New Delhi / Arrive Bangkok /Leave Bangkok(Mr. Takahara)
3-Oct/WED		Arrive Tokyo (Mr. Takahara)

Chapter 1 Introduction Objectives and Background

1.1 Scope

A disaster is defined as a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

1.2 Background

A disaster is defined as a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

The Disaster Risk Management Strategy, (DRMS) is formulated as mandated under clause 11 of the Disaster Management Act of Bhutan 2013 and is guided by the Five Year Planning process. The objectives of the DMSF are to provide guidance in implementing rules and regulations pertaining to Disaster Risk Management (DRM); recognize and acknowledge the respective roles of agencies and stakeholders; to establish linkages and coherence between DRM, Climate Change Adaptation (CCA) and sustainable development; and to provide the principles, strategies and priorities to guide the development of various plans and programs for risk prevention and reduction, preparedness, response, recovery and reconstruction measures.

National Disaster Management Authority

Clause 7 of DM Act 2013 established the National Disaster Management Authority (NDMA), as the highest decision making body on disaster management in Bhutan.

The NDMA comprises of:
1. The Prime Minister, as the ex-officio Chairperson;
2. The Minister for Home and Cultural Affairs, ex-officio Vice Chairperson;
3. The Finance Minister;
4. The Secretaries of all Ministries;
5. Gyalpoi Zimpon;
6. Head of the National Environment Commission;
7. President, Bhutan Chamber of Commerce and Industry;
8. Head, Department of Disaster Management as Member Secretary; and
9. Such other member as may be co-opted in accordance with rules framed under the Act.

The NDMA is responsible for approving - national DM strategies, policies; the national DM and Contingency Plan; vulnerability and hazard zonation maps; structural and nonstructural measures, national standards, guidelines and procedures. The NDMA is also responsible for allocation of DM related funds; directing agencies to mainstream disaster risk reduction into their development plans, policies, programs and projects; and ensuring the establishment of an Inter-Ministerial Task Force. In addition, the NDMA has the power to direct any agency including private sector on disaster management; establish/commission research, develop and provide training in the field of disaster management; direct the Department of Disaster Management, Dzongkhag

Disaster Management Committees and agencies including the private sector as may be necessary for the effective implementation of the Act; or perform such other function as may be prescribed under the Act or any law in force.

The DM Act, 2013 classifies disasters in three categories:
- A disaster is classified Type I, if it can be managed with available resources and is within the coping capacity of the Gewog / Thromde concerned.
- A disaster is Type II, if it can be managed with available resources and is within the coping capacity of the Dzongkhag concerned.
- A disaster shall be classified Type III, if the severity and magnitude is so great that it is beyond the available resources and coping capacity of the Dzongkhag concerned.

The NDMA has the authority to reclassify disaster types in accordance with the DM Act 2013 – Rules and Regulations. The chairperson of the DDMC, subject to approval of the NDMA, may declare Type I and II disaster in accordance with the DM Act – Rules and regulations. The authority to proclaim Type III disaster rests with the Druk Gyalpo, on written advice of the Prime Minister.

Dzongkhag Disaster Management Committee:

Clause 24 of the DM Act 2013 mandates every Dzongkhag Administration to constitute a Dzongkhag Disaster Management Committee (DDMC) under the Chairmanship of the Dzongdag.

The DDMC will comprise of:
1. The Dzongda, as Chairperson;
2. A Dzongkhag Welfare Officer of the Druk Gyalpo's Office of People's Welfare, if any;
3. Chairperson of Dzongkhag Tshogdu;
4. All Gups;
5. All Thrompons/ Thromde Thuemi;
6. Superintendent of Police of Officer-In-Charge, Royal Bhutan Police;
7. Drungchen, Zhung Dratshang or Dzongkhag Rabdey;
8. Dzongkhag Disaster Management Officer as Member Secretary; and
9. Such other member as may be co-opted in accordance with the DM Act 2013.

The DDMC is responsible for – Preparing and implementing the Dzongkhag Disaster Management and Contingency Plan; monitoring and evaluating measures for prevention, mitigation, preparedness, response and capacity building taken up by sectors in the Dzongkhag; ensuring establishment and functioning of Critical Disaster Management Facility; ensuring mainstreaming of disaster risk reduction into the local development plan and programs; ensuring compliance of approved hazard zonation and vulnerability maps; ensuring the enforcement of structural and non-structural measures; ensuring communication of hazard/disaster events to the DDM and NDMA; ensure assessments and monitoring reports; ensure promotion of education, awareness, capacity building at dzongkhag and community level; conduct regular mock drills; report on the progress of implementation of the Disaster Management and Contingency Plan; direct Dungkhag, Thromde and Gewog Disaster Management subcommittees, if any; and perform such other functions as prescribed under the Act by the NDMA.

DDMC Subcommittee:

The DDMC may, if it considers necessary, constitute subcommittees at the Dungkhag, Thromde and Gewog levels to assist the DDMC.

All Gups, Thrompons are members of the DDMC and are responsible for preparing the Dzongkhag Disaster Management and Contingency Plan; ensuring mainstreaming of disaster risk reduction into Gewog and Thromde plan, policy, program and project; reporting to the DDMC on the measures taken by each sector on awareness, prevention, mitigation, preparedness, response and capacity building; reporting on a quarterly basis to the Dzongkhag Disaster Management Committee on the implementation of Dzongkhag Disaster Management and Contingency Plan or Gewog or Thromde Disaster Management and Contingency Plan, if any; educating and raising awareness and supporting community capacity building; conducting regular mock drills; facilitating efficient functioning of Critical Disaster Management Facilities; ensuring adherence to hazard zonation and vulnerability map and implementation of structural and non-structural measures; ensuring communication of disaster information to DDMC; conducting disaster response, relief and recovery operation under the direction and supervision of the DDMC; and identifying and mobilizing local resources for response and relief operations.

In order to realize these procedures, we need a network infrastructure that can be used for disaster countermeasures not affected by disasters, disaster response / relief, and reconstruction.

The Royal Government of Bhutan established National Fiber Network connecting its districts and villages with fiber optics down to the block level. The Govt. also made the dark fiber available to the licensed Telcos and ISPs free of cost aimed at expansion of ICT services around the country. Telcos has established Microwave Towers as secondary telecommunication/broadband network as well.

However, since the telecommunication/broadband network is based on terrestrial communication systems, existing network infrastructure is vulnerable to disasters and emergency situation.

In near future, there is a plan to use GSAT-9 (SAS) satellite to improve broadcasting and ICT services by establishing backup channels for communication in disaster management and recovery needs.

The Government is in process of drafting Standard Operating Procedure for Telecommunications Services to respond to disaster, to guide industry in the restoration of telecommunications services using emergency telecommunication network in the disaster affected areas. So far, the Govt. needs technical experts to establish robust Emergency Communication Network.

1.3 Facts and basic data of Bhutan

Bhutan is located on the southern slopes of the eastern Himalayas, lies between latitudes 26°N and 29°N, and longitudes 88°E and 93°E. The land consists mostly of steep and high mountains crisscrossed by a network of swift rivers forming deep valleys before draining into the Indian plains. Elevation rises from 200 m to more than 7,000 m. This geographical diversity with equally diverse climate conditions contributes to Bhutan's outstanding range of biodiversity and ecosystems causing frequent disasters.

The northern region of Bhutan consists of an arc of Eastern Himalayan alpine shrub and meadows reaching up to glaciated mountain peaks with an extremely cold climate at the highest elevations. The valley of Drangme Chhu, where the river crosses the border with India watered by snow-fed rivers are at risk at times.

The Black Mountains in the central region of Bhutan form a watershed between two major river systems: the Mo Chhu and the Drangme Chhu. Peaks in the Black Mountains range between 1,500 and 5,000m above sea level, and fast-flowing rivers have carved out deep gorges in the lower mountain areas.

Land Area	38,394 km^2
Total Area	38,394km^2 (#133)
Population	750,125 (#164)
Population Density	19.54/km^2
Government Type	Constitutional Monarchy
GDP (PPP)	$6.43 Billion
GDP Per Capita	$8,100
Currency	Ngultrum (BTN)

In the south, the Shiwalik Hills are covered with dense Himalayan subtropical broadleaf forests, alluvial lowland river valleys, and mountains up to around 1,500 m above sea level. The foothills descend into the subtropical Plain of about 10 to 15 km wide strip extends into Bhutan. Mountain Rivers, fed by either the melting snow or the monsoon rains, empty into the Brahmaputra River in India.

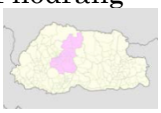
Bhutan consists of 20 Administrative Divisions called Dzongkhag (districts). Each Dzongkhag is subdivided into 205 smaller administrative areas called Gewogs (village blocks).

Name of Dzongkhag and respective population

SL	Dzongkhag	Population	SL	Dzongkhag	Population
1	Bumthang	17,820	11	Samdrup Jongkhar	35,079
2	Chhukha	68,966	12	Samtse	62,590
3	Dagana	24,965	13	Sarpang	46,004
4	Gasa	3,952	14	Thimphu	138,736
5	Haa	13,655	15	Trashigang	45,518
6	Lhuentse	14,437	16	Trashi Yangtse	17,300
7	Monggar	37,150	17	Trongsa	19,960
8	Paro	46,316	18	Tsirang	22,376
9	Pema Gatshel	23,632	19	Wangdue Phodrang	42,186
10	Punakha	28,740	20	Zhemgang	17,763

Dzongkha and 205 Gewogs of Bhutan

Dzongkhag	Gewog	Dzongkhag	Gewog
Bumthang 	Chhoekhor, Chhume, Tang, Ura	Lhuentse 	Gangzur, Khoma, Jarey, Kurtoed, Menbi, Metsho, Minjay, Tsenkhar
Chhukha 	Bjachho, Bongo, Chapcha, Darla, Dungna Geling, Getana,Lokchina, Metakha, Phuentsholing, Sampheling	Mongar 	Balam, Chali, Chaskhar, Drametse,Drepong, Gongdue,Jurmey, Kengkhar, Mongar, Narang, Ngatshang, Saling, Shermuhoong, Silambi, Thangrong, Tsakaling, Tsamang
Dagana 	Dorona, Drujegang, Gesarling, Goshi, Kana, Karmaling, Khebisa, Lajab, Lhamoi Zingkha, Nichula, Trashiding, Tsangkha, Tsendagang, Tseza	Paro 	Dopshari, Doteng, Hungrel, Lamgong, Lungnyi, Naja, Shapa,Tsento, Wangchang
Gasa 	Khamaed,Khatoe, Laya , Lunana	Pema Gatshel 	ChimoongmChokhorling, Chongshing, Dechheling, Dungmaed, Khar, Norbugang, Nanong, Shumar, Yurung, Zobel
Haa 	Bji, Gakiling,Samar, Sangbay,Sangbay,Uesu, Gangzur,Khoma, Jarey, Kurtoed , Menbi Metsho, Minjay, Tsenkhar	Punakha 	Barp, Chhubug, Dzomi, Goenshari,Guma Kabisa,,Lingmukha, Shenga Bjemi Talog, Toepisa,Toewang,

Dzongkhag	Gewog	Dzongkhag	Gewog
Samdrup Jongkhar 	Dewathang, Gomdar, Langchenphu,Lauri, Martshala, Orong, Pemathang, Phuntshothang, Samrang, Serthi, Wangphu	Trashi Yangtse 	Bumdeling,Jamkhar, Khamdang, Ramjar, Toetsh, Tomzhang, Yalang, Yangtse
Samtse 	Dungtoe, Dophoogchen, Duenchukha Namgaychhoeling, Norbugang, Norgaygang Pemaling, Phuentshogpelri, Samtse, Sangngagch hoeling, Tading, Tashicholing Tendruk, Ugentse, Yoeseltse	Trongsa 	Dragteng, Korphoog, Langthil, Nubi, Tangsibji
Sarpang 	Chhuzagang,Chhudzom,Dekiling,Gakiling, Gelephu, Jigmechholing, Samtenling,Senggey Sherzhong, Shompangkha, Tareythang, Umling	Tsirang 	Barshong, Dunglegang, Gosarling, Kikhorthang, Mendrelgang, Patshaling, Phuntenchu, Rangthangling, Semjong, Sergithang, Tsholingkhar, Tsirangtoe
Thimphu 	Chang,Darkala,Genye, Kawang,Lingzhi, Mewang,Naro,ས་Soe	Wangdue Phodrang 	Athang, Bjendag, Darkar, Dangchu, Gangteng,, Gasetsho, Gom, Gasetsho, Wom, Kazhi, Nahi, Nyisho, Phangyul, Phobji, Ruepisa, Sephu, Thedtsho
Trashigang 	Bartsham, Bidung, Kanglung, Kangpar, Khaling, Lumang, Merag, Phongmed, Radi, Sagteng, Samk har, Shongphoog, Thrimshing,Uzorong, Yangnyer	Zhemgang 	Bardo, Bjoka, Goshing, Nangkor, Ngangla, Phangkhar, Shingkhar, Trong

1.4 Survey objectives

The first phase, preparatory survey is considered, here the experts to collect information on the existing terrestrial telecommunication systems that are in practice. The mission surveyed on the establishment of emergency/disaster information network including satellite systems and related ICT applications. A national emergency communication plan as well as technical personnel training needs also considered as required.

The results are summarized and proposed as basic and essential points to be considered in appropriate framework and plan for development with sustainability.

This survey is to achieve an ICT networks with affordable services indispensable for Emergency Telecommunications in Disaster Management monitoring and observation. The Early warning, Disaster communications, Information dissemination should include a number of activities such as weather monitoring, weather forecasts, phenomena analysis, and issuing alert to the public.

The scope will be to introduce ICT based Disaster management system to minimize Disasters Risk spread, to ALERT and INFORM hazard information, to share information on ensuing disaster risks, and to timely disseminate warning message to residents to eliminate confusion, restore order and ultimately save lives.

1.5 Survey methodology

(1) Study documents prior to visits to that country
(2) Investigate current status by requesting to reply a questionnaire
(3) Interview high officials of respective department to correlate information
(4) Set up discussions sessions to share information
(5) Coordinate with APT and seek cooperation from APT.

1.6 Topics and Facts leading to needs

Disasters are events beyond the capacity of the people, and take time to recover from the devastation caused. Understanding types of disasters that affect a locality provides a basis for developing disaster preparedness, and assists process for assessing risks.

(1) Understanding Risk:

Use of participatory local level risk profiling methodologies and integrated context analyses that differentiate data across those groups subject to more risk will be essential to better analyze and understand that contexts that different groups experience and hence build the basis for effective planning, design and programming.

(2) Capacity development:

National and local level capacity development is essential to achieve this vision. This should include trainings of local preparedness and response actors on the needs of those subject to more risk. Trainers should include representatives of at-risk groups and practical trainings within community settings for translation of knowledge into practical skills. Leadership capacity development is also needed to help empower community actors to contribute in multi-stakeholder DRR platforms.

(3) Disaster Management Communication System

A dedicated network system for public safety is essential. This system must be coordinated with Telecom operator for efficient deployment to communication resources in the event of disaster and emergency.

1.7 Survey Items & Issues

(1) Status of natural disasters in recent years, damages caused on infrastructure
(2) Government Plan and Policies for Disaster Management
(3) Status of Disaster Information Management, Practical situation and status on Telecommunication and ICT in Disaster situation
(4) International Cooperation by donor countries and international organizations in ICT and other sectors.
(5) Possibility, effectiveness and issues of deploying ICT systems
(6) Discussion with govt. Officials to create a possible ICT Pilot Project draft proposal

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Chapter 2 Disaster Communication Framework and Brief History of Disaster Incidents in Bhutan

2.1 Disaster Risk Management Strategy (DRMS)

The Disaster Risk Management Strategy, (DRMS) is formulated as mandated under clause 11 of the Disaster Management Act of Bhutan 2013 and is guided by the Five Year Planning process. The DMSF is envisioned to serve as reference for disaster management by articulating government policy, principles, expected results, and clearly identifies priorities and focus areas to maximize efficient allocation of limited financial and technical resources. Subsequently, the Strategy outlines all key results that need to be achieved under each of the priorities and indicative activities that need to be carried out to achieve these outcomes.

The objectives of the DRMS are to provide guidance in implementing rules and regulations pertaining to Disaster Risk Management (DRM); recognize and acknowledge the respective roles of agencies and stakeholders; to establish linkages and coherence between DRM, Climate Change Adaptation (CCA) and sustainable development; and to provide the principles, strategies and priorities to guide the development of various plans and programs for risk prevention and reduction, preparedness, response, recovery and reconstruction measures.

The DMSF is designed as strategic derivative of DM Act 2013. It is formulated with long term perspective; thus, well aligned with the four Priority Actions of the Sendai Framework for Disaster Risk Reduction 2015 – 2030. Under each of the priority actions, the issues and gaps, key interventions and expected results are detailed in chapter 2.

It also provides the necessary guidance in the development of medium term disaster management plans, which should be part of development planning process of the Five Year Plan. It outlines the context, rationale, and drivers by summarizing the existing hazards, vulnerabilities, disaster risks and current challenges

The DMSF has been developed through extensive consultative process with relevant national and international stakeholders and the strategic interventions under each priority actions has been discussed and agreed upon.

2.2 Disaster Management Act of Bhutan 2013

Disaster Management Act of Bhutan was enacted 2013 by parliament of the Kingdom of Bhutan. The purpose of this act is to provide for the establishment and strengthening of institutional capacity for disaster management, Mainstreaming of disaster risk reduction, an integrated and coordinated disaster management focusing on community participation, and Matters incidental thereto.

The National Disaster Management Authority is the highest decision making body on disaster management in Bhutan.

Function of National Disaster Management Authority is approve the Disaster Management strategic Policy framework, approve the national Disaster Management and contingency Plan, approve hazard zonation and vulnerability map, approve structural and non-structural measures and direct its implementation, approve

national standard, guideline and standard operating procedure for effective disaster management including but not limited to objective assessment tool and so on.

Dzongkhag Disaster Management Committee

The Dzongkhag Disaster Management committee shall:

a) Prepare, review, update and implement the Dzongkhag Disaster Management and contingency Plan;
b) Monitor and evaluate measures taken for prevention, mitigation, preparedness, response and capacity building by each sector in the Dzongkhag;
c) Ensure establishment and functioning of critical Disaster Management facility;
d) Ensure mainstreaming of disaster risk reduction into the development plan, policy, program and project;
e) Ensure compliance of the approved hazard zonation and vulnerability map;
f) Ensure the enforcement of structural and non-structural measures;
g) Ensure that information about an event or a disaster is promptly communicated to the national Disaster Management authority, Department of Disaster Management and all concerned;
h) Ensure that the damage assessments in the field are carried out professionally and efficiently without fear or favor.

The Dzongkhag Disaster Management committee may, if it considers necessary, constitute a subcommittee at the Dungkhag, thromde or gewog level to assist the Dzongkhag Disaster Management committee in the performance of its functions under this act.

The national Disaster Management authority shall constitute an inter-Ministerial task force. The inter-Ministerial task force shall comprise of technical experts from relevant agencies.

The inter-Ministerial task force shall:

a) Review hazard zonation and vulnerability map and structural and non-structural measures;
b) Review disaster risk reduction and disaster management activities;
c) Review national standard, guideline and standard operating procedure for disaster management;
d) Provide necessary technical assistance in the preparation of Disaster Management and contingency Plan, where necessary;
e) Advise relevant agency in setting up critical Disaster Management facility; and
f) Perform such other function as may be directed by the national Disaster Management authority.

The Department of Disaster Management/secretariat of National Disaster Management Authority shall serve as the secretariat and executive arm of the national Disaster Management authority and also function as the national coordinating agency for disaster management. The Department of Disaster Management/secretariat of national Disaster Management authority shall:

a) Lay down the disaster management strategic policy framework.
b) Ensure that agencies mainstream disaster risk reduction into their development plans, policies, programs and projects.

c) Prepare the national Plan in coordination with relevant agencies;
d) Formulate national standard, guideline and standard operating procedure for disaster management;
e) Develop and implement public education, awareness and capacity building program on disaster management;
f) Develop standard training module and curriculum on disaster management in coordination with relevant agencies;
g) Develop, maintain and update Disaster Management information system in coordination with relevant agencies;
h) Ensure the implementation of Disaster Management and contingency Plan and disaster management activities at all levels;
i) Facilitate the constitution of Disaster Management Committees and ensure its efficient functioning;
j) Facilitate the formulation of hazard zonation and vulnerability map by relevant agencies;
k) Facilitate and coordinate the setting up of critical Disaster Management facility and ensure its effective and efficient functioning;
l) Facilitate the establishment/commissioning of research, development and training in the field of disaster management;
m) Collaborate with government of other countries, legitimate international organizations, international non- governmental organizations, business establishments or volunteer groups identified by the National Disaster

2.3 Information, Communications and Media Act

This Act is the Information, Communications and Media Act of Bhutan 2018.

The purpose for which this Act was enacted is:

WHEREAS, to create and promote a Bhutanese information society and the right environment for the vibrant growth of ICT and Media sectors in line with the principles of Gross National Happiness;

Whereas, to ensure technology neutrality, convergence, innovation, private sector participation and competition in the development of the ICT and Media sectors;

Whereas, to ensure quality, diversity, speed and choice of ICT and media services, so that the country benefits from the opportunities presented by new developments in the sectors;

Whereas, to realign and ensure clearer responsibilities of the implementing and the regulatory bodies;

There shall be an autonomous regulatory authority called the Bhutan InfoComm and Media Authority (BICMA) to carry out responsibilities entrusted under this Act.

The Authority's functions shall be to:
(1) Grant licenses, certificates and permits, and regulate ICT and Media facilities and services and enforce license conditions;
(2) Ensure that licensees, permit-holders and other users of the radio equipment or devices comply with requirements laid down by relevant international, regional or national organizations in respect of equipment and technical standards and environmental health and safety standards, including electromagnetic radiation and emissions;

(3) Prescribe, regulate and monitor compliance with national codes and standards, international or other obligations entered into by the Government in relation to ICT and Media matters;
(4) Regulate interconnection or sharing of infrastructure and facilities between or among ICT facility providers;
(5) Maintain and promote competition and take action to prohibit, prevent and bring to amend any abuse of market power or anticompetitive behavior within the ICT and Media industry;
(6) Ensure interoperability and efficient use of ICT and Media facilities and services;
(7) Ensure that licensees and permit-holders are able to carry out their obligations to provide services free of undue delay, hindrance or impediment;
(8) Ensure the proper maintenance of accounting systems by the public ICT providers and media services providers;
(9) Assign spectrum consistent with the spectrum policy and plan;
(10) Plan, administer, manage and assign numbering for ICT services;
(11) Protect consumers of ICT and Media services, among others, the rates charged for, and the quality and variety of ICT services provided;
(12) Provide an effective, efficient and affordable mechanism for the investigation and resolution of complaints;
(13) Promote technological innovation in the ICT and Media sectors;
(14) Plan and manage universal service plans and the Universal Service Fund pertaining to the ICT facilities and services based on policy directives issued by the Ministry;
(15) Create a conducive environment by setting standards for Bhutan to develop competitive and dynamic ICT services market; and
(16) Ensure universal access to all ICT services at affordable rates.
(17) Adopt Rules and Code of Conduct for the efficient functioning of the Authority.
(18) Conduct periodic circulation audit of print media firms

2.4 Disaster Information Management System Wireframe

The Disaster Management Act of Bhutan 2013 entrusted the department of Disaster Management (DDM) as a national coordinating agency for disaster management in the country. Upon the establishment of DDM, the vital role of disaster information and communication was felt when the country was devastated by Cyclone Aila in May and 6.1 magnitude of earthquake in September in the same year, 2009. During the time of those twin disasters, event information was a nerve Center for the government to intervene in saving lives and properties and providing appropriate relief support to the affected communities.

Thus In 2010, DDM initiated development of DMIS to keep track record of pre-crisis information and subsequently developed a post-disaster needs assessment tool as well as post-event mapping tool to better track community-level impacts. Despite having these information systems in place, the operational impact is limited, meaning the end-users rarely use those information systems and that, since their creation, the systems have become obsolete. Considering the lessons learned from these systems and the comments received from different agencies, DDM intends to review, improve and integrate the information and tasks supported by those systems and ensure availability of one system that is integrated, workable and user-friendly. This Act gave DDM a mandate to develop, maintain and update Disaster Management Information System (DMIS) in coordination with relevant agencies.

Despite having these information systems in place, the operational impact is limited, meaning the end- users rarely use those information systems and that, since their creation, the systems have become obsolete. Considering the lessons learned from these systems and the comments received from different agencies, DDM intends to review, improve and integrate the information and tasks supported by those systems and ensure availability of one system that is integrated, workable and user-friendly. This Act gave DDM a mandate to develop, maintain and update Disaster Management Information System (DMIS) in coordination with relevant agencies.

2.5 Climate change and vulnerability to disaster

Bhutan as a landlocked country is extremely vulnerable to the effects of climate change. The fragile mountain ecosystem, the high dependence of the economy on hydropower and agriculture make it more open to climate change phenomena leading to natural disaster within the country and across borders. There are a number of wildlife are in the edge of extinction. One-horned rhinoceros, Chinese Pangolin, are to mention as very precious species. Bhutan's commitment to remain carbon neutral and environmental policies collects international appreciation. Bhutan's effort in its global environmental issue continues to set a great example for rest of the world.

Climate change is recognized as one of the most urgent priorities of the 21st century and is a driving force for institutions and individuals to move towards a model of sustainable development.

Climate change is contributing to an unprecedented scale of natural disasters from extensive flooding to droughts, cyclones/ typhoons/ hurricanes, wildfires and a rising sea level worldwide. As extreme weather events are becoming more severe and more frequent, ICTs will take a major role in accelerating progress to cope with the harmful effects of climate change.

In order to improve the surrounding environment and public safety, support for environmental conservation and climate change is essential. Consideration support to cope with natural disasters, such as floods, storms, earthquakes and landslides, is needed for public safety.

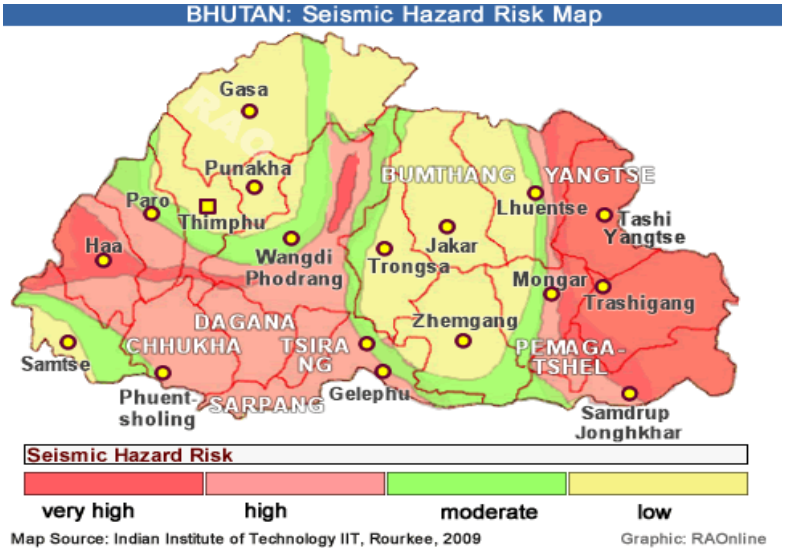


Fig. 2.1 Bhutan's seismic hazard risk map

2.6 Dzongkhag Wise Disaster Brief History

2.6.1 Bhutan's seismic hazard status

According to available data, the Indian institute of technology in Rourkee, India, has done a seismic hazard map of Bhutan showing, for the first time, hazard zones in the event of an earthquake.

According to this studies, Thimphu, Paro, Punakha, Bumthang and Trongsa valleys fall in low and moderate hazard areas, while Haa, Chukha, Trashigang, Mongar, Lhuentse and Trashiyangtse and the southern dzongkhags are in high and very high risk areas.

The map, however, doesn't give us adequate information on what exactly constitutes a high hazard zone, its Richter scale or geological conditions conducive to earthquakes.

The following are the earthquakes that suffered major damage. Damaged number of the buildings in the top five Dzongkhag due to two earthquakes are as follows.

Dzongkhag	Mongar Earthquake	Sikkim Earthquake	Total
Mongar	2,326	490	2,816
Trashigang	1,661	0	1,661
Paro	0	1,105	1,105
Haa	0	1,076	1,076
Trashiyangtse	636	403	1,039

Collapse of a steel tower due to an earthquake, rupture of a communication line due to swaying of a steel tower, and the like are conceivable.

Mapping the OPGW network with the map of the earthquake disaster situation maps the possibility of tower and cable damage in Mongar, Trashigang, Paro, Haa, Trashiyangtse where buildings collapsed a lot. If the cable is broken, it will be long-lasting because it is not a redundant network. There is a possibility that communication of Dzongkhag in the north mainly connected by ADSS etc. cannot be made.

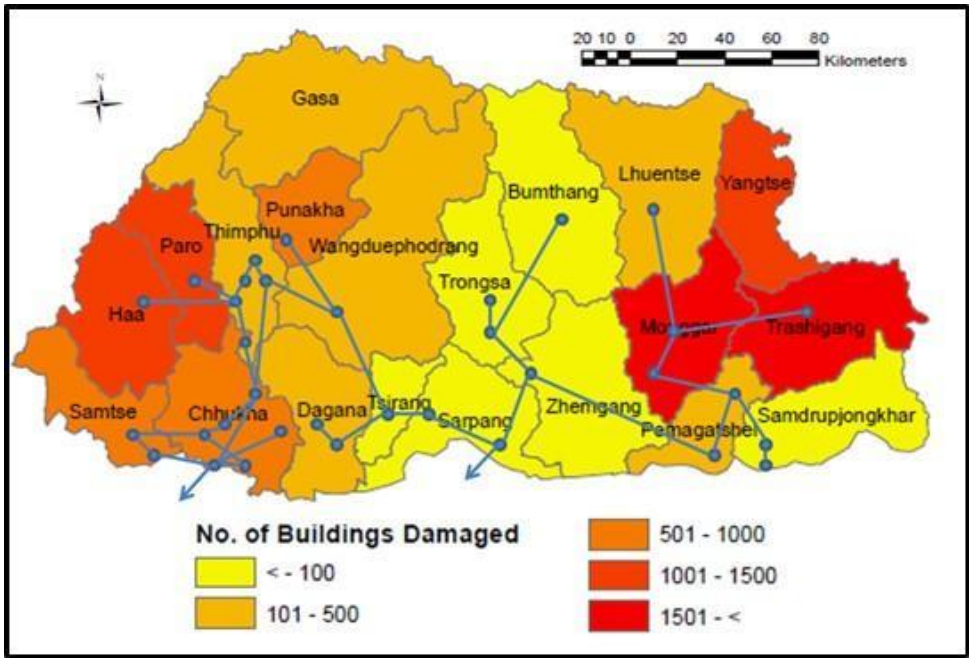


Fig. 2.2 Map showing buildings damaged due to earthquake

2.6.2 Glacial Lakes Outburst Floods (GLOF)

Bhutan has 677 glaciers and 2,794 glacier lakes, of which 25 of Glacier lakes are potentially dangerous. It is said that 21 outburst cases were Bhutan. The case of 17 occurred from the 19th century to the 1970s, and the case of 4 outbursts occurred in the last 40 years. The most recent GLOF occurred on June 28, 2015 at outburst of Lemthang Tsho.

Photo 2.1 Glacial Lake Outburst Flooding in Bhutan, by Sukaina Bharwani

2.6.3 Floods /Flash Floods

The flooding that occurred in the past		The top 5 Dzongkhag by Flood in 2016	
Year	Place	Dzongkhag	Loss (million NU)
2000	Phuentsholing & & Pasakha	Sarpang	159
2004	Eastern Bhutan	Chuka	141
2009	All Dzongkhag (Cyclone Aila)	Samtse	68
2016	Phuentsholing and Sarpang	Trongsa	40
		Mongar	35

Photo 2.2 Town was completely washed away by flash floods [image: by Kuensel]

2.6.4 Forest fire/Structural Fires

No.	District Name	No. of cases	Damage/ Loss (acres)	No.	District Name	No. of cases	Damage/ Loss (acres)
1	Bumthang	4	62	11	S/Jongkhar	5	
2	Chukhha	10	94.5	12	Sarpang	7	2710
3	Dagana	5	339.5	13	Samtse	15	1668.18
4	Gasa	1	50	14	Trashigang	29	15309.69
5	Haa	4	1359.9	15	Trashiyangtse	18	1893.07
6	Lhuentse	32	14849.3	16	Thimphu	64	5675.02
7	Monggar	35	12620.49	17	Tsirang	1 -	
8	Paro	8	1091.8	18	Trongsa	4	640.2
9	Punakha	9	1858.9	19	Wangdue	26	31078.45
10	Pemagatshel	3	-	20	Zhemgang	13	1295.67
					Total	303	92,596.97

Photo 2.3 Forest fires in Bhutan (image by Nima Wangdi)

2.6.5 Landslides

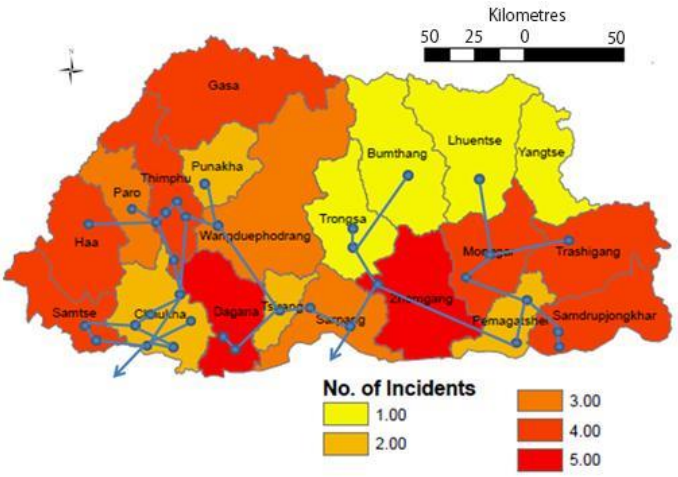
Year	Causes	Affected Areas
2000	Seasonal Monsoon	Thimphu, Chukha, Trashigang, amdrupjongkhar, Mongar, Lhuentse, Pemagatshel,Samtse, Tsirang Sarpang, Zhemgang, Wangduephodrang
2002	Sudden burst of sliding mud and debris	Thimphu-Tsirang highway
2005	Triggered by heavy rain	Palamphu, Mongar-Lhuentse highway (mudslide)
2006	n/a	Bemsisi, Thimphu(landslide)
2011	Sikkim earthquake	Haa

Photo 2.4 Landslides experienced Bhutan by V. K. Joshi (Bijji)

2.6.6 Windstorms

The windstorm is prominent during spring (March to May) and autumn (September to November) seasons. The area is mostly affected by storm developed from cyclone originated from the Bay of Bengal.

The windstorm damage is inevitable because it affects a wide range even if considering the location condition of the iron tower used for OPGW. At most, the number of occurrences was 5, but it occurred across Bhutan. If the optical cable of OPGW is broken at Zhemgang, communication will be discontinued at the six Dzongkhag in the western area, and its influence is great.



2.7 Dzongkhag wise Disaster Management & Contingency Plan

- Thimphu Dzongkhag plan -

The Disaster Management Act of Bhutan 2013 mandates the Dzongkhag Disaster Management Committees to develop Disaster Management and Contingency Plans, in consultation with the Dzongkhag sectors and other relevant agencies.

With the changing risk patterns and frequency of disasters, formulation of Dzongkhag specific disaster management plan is an important strategy to strengthen local level disaster management systems and systematically reduce disaster risks.

The plan is prepared through conduct of Hazard, Vulnerability and Capacity Assessment of the 8 Gewogs in consultation with the Gewog Administrative Officer, Tshogpa, discussion with the Sector Heads of Dzongkhag Administrations, representatives from the schools and regional offices to strengthen school and Dzongkhag DM plan linkages; data collation and analysis; and finally a simulation on standard procedures for response followed by endorsement from the Dzongkhag Disaster Management Committee (DDMC).

The Dzongkhag Disaster Management and Contingency Plan presents hazard, vulnerability and capacity profile for the 8 Gewogs. The plan also outlines priority disaster risk reduction, awareness raising and capacity building activities and spells out the standard procedures for response. An implementation and monitoring process for the plan is also included.

This Plan is to be referred by the Dzongkhag Administration and sectors to ensure mainstreaming and integration of disaster risk management into their annual and five-year development plans. It is required that every stakeholder and relevant National Disaster Management institutions and agencies take ownership and fulfil their own roles and responsibilities to make this Dzongkhag a disaster resilient and safe place.

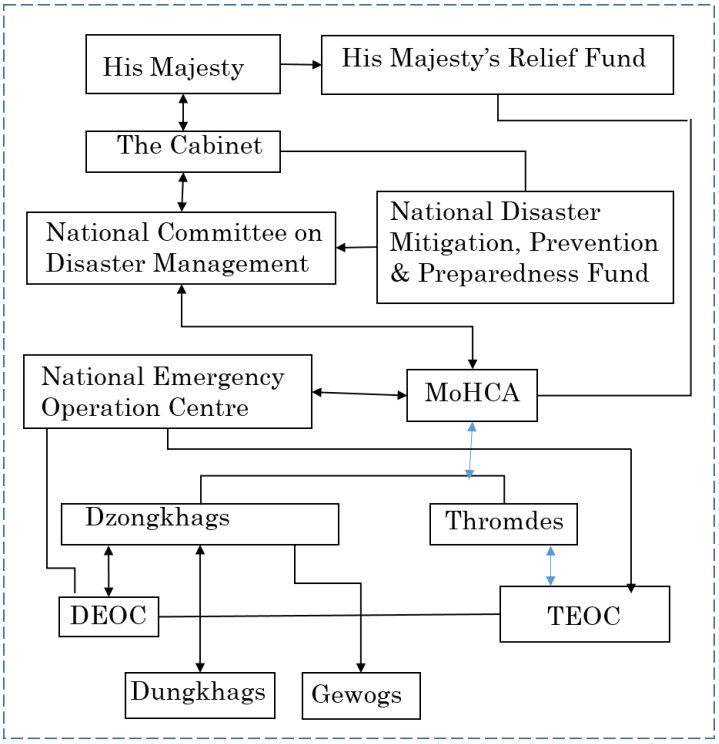


Fig. Disaster Management Institutions/ Authorities and Funding Arrangements

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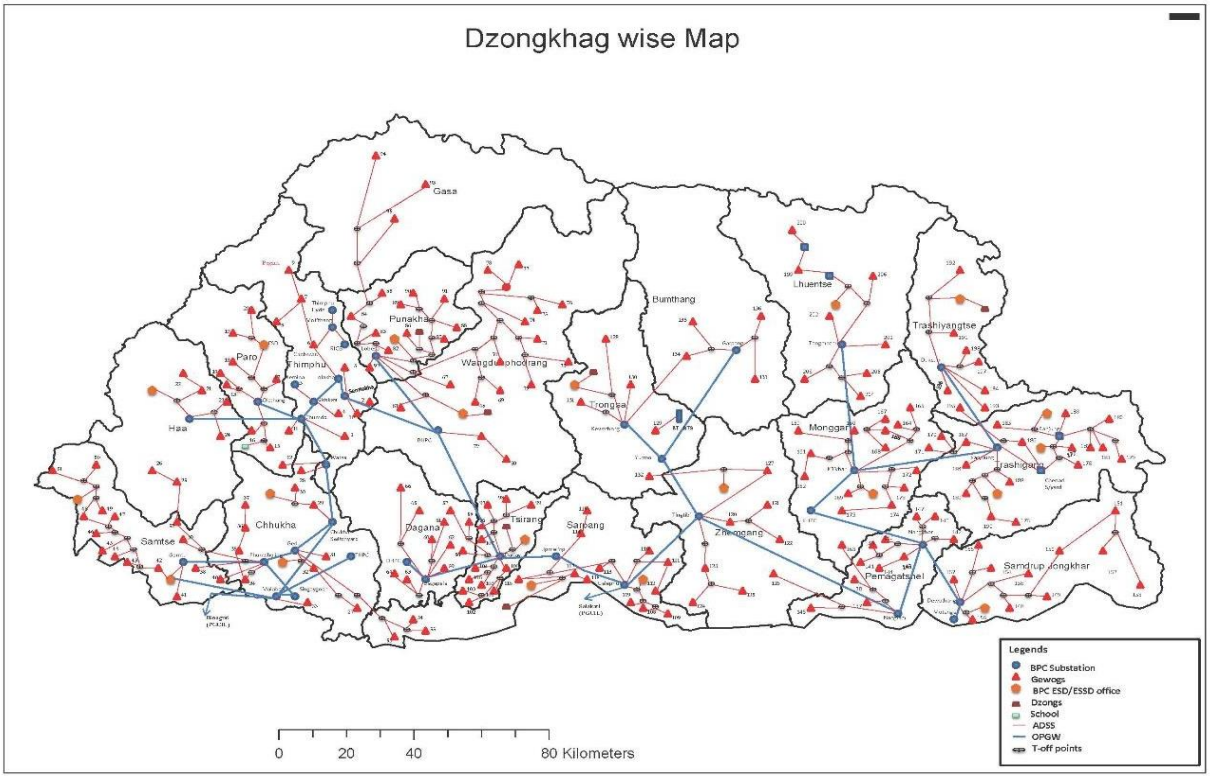
Chapter 3 Studies on Existing Available Infrastructure and Services

3.1 National Telecommunications Networks

Bhutan's long distance communication composed of an optical fiber network, constructed and maintained by the Bhutan Power Corporation Limited, and managed by the Ministry of Information and Communications. This long-distance optical fiber is provided to telecommunications carriers free of cost. All 20 Dzongkhag administration offices, 201 Gewog offices, 196 Community Centers, have optical fiber connectivity. International connections are connected from Malabase and Gelephu stations.

The optical fiber network as available is shown in Fig. 3.1.

Fig. 3.1 Govt. optical fiber network



3.2 Nationwide Mobile Networks

Mobile carriers provide services to remote locations using the optical fiber networks of Bhutan's government. In the BTL, the network comprised of the combination of optical fiber and microwave networks.

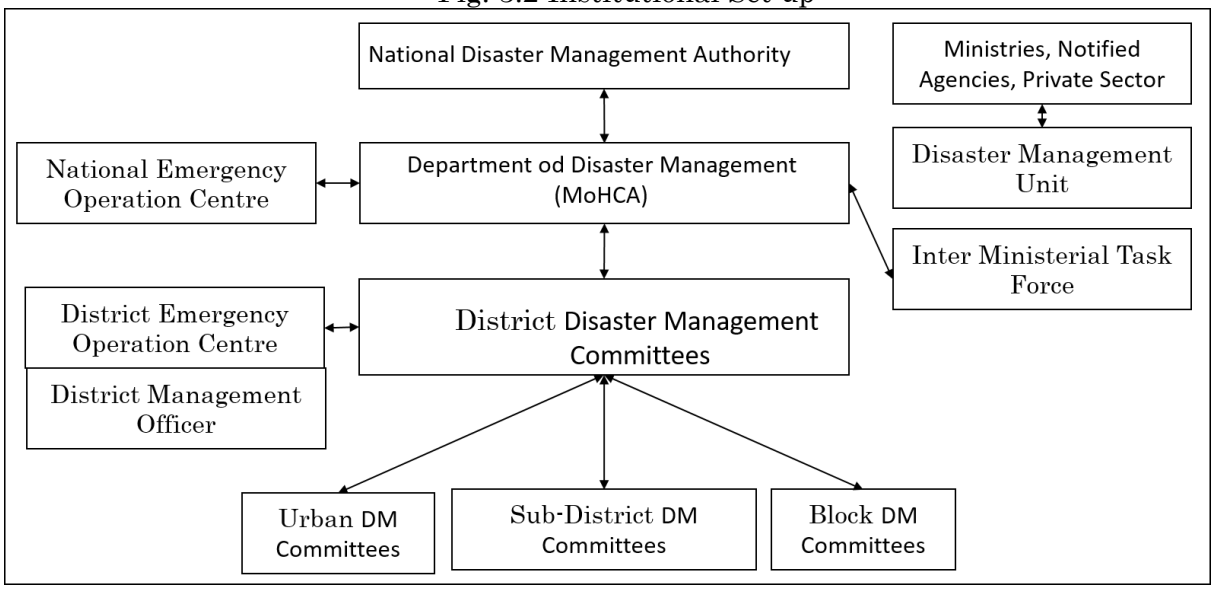
3.3 ICT Network for Disaster risk Reduction

Disaster Management (DM) ACT 2013 defined Disaster Management System. DM core institutions are National Disaster Management Authority, Dzongkhag Disaster Management Committee, Thoronde Disaster Management Sub-Committee, Gewog Disaster Management Sub-Committee, Dungkhag Disaster Management Sub-Committee. Major Functions of the department of Disaster Management are as follows.

The DDM shall serve as the secretariat and executive arm of the NDMA and also function as the National Coordinating Agency for disaster management. Prepare the National Plan in coordination with relevant Agencies, and formulate national standard, guideline and standard operating procedure for disaster management, develop and implement public education, awareness and capacity building program on disaster management. Develop standard training module and curriculum on disaster management in coordination with relevant agencies, and facilitate the formulation of hazard zonation and vulnerability map by relevant agencies.

In addition to these institutions Inter Ministerial Task Force, Disaster management Unit, Department of Disaster Management, National Emergency Operation Center, Dzongkhag and Emergency Operation Center manage the disaster. The Institutional Setup of Disaster management is as shown in Fig. 3.2.

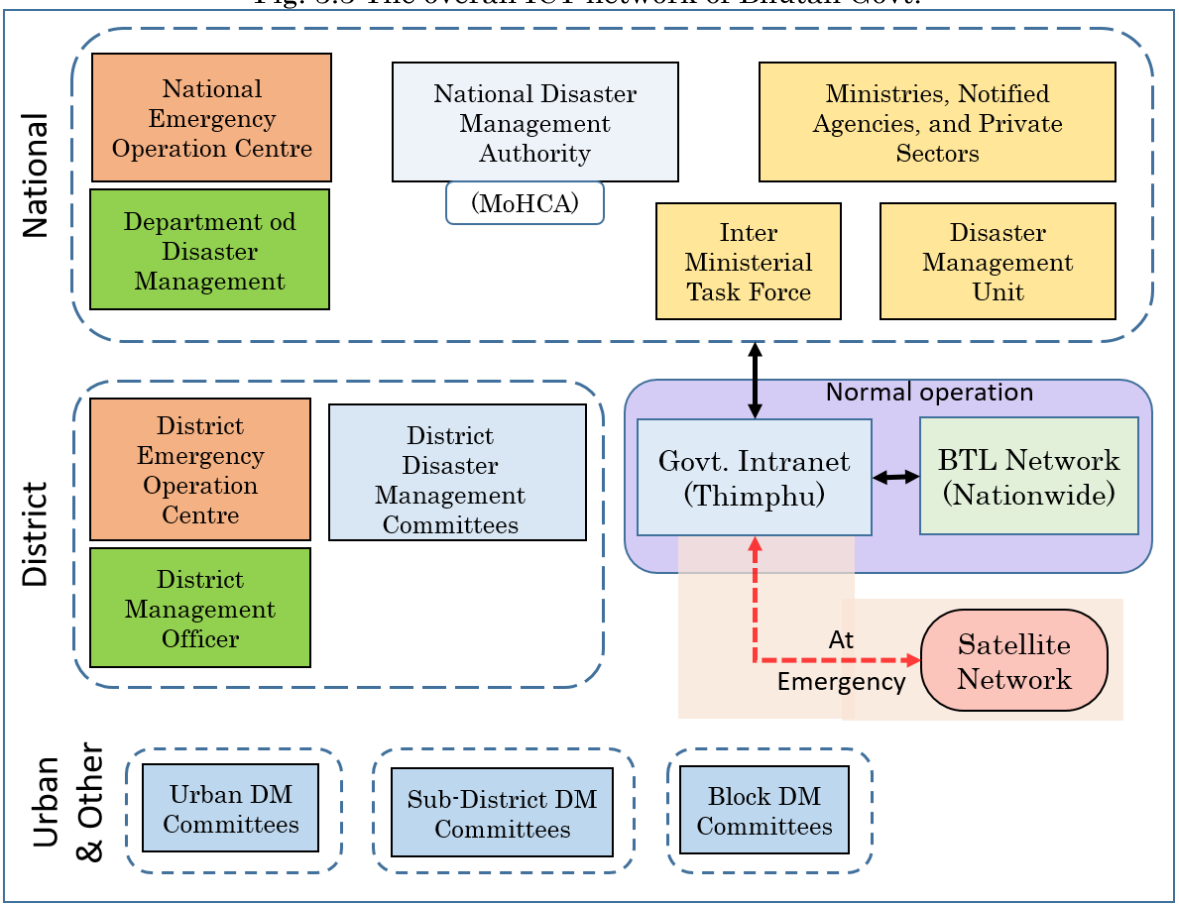
Fig. 3.2 Institutional Set up



3.4 Government Exclusive ICT Network

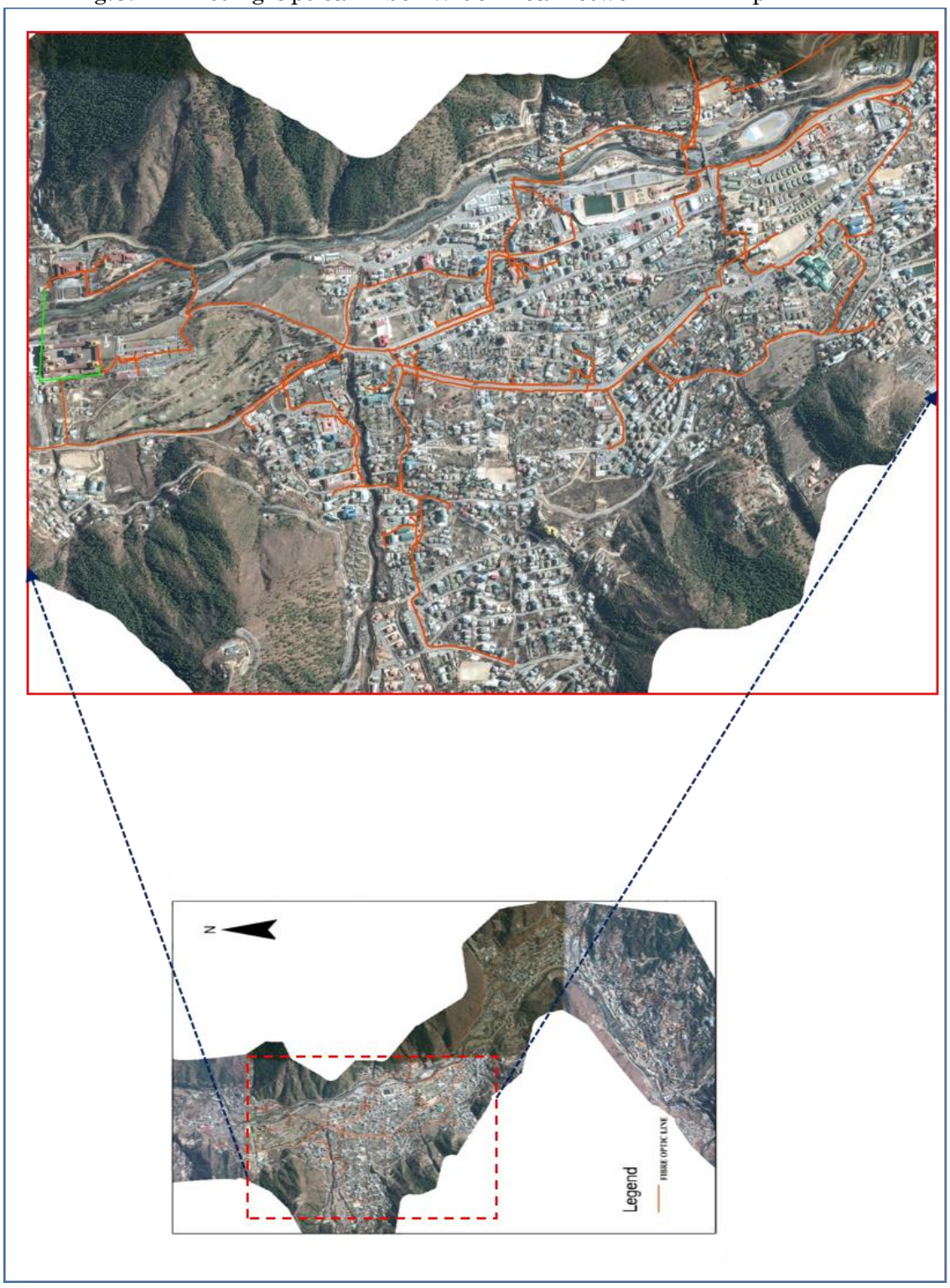
The communication network connection between the aforementioned organizations is as follows. Communications among the related organizations are possible through the government Intranet. The telecom service used in normal state but when disaster occurs and the trunk routes are interrupted, reporting of the damage situation and recovery activities are also interrupted. A seamless communication be realized using the satellite communication system which in turn effective in an emergency.

Fig. 3.3 The overall ICT network of Bhutan Govt.



Government Intranet (TWAN) is an optical fiber network that connects government agencies and corporations in Thimphu providing network connectivity to G2C, G2G, video conference services and applications. TWAN is extended to all 20 Dzongkhag administration offices and to Community Centers through Point to Point connection to bring the government as a whole under one network umbrella. The Thimphu Optical Fiber Wide Area Network is shown in Fig. 3.4. Thimphu Intranet is a network strong against disasters because it is looped and accommodates institutions of related government. The related database is accommodated in the data center, and the Intranet and a triple fiber connection route are secured.

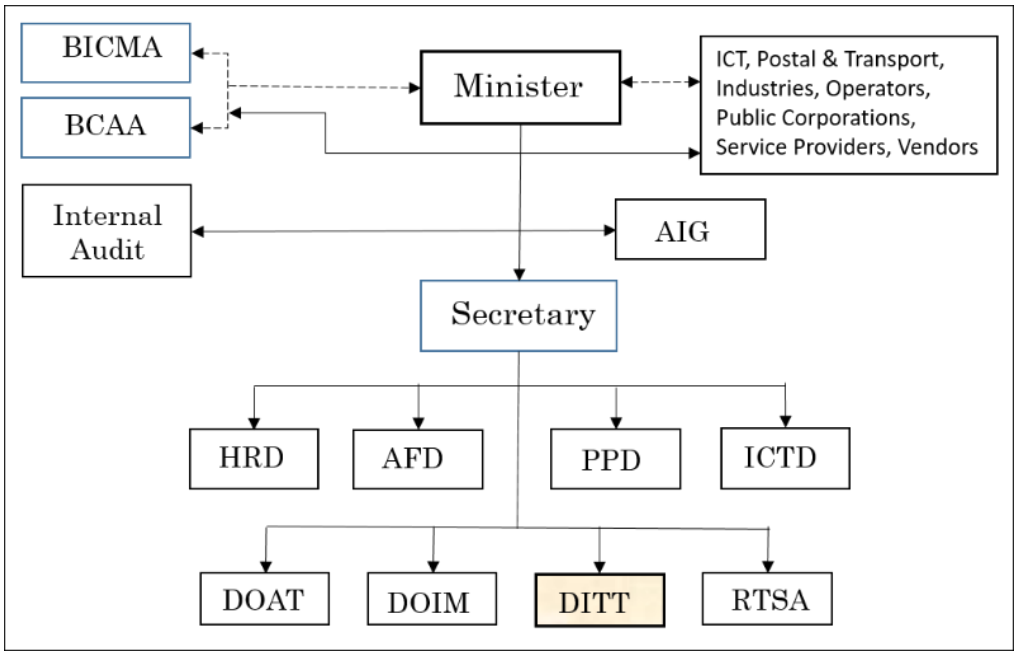
Fig.3.4 Existing Optical Fiber Wide Area Network in Thimpu (Ref:DITT)



Chapter 4 Studies on Existing status with Policies & Procedures of Disaster Management in Bhutan

4.1 Ministry of Information and Communications (MoIC)

The Ministry's mission is promoting the development of reliable and sustainable information, communications and transport networks and systems and facilitating the provision of affordable and easier access to associated services, particularly to meet the basic social needs and help improve living standards of people in rural and far-flung communities of Bhutan, for the ultimate purpose of making a meaningful contribution to Gross National Happiness.

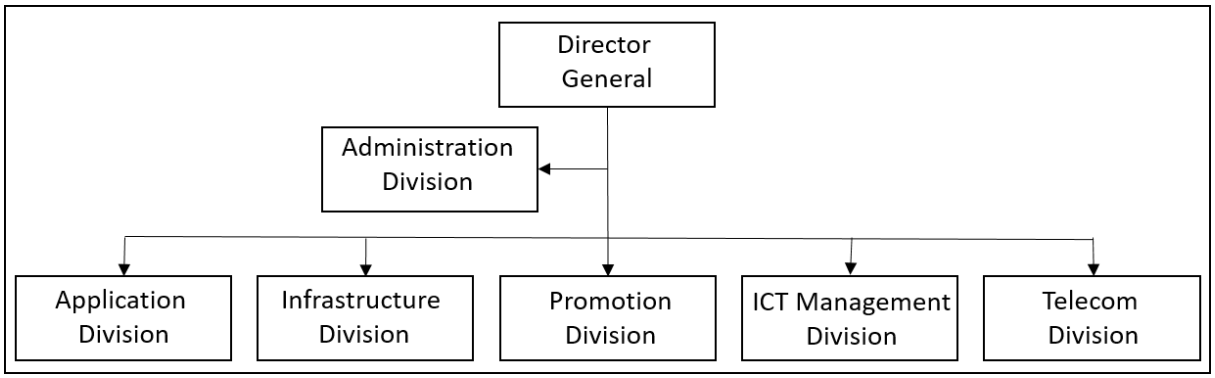


The Ministry's objectives are:

1. To increase safe, reliable and affordable surface and air transport;
2. To enhance access to sustainable, green and inclusive public transport;
3. To improve access to reliable and affordable ICT and media services;
4. To improve effective and efficient public service delivery; and
5. To keep alive culture and tradition through ICT and media.

4.1.1 Department of Information Technology & Telecom (DITT)

This department is under the Ministry of Information and Communications. The Department has five divisions, viz. Application, Infrastructure, Promotion, Telecom and ICT Management divisions.



In line with the ICT vision of the country to create an "ICT enabled knowledge society as a foundation for Gross National Happiness", the mandate of DITT is as given below:

1. Frame ICT policies, regulations, standards and legislation,
2. Drive innovation, development and adoption of ICTs,
3. Promote ICT as an industry and overarching enabler of national development,
4. Support development of reliable ICT infrastructure in the country,
5. Determine appropriate technologies and systems suitable to unique Bhutanese conditions,
6. Facilitate promotion of good governance and shared national consciousness through the use of ICT and
7. Develop sustainable and affordable ICT facilities and services for all Bhutanese to improve their living standard. The Department is located within MoIC premises in Thimphu.

4.2 Bhutan Infocomm & Media Authority (BICMA)

The Bhutan InfoComm and Media Authority (BICMA) is an autonomous government agency established as per the provisions of the Information, Communications and Media Act of Bhutan 2018.

BICMA is a converged regulatory body responsible for the regulation of Information, Communications and Media sector in Bhutan. Its main mandates are:

1. Licensing and enforcement of cable TV, broadcast media, printing presses, publications, ICT facility and service;
2. Enabling a secure, efficient and reliable delivery of ICT and Media services at affordable prices;
3. Managing access to the radio-frequency spectrum and monitoring their usage;
4. Support the continuous technological advancement to improve the standards of information, communications and media;
5. Facilitate the establishment of an integrated, efficient and high quality ICT infrastructure in the country;

6. Maintain a dynamic and progressive regulatory system to promote market development, manage competitions while protecting consumers and other users;
7. Improve and monitor the choice content available in the media including news, current affairs, religious knowledge, art, culture, science, technology, social sector concerns, music, sports, drama and other subjects of public and national interest;
8. Set appropriate technical standards and rules to ensure interoperability, efficient use of radio spectrum and telephone numbers.

4.3 Ministry of Home & Cultural Affairs (MOHCA)

4.3.1 Ministry of Home & Cultural Affairs

The Ministry's mission is:

1. Preservation, promotion, development and protection of culture and heritage.
2. Provide professionalized immigration services to public.
3. Guide and Support local governments in the efficient and effective delivery of services.
4. Provide efficient service delivery in the issuance of citizenship and other related documents.
5. Ensure stable law and order situation in the country.
6. Efficient management of civil administration.

To be the leading organization spearheading the efficient functioning of decentralized administration, upholding the principles of democratic governance which ensures maintenance of law and order; preserves and promotes cultural and spiritual values contributing towards the realization of Gross National Happiness (GNH).

4.3.2 Department of Disaster Management (DDM)

The Department's mission is to deliver effective coordination and facilitating services with competence in disaster management and to enable government and other stakeholders attain disaster resilience and GNH

A consultant conducted a presentation about "Pilot Strengthening Plan on National Emergency / Disaster Telecommunication Framework / Bhutan", and made a question and answer.

4.4 Bhutan Telecom Ltd (BTL)

Bhutan Telecom Limited (BTL) is the leading provider of telecommunications and Internet services in the Kingdom of Bhutan. Besides fixed line telephony, it provides GSM Mobile services under its flagship brand B-Mobile, and Internet Services under the brand name of DrukNet. It is the leading provider of both mobile telephony and Internet services in the country, and the only fixed line telephony services provider in the country.

BTL came into existence on 1 July 2000 as a fully state-owned company, with the corporatization of the erstwhile Department of Telecommunications which was established in 1970. The first rudimentary works in building a telecommunication network in the country was taken up in 1963 to aid development works of the First Five Year Plan for modern economic development of the country. Since then, BTL has come a long way from its humble beginnings and today boasts of a fully digital microwave and optical fiber backbone network covering the length and breadth of the country.

BTL has left no stone unturned in its efforts towards fulfilling both its commercial and social mandates. Today, BTL's revenue and customer base are growing at a sustained pace. B-Mobile has taken its services to even the remotest corners of the country where commercial viability is out of the question and its network has covered all 205 Gewogs (Blocks) in the country.

The consultant confirmed the current BTL backbone network, correspondence at the time of disaster, equipment information management.

4.5 Tashi InfoComm Pvt. Ltd. (Tashi Cell)

Tashi InfoComm Limited is the first private cellular company in Bhutan, a separate entity under Tashi Group of Companies. The company was incorporated on January 23, 2007, under the Companies Act of Kingdom of Bhutan 2000, after it won an international bid to operate as the second cellular operator in Bhutan. The company launched its GSM services on April 6, 2008, under the brand name "TashiCell", with its registered office located at Norzin Lam, Thimphu. The cellular license issued by Bhutan InfoComm and Media Authority (BICMA) mandates TashiCell to build mobile network to provide cellular services to the entire nation. The mobile network is based on GSM WCDMA/HSPA+ technologies. As of 31st March 2017, TashiCell had 231, 581 mobile subscribers.

The consultant confirmed the current TCL backbone network, correspondence at the time of disaster, equipment information management. TCL shared the status of service provision, failure recovery method and so on.

4.6 Bhutan Broadcasting Service (BBS)

The Bhutan Broadcasting Service broadcasting radio in FM band.

BBS is the National TV and Radio Broadcaster of the Kingdom of Bhutan. It has 36 transmission stations for TV, and radio on FM shortwave offering nationwide services.

The consultant confirmed the current BBS's backbone network, correspondence at the time of disaster, equipment information management. BBS shared the status of service provision, failure recovery method and so on. .

In normal state, radio broadcasting live from 6:00AM to 9:00PM, and recorded program is broadcasted from 9:00PM to 6:00AM daily covering most of the country through 30 relay stations. The TV broadcast is liver from 6:00PM to 11:00PM and the same program is re-broadcasted the following day from 6:00AM to 12:00 Noon. When SAS satellite network is operational, it will carry more programs including DTH delivery.

4.7 Association for Bhutan Cable Operators

Association for Bhutan Cable Operators (ABCO) was established in 2001 with a mission to connect the near and far with cable TV networks to provide quality content of entertainment, educational and latest informational updates. Out of 92 cable operators, 91 joined the association.

It is the association that delivers the source video as OPGW or satellite to Head End and delivers it to the end user via cable. Regarding coverage area, it covers 179 Gyoks out of 205 in 20 Dzongkhags. All urban areas are covered and 600 blocks are now can receive cable TV covering 45% of the population. There are 48,000 authorized subscribers and 53,000 unauthorized subscribers availing the service.

The ABCO provides 60 channels in Thimphu and other areas are served with about 80 headends providing 25~30 channels in the remote areas. Many of these headends are connected using Telecom networks. However it will be connected with fiber and satellite to cut down costs in near future. According to Mr. Sherub Gyeltshen, the General Secretary of the association, cable will play a vital role in disaster situation not too far from now.

The consultant confirmed the current ABCO cable television service backbone network, correspondence at the time of disaster, equipment information management. ABCO shared the status of service provision, failure recovery method and so on. The service area is offered to 20 Dzongkhag and 205 Gewog, 600 Chiwogs. We found that video delivery to Head-end depends on OPGW in some areas.

4.8 Thimphu Local Govt. (Dzongkhag) Administration

Vision of Dzongkhag: A peaceful and progressive Dzongkhag with optimal socio-economic development in harmony with nature and culture.

Mission of Dzongkhag: To ensure equitable and sustainable socio-economic wellbeing of the people through quality services.

With a total area of 1,795,868 square kilometers, Thimphu is the capital city of Bhutan. The city lies in the western part of the country. It is located at an altitude of 2330 meters above the sea level. The Dzongkhag has 64.3% of its area under forest cover. The Dzongkhag office is located at Changlimithang.

Thimphu Dzongkhag has one Drungkhag, namely Lingzhi and eight gewogs namely Chang, Kawang, Dagala, Genekha, Mewang, Lingzhi, Soe and Naro. The Drungkhag administration at Lingzhi looks after the three Gewogs of Soe, Lingzhi and Naro.

Dzongkhag Administration, Thimphu, Disaster Management & Contingency was established and operated. Dzongkhag Administration, preparing by VHS handy equipment and repeaters to ensure emergency communication between Thimphu and other Gewogs.

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Chapter 5 Proposed Emergency/Disaster Communication Using Satellite Network in Bhutan

5.1 Current status

The Royal Government of Bhutan established National Fiber Network connecting its districts and villages with fiber optics down to the block level. The Govt. also made the dark fiber available to the licensed Telcos and ISPs free of cost aimed at expansion of ICT services around the country. Telcos has established Microwave Towers as secondary telecommunication/broadband network as well.

However, since the telecommunication/broadband network is based on terrestrial communication systems, existing network infrastructure is vulnerable to disasters and emergency situation.

The Early warning, Disaster communications, Information dissemination include a number of activities such as weather monitoring, weather forecasts, phenomena analysis, and issuing alert to the public.

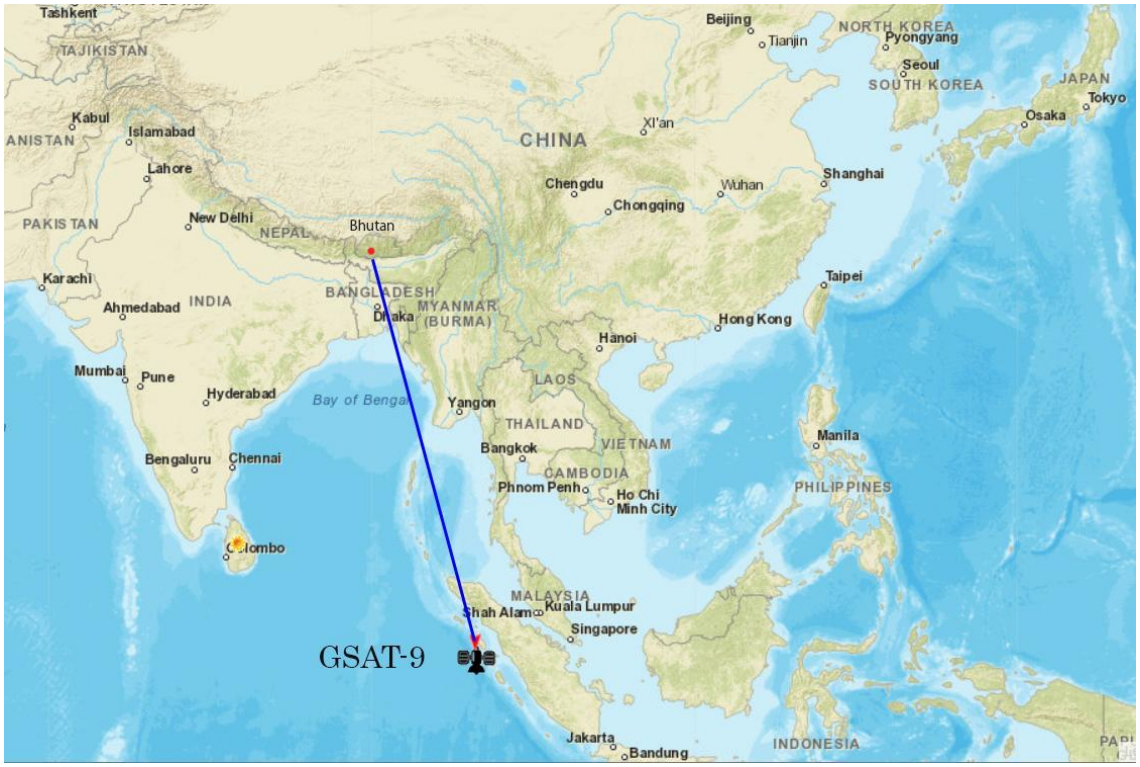
The ICT based Disaster management system is to minimize Disasters Risk spread, to ALERT and INFORM hazard information, to share information on emerging disaster risks, and to timely disseminate warning message to residents to eliminate confusion, restore order and ultimately save lives.

It is decided that GSAT-9 (SAS) operated by Indian operator is available to deploy satellite network in Bhutan for disaster management communication and other applications. Therefore, coordination and adjustment with the Indian Govt. and satellite telecommunications carriers is indispensable.

5.2 Basic data of SAS (GSAT 9)

- Satellite Name: GSAT 9 (South Asia Satellite)
- Position: 97° E (97° E)
- Operator: Indian Space Research Organization (ISRO)
- Launch date: 5-May-2017
- Launch mass: 2230 kg
- Dry mass 976 kg:
- Expected lifetime: 12 yrs.
- Details: 6 C band and 24 Ku band transponders with India coverage beam.

Fig. 5.1 Location of satellite GSAT 9 over the equator



The SAS is a communication satellite and neighboring countries can exploit it for various telecommunication and broadcast purposes. It can be used for telemedicine, tele-education, disaster management help and support, direct to home etc. The satellite will also help in natural resource mapping.

To boost the communication capabilities of India's neighbors, the satellite is equipped with 12 Ku-band transponders. Each country using the satellite will be provided access to at least one transponder. The countries would use that to uplink-downlink their own programming or even do common programming as well.

The SAS will benefit all SAARC countries excluding Pakistan which opted out. The countries that are already on board are Nepal, Bhutan, Maldives, Bangladesh and Sri Lanka. Afghanistan is in the process of signing the agreement.

The satellite's coverage area extends to the entire South Asia. Though partner countries will have the task of developing their own infrastructure on the ground, where India has expressed willingness to help in infrastructure and applications development.

This GSAT-9 satellite is to improve broadcasting and ICT services by establishing backup channels for communication in disaster management and recovery needs. A 36 MHz transponder is made available for Bhutan uses.

As of August 2018 the VSAT hub for this network is being installed at Thimphu by an Indian supplier and there will be 110 VSATs in line to be installed soon. Initially the prominent or major Dzongkhag headquarters are to be connected via this Satellite network. In future VSATs will be installed at all the Dzongkhag headquarters.

5.3 Projected application of the Satellite services

The VSAT system is commonly used to meet emergency communications requirements. A VSAT network consists of a fixed or transportable VSAT that connects to a hub station to provide communications links to emergency response units and other related sites.

The satellite system in connection with alert issue and subsequent disaster management applications will be extremely beneficial in case of occurrence of a disaster event. It will connect laptops or desktop computers by Wi-Fi to the Internet, for sending emails, uploading pictures from sites, establishing videoconferencing, etc.

Having satellite communications already available when a disaster strikes, or integrated into a disaster communications management and response system, ensure connectivity when and wherever a disaster strikes by keeping well maintained and periodical checkups.

Emergency medical care is a part of disaster relief and response efforts. The presence of emergency medical units that can link remote to central healthcare centers can provide additional support for a demand for urgent care. Such medical assistance can serve rural remote populations, year round to meet primary needs.

Communications between divergent systems and organizations is an essential component. Systems should examine ways to ensure interoperability

A transportable mobile station with ease of interface with IP networks, interoperable in emergency situations for voice communications and internet access when the other means of communications are no longer in operation.

Satellite services will support Bhutan with a wide range of voice, data and video applications that enable first responders and relief workers to have access to critical communications when the terrestrial communication is disrupted.

VSAT systems typically used for emergency response provide two way connectivity of up to several Mbps for applications including voice, data, video and Internet.

Power supply system should be independent from local terrestrial infrastructures and often local power sources. Systems should be capable of connecting to public networks when necessary to be able to provide services such as mobile voice, short messaging Service (SMS), Internet access to mobile terminals, broadband data, Push to Talk Radio equipment, data transfer, including live video.

Since GSAT-9 provides Ku band transponder for Bhutan uses, antennas for Bhutan could be in range of size from 1.0 meter to 3.6 meters, depending on the locations and transmission factors. Some small portable antenna could be useful for “fly-away” systems that are transportable and quickly made operational with no special tools or test equipment for installation.

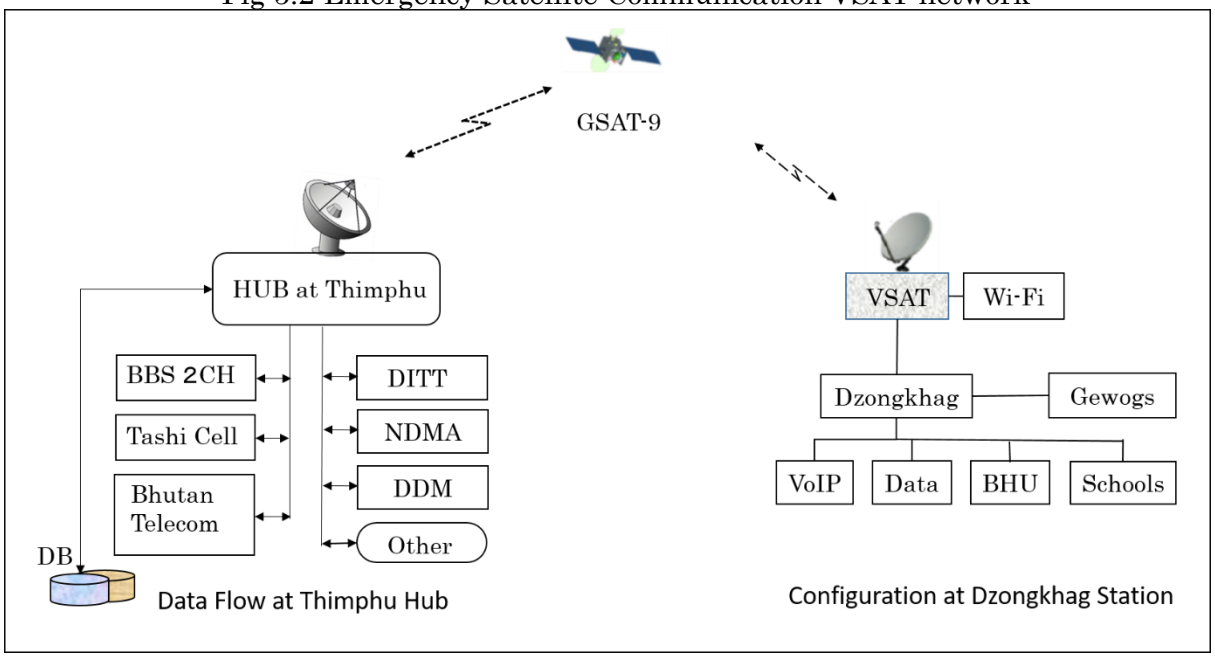
A VSAT HUB Station is installed in Thimphu at the BBS premises and 110 VSATs (including 2 portable VSATs) will be subsequently installed in Bhutan where the Satellite is set to use for the following purpose.

(1) Emergency Communications during Disasters (Disaster Management Support)
(2) Back up to terrestrial connectivity and connecting off-grid gewogs.
(3) 2 Mbps link each between Thimphu & Eastern Bhutan and Thimphu & Central Bhutan for providing backup to National OFC catering to critical voice connectivity.
(4) Two 512Kbps links to connect Thimphu with International Gateway access of Bhutan Telecom Ltd and Tashi Infocomm networks.
(5) 512Kbps connectivity to each of the three off-grid gewogs with Thimphu. Digital Broadcasting (BBS Channels).

For emergency or disaster management communication, 4MHz BW on this 36 MHz transponder is made available. According to Bhutanese Authorities, more BW may be available in future.

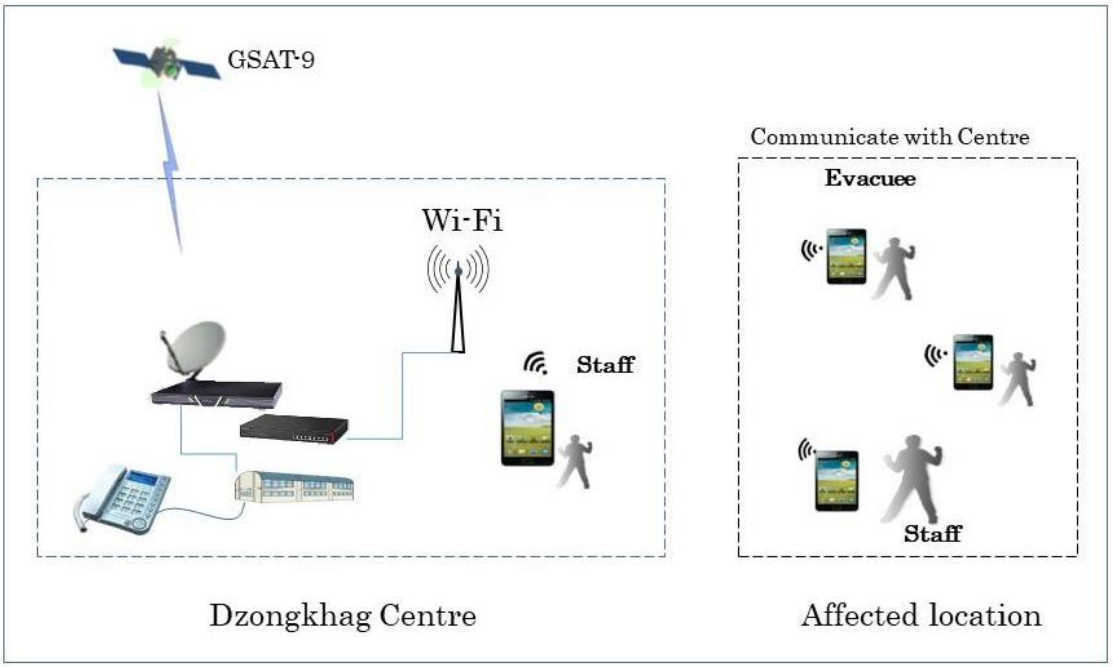
A dedicated network system for public safety is essential. This system must be coordinated with Telecom operator for efficient deployment to communication resources in the event of disaster and emergency. A basic Emergency Satellite Communication VSAT network is shown in Fig. 5.2.

Fig 5.2 Emergency Satellite Communication VSAT network

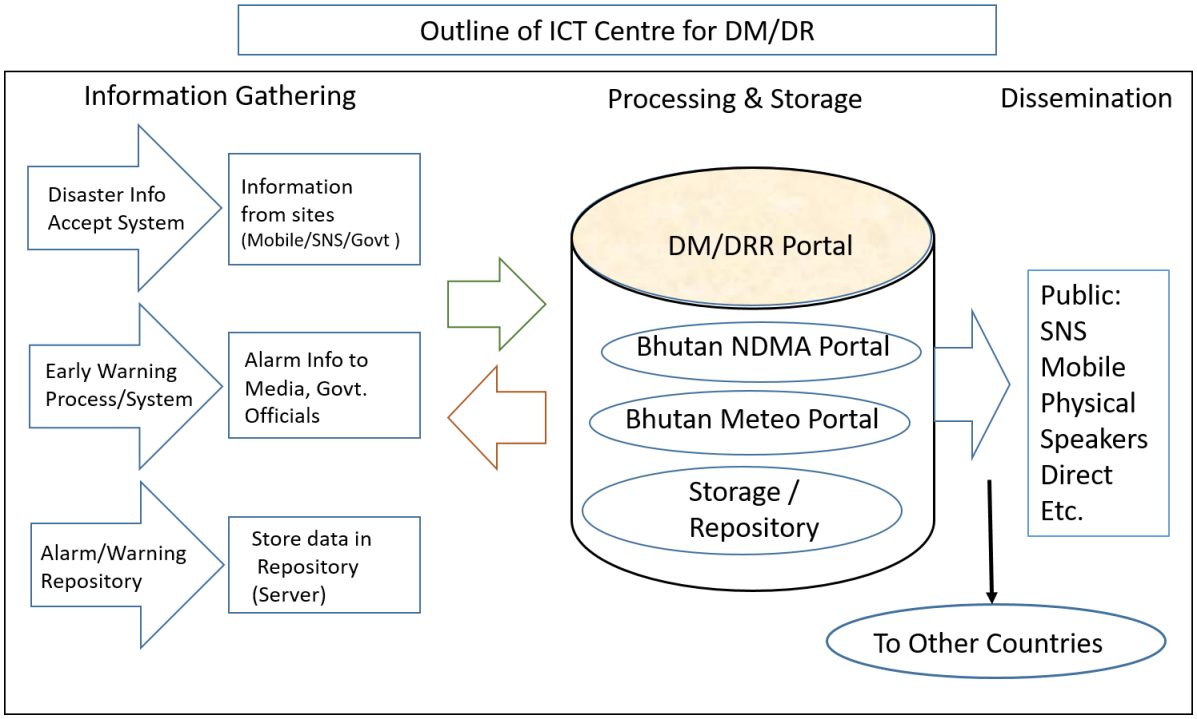


5.4 VSAT Systems Network

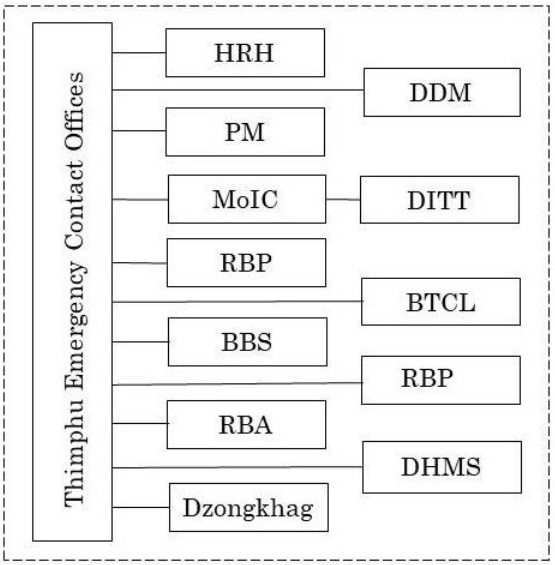
Communication between staffs and evacuees at the Local centers, Disaster affected area using VSAT and smartphones,



5.5 Services possible to provide through the network



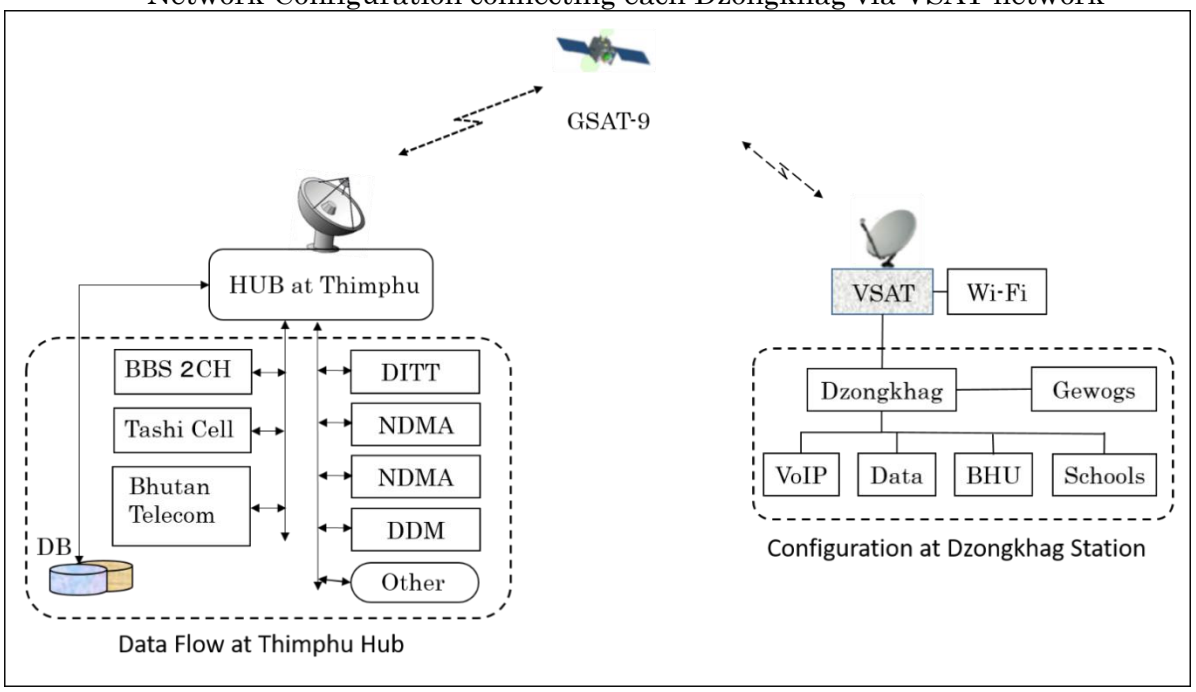
Thimphu Emergency Contact Points



Abbreviations as used here

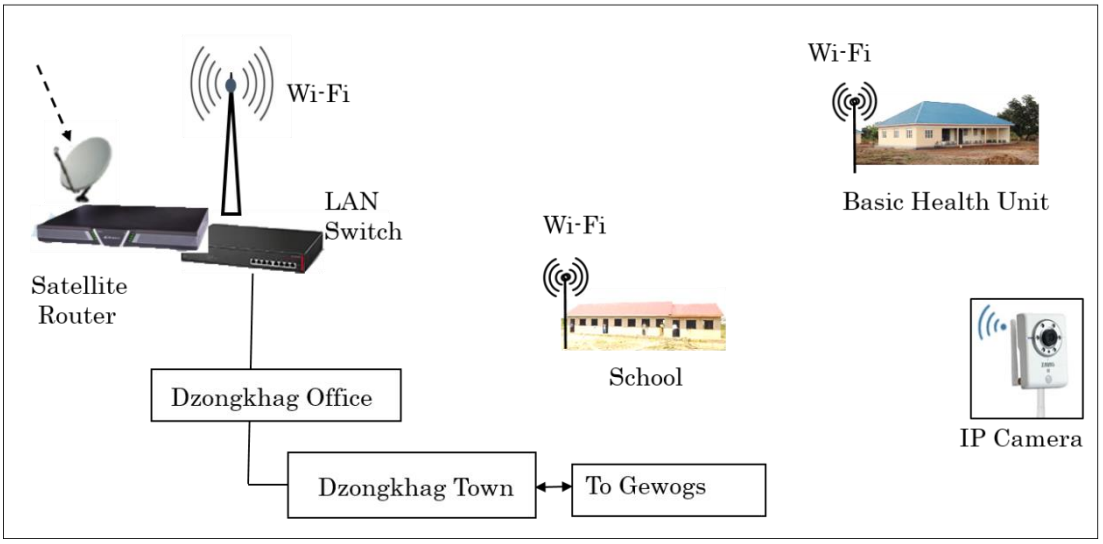
HRH	His Royal Highness
PM	Prime Minister
DDM	Department of Disaster Management
MoIC	Ministry of Information and Communications
DITT	Departnment of Information Technology & Telecom
RBP	Royal Bhutan Police
BTCL	Bhutan Tourism Corporation Limited
BBS	Bhutan Broadcasting Service
RBA	Royal Bhutan Army
DHMS	Department of Hydro-Met Services
Dzongkhag	Thimphu Zongkhag Office

Network Configuration connecting each Dzongkhag via VSAT network

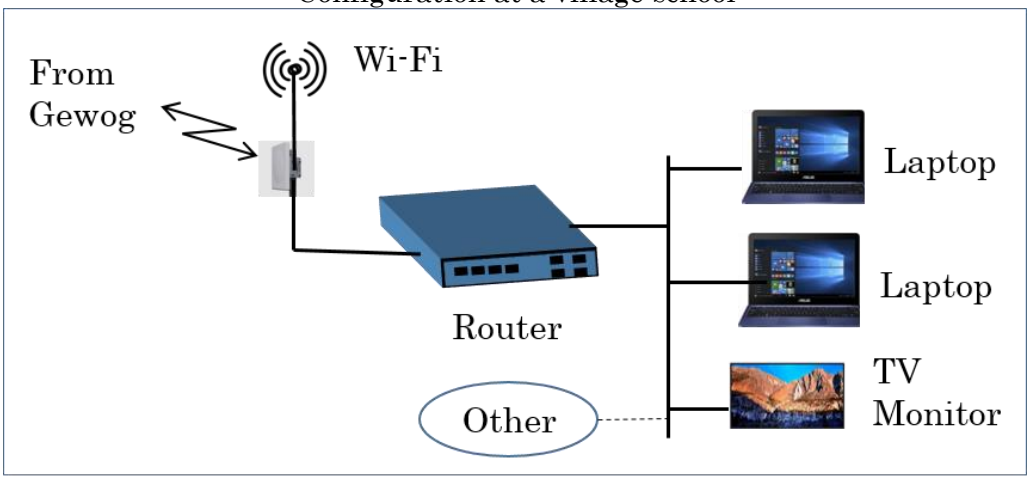


5.6 Infrastructure need for Disaster Management & Risk Reduction

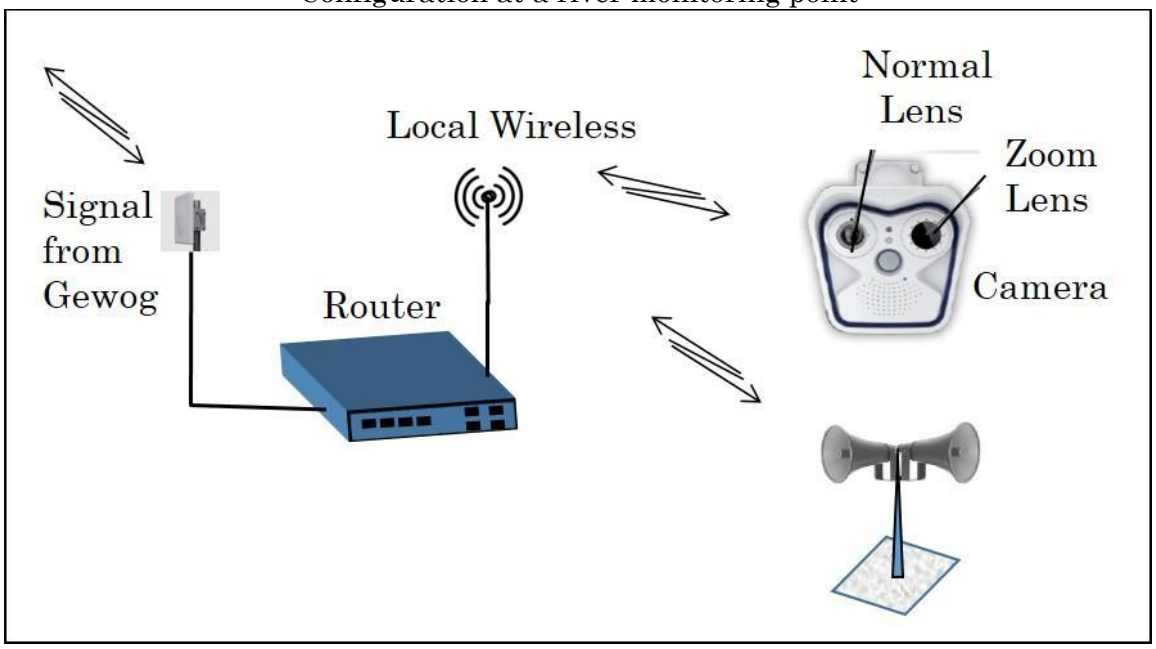
Configuration at Dzongkhag HQ



Configuration at a village school



Configuration at a river monitoring point



Low power speakers that can be operated with solar power system and can be activated through Internet connections using Wi-Fi and local wireless. Low power AM / FM Broadcast system can be of help when everything fails. Needless to say that solar powered and hand powered radio sets could play a vital role as well.

Chapter 6 Recommendations of Disaster/ Emergency Communications and Early Warning System for Central and Local Government

6.1 Technologies & network for Disaster emergency Preparedness

The Bhutan Disaster Management Satellite Network (BDMSat) System will be used to transmit and receive voice, data or video between local governments, disaster prevention related organizations, covering wide area of the country including places that are difficult to access even in normal situation. Initially the available 4 MHz bandwidth could be used as follows. However according to the coding method, the bit rate could vary and thus may cause clogging in providing services within this limited BW.

(1) Individual communication (256 Kbps)
(2) Govt. video communication (1 Mbps)
(3) Digital Image transmission (256Kbps)
(4) Digital video transmission (2Mbps)
(5) IP phones service (512kbps)

And many other services as required by the local Govt. & Agencies. The BW can be improved by advanced coding and shared bandwidth system in the network.

In future when more bandwidth will be available, the services can be expanded to distance education, group training, regular drills on important needs, and many others.

6.2 ICTs for emergency response and early warning systems

Early means prior to the arrival of a hazard: while there is still time to reduce potential harm or loss by a disaster. A warning is the message that announces an imminent danger.

A community is the place where warning information must reach at the earliest, however in practice, it is not always the case. Many communities are well informed, motivated and able to independently drive EWS from the local level without waiting for information from the outside. Early warnings alone do not keep hazards from turning into disasters. Early action, is also essential, and has been proven effective at reducing effects of disasters.

The continuous occurrence of disaster in many countries forcing governments to involve in need to strengthen disaster preparedness for response, and ensure capacities are in place for effective response and recovery at all stages.

Sendai Framework for Disaster Risk Reduction 2015 (SFDRR) adopted things related to disaster. Priority 4 of the SFDRR 2015 – 2030 states, “Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction”.

Item 36 (d) states “Media to take an active and inclusive role at the local, national, regional and global levels in contributing to the raising of public awareness and understanding and disseminate accurate and non-sensitive disaster risk, hazard and disaster information, including on small-scale disasters, in a simple, transparent, easy-to-understand and accessible manner, in close cooperation with national authorities;

adopt specific disaster risk reduction communications policies; support, as appropriate, early warning systems and life-saving protective measures; and stimulate a culture of prevention and strong community involvement in sustained public education campaigns and public consultations at all levels of society in accordance with national practices".

Early warning systems are the means by timely dissemination of information in a systematic way prior to a disaster in order to make informed decisions and take action facilitating communication and prompt response.

The continuous occurrence of disaster in many countries forcing governments to involve in need to strengthen disaster preparedness for response, and ensure capacities are in place for effective response and recovery at all stages.

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ICTs play a key role in responding to emergencies, and often satellite communications are the only way of communicating when mobile cellular towers have been compromised and terrestrial networks are down. In most emergencies satellite systems that rely on solar power are the only option. Satellites are crucial for coordinating relief and recovery efforts, but they are just one way that ICTs are being enlisted in the response to climate change.

ICT driven early warning systems are analyzing real time data to send out warning signals on impending natural disasters to citizens. Affected communities are alerted via their mobile phones and are given advanced warning and other information on disaster-stricken areas.

ICTs are also helping mitigate the impact of climate change on people and animals. For example, satellite imagery is tracking environmental changes in temperature, sea level or land use.

At the recent COP24, the meeting of the "Conference of the Parties to the United Nations Framework Convention on Climate Change", a global climate agreement was reached to achieve the targets set out in the 2015 Paris Agreement. The COP24 agreement- which comes in the wake of the "UN's Emissions Gap Report 2018" that warned of dire medium-term consequences of climate change – recognizes that coordinated international efforts are needed to curb the impacts of climate change.

6.3. Satellite Network & Applications for Local Govt. Applications

The Local Authority Satellite Communication (LASCOM) network of Japan is an independent network built for the purpose of (1) expansion and strengthening of disaster management system, (2) transmission of administrative information, and (3) information gathering from remote locations.

The features of J-ALERT system of the LASCOM network are as follows.

A small receiver exclusive for J-ALERT directly receives emergency information from the Authority through a satellite communication network.

The receiver is a device that is capable of receiving emergency information including various alarms. Since it is satellite communication, network communication congestion may occur in case of earthquake disaster or other heavy information data. When connecting with the Internet, it is possible to monitor the status of the J-ALERT dedicated small receiver services. The basic network concept for Bhutan disaster management, Disaster risk reduction, early warning system combined is shown in fig. 6.1.

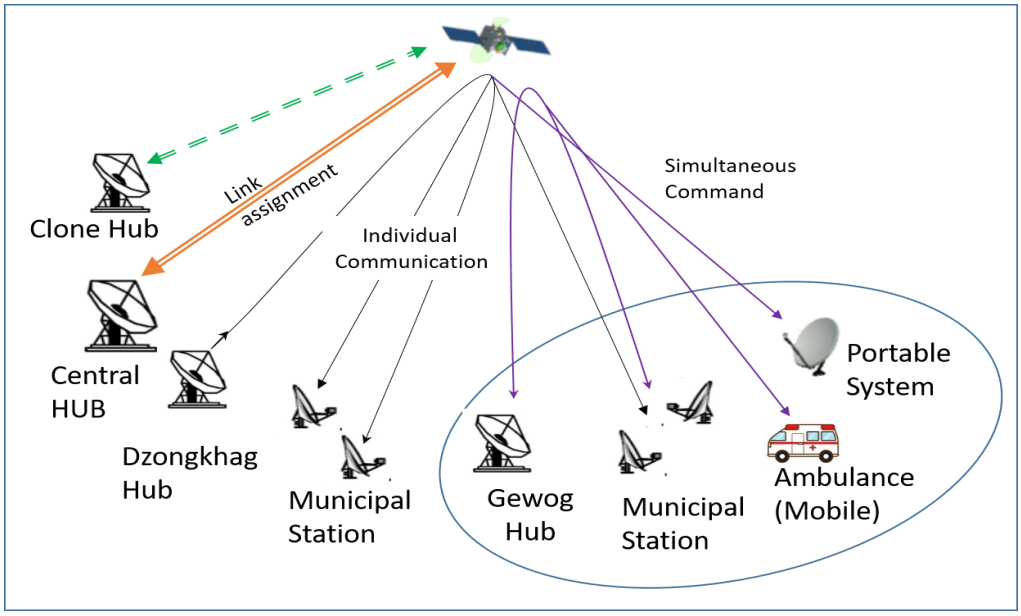

Fig.6.1 Concept of Bhutan DM/DRR/EWS Network

However, the mountainous region with a number of rivers resembles much about Japan situation so far as disaster management is concerned. Therefore, a network with dedicated bandwidth but shared bandwidth allocation is effective for Bhutan situation.

The details are beyond the scope of this survey and thus not included here in this report.

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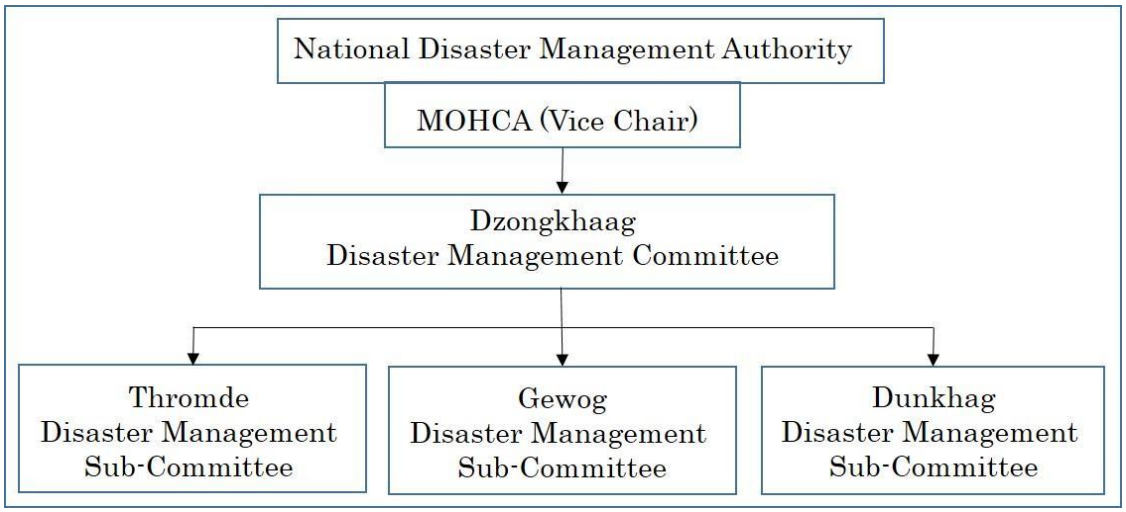
Chapter 7 Capacity Building Guideline in relation to Disaster Preparedness and Emergency Communications

7.1 Disaster Management Core Institution



7.1.1 Outline of Personnel training from various offices 1

Who should attend:

(1) Relevant government entities such as the National Disaster Management Authorities and their partners (e.g. NDMA and DDMC members).
(2) Persons responsible for coordinating the delivery of ICT services during emergencies.
(3) Persons responsible for regulating ICT services or who have an impact on ICT functions.
(4) The goal of training will be to broaden knowledge on the humanitarian context of emergency response and the Inter-Agency response mechanisms.
(5) The course should be delivered to a maximum of 20 participants at a time to attain maximum efficiency.

7.2 Capacity Building and Training Components

Training is an essential component of disaster communications management and preparedness, particularly when considering satellite based equipment. If personnel are unable to operate the equipment or keep systems and equipment maintained, there will be communications failures when links are most needed. Satellite based services are often used only as a backup system when primary networks fail, and special equipment only imported into a disaster site when the need arises. First responders or system operators may not have as regular interaction with satellite equipment as with other devices, so may not have the level of familiarity required to respond to a critical situation.

Most of the new generation satellite equipment is easy to install and use. Even then, personnel should be trained on any communications equipment for the smooth operation of satellite stations in the event of a disaster. Regular training for potential operating staff, and regular preparatory maintenance of the equipment is essential.

It is essential that government officials, businesses, educational institutions and medical facilities that may need to rely upon satellite devices for critical emergency response operations be trained on the equipment so that they are prepared when the need arises. It is also critical that equipment be maintained and functional for rapid deployment.

The number of terminals in Emergency / Disaster Telecommunication with Satellite network is as follows. As these facilities are installed, it is necessary to maintain and operate at each site. It is necessary to arrange the number of personnel allocation necessary for this maintenance and operation at least 2 in the central ministry, 2 in each of Dzongkhag, 1 each in Thromde, Gewog, Dunkahag level.

The usage of satellite infrastructure when completed should be adequate within the possibility of occurrence of a disaster event. All the projected guidelines should be carefully followed for the sake a better interoperability between the various communication systems deployed within the disaster area. In order to achieve better preparedness regular adequate training and guidance for the Gyogs staff is highly desired which will be very much helpful when such a need appears.

7.3 Training programs useful for systematic manpower development

7.3.1 Training for managerial staff (Dzongkhag level)

Consciousness of people related to disaster prevention is extremely important on preparation before disaster, and measures to take after disaster for public protection. The utilization of appropriate ICT is increasingly prioritized at the government level to ensure public safety.

The contents of the training to be designed to develop knowledge and skills related to gathering, editing, transmitting related information for disaster recovery.

Considering the limited resources and manpower assigned to disaster management become highly occupied in day to day activities, the training course to be designed for a shorter period than the conventional general training programs to enable busy staff to participate in this program. The participants from DDIT, NDMA, BTCL, DDMC, MoE, and one from each Dungkhag Disaster Management Sub-Committee. The contents will include the following items with about 30 participants in Bhutan.

(1) Sharing Information on DM/DRRM for effective future plan needs
(2) Disaster Management Plan, Legal Framework, and Practice in Bhutan
(3) Advanced ICT for DRRM with Situation Experiences elsewhere
(4) Emergency Operation process and effective support of UN & others
(5) Existing DM/DRM system and applications in Bhutan
(6) Practice and workshops with available system & facilities.
(7) With proper coordination, this training could be realized as “APT Local Training” program in Bhutan.

7.3.2 Training for office and operational staff in disaster management

Once the training as stated in item 8.1.1 above is completed, the staff related to DM/DRM in Gewog level could be trained gradually with more locally applicable contents. The instructors here could include those who have completed the training above including the operational staff from NDMA and DITT

Purpose

(1) To develop knowledge and skills to plan, implement and manage ICT solutions to support emergency preparedness and response.
(2) To enhance emergency preparedness and response through effective ICT services
(3) To enhance collaboration and cooperation between parties and humanitarian responders in the area of ICT emergency preparedness and response
(4) The goal of the training is to provide emergency uses of ICT skills in an emergency context.

Course Curriculum

Training Course on ICT for disaster management

- Type: Training Course
- Host: Ministry of Communications, Royal Bhutanese Govt.
- Date: (as to be decided)
- Location: Thimphu
- Venue: DITT facilities

Course objectives

At the end of the training the participants should be able to:

(1) Develop knowledge and skills to plan, and implement ICT solutions for emergency preparedness and response.
(2) Assist enhancing emergency preparedness and response using ICT services
(3) Able to expand collaboration and cooperation between stakeholders and emergency responders using ICT in emergency preparedness and response activities.
(4) Able to draft a personal action plan that can support building an ICT emergency preparedness and response needs.

Course content

- Tools and Terminology for Communication and Information Management
- Overview of Disasters and Emergencies
- Role of ICT in Emergency Management and humanitarian ICT Response
- Compliance with Legal Framework
- National Disaster Management Framework of Bhutan
- Disaster Risk Assessment and ICT Capacity Gap
- ICT Readiness for Business Continuity

Methodology

- The trainings are delivered using a blended learning approach such as presentations, group work, guided sessions of practical exercise and web based tutorials.

Requirements

- Proficiency in use of English language
- Meet admission criteria

Initial Stage: Train 30 staff from NDMA, DDMC and other organizations members
Projection: Train about 300 members from Disaster Management in Bhutan

Organizations	Initial Training Program (persons)			Within a Timeframe **		
Entity/ Location	Staff	O & M	Total	Staff	O & M	Total
NDMA	2	3	5	10	5	15
DDMC	2	3	5	5	5	10
Other Govt. Depts	5		5	50		50
Dungkhag DMSC*	5	-	5	15		15
Gewog DMSC*	5	-	5	200		200
Private entities*	5	-	5	10	0	10
Total			30			300

*Selected locations. ** Within two years

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Chapter 8 Technologies & Equipment for Best Practice Disaster Emergency Preparedness, Relief and Reconstruction

8.1 The Movable & Deployable ICT Resource Unit (MDRU)

Disaster prevention and reduction activities are conducted in the phases of mitigation, preparedness, response, and recovery and ICT will enable efficient and effective disaster management.

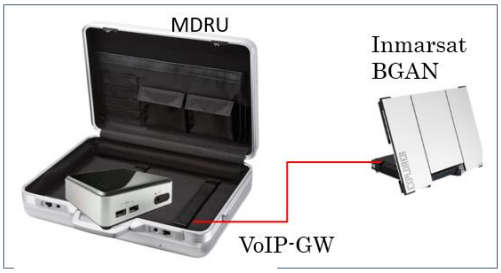
The Great East Japan earthquake / Tsunami in 2011 left communities without ICT services for days and weeks. The MDRU Project was launched by Nippon Telegraph and Telephone (NTT) group to provide a quick response ICT solution to restore communications in all disaster-affected communities.

The MDRU has the ability to accommodate communication and information processing functions which can be easily transported to the disaster affected area, and ready to deploy within a short time to establish communication at the disaster site for ICT services.

Container Type Full Spec MDRU

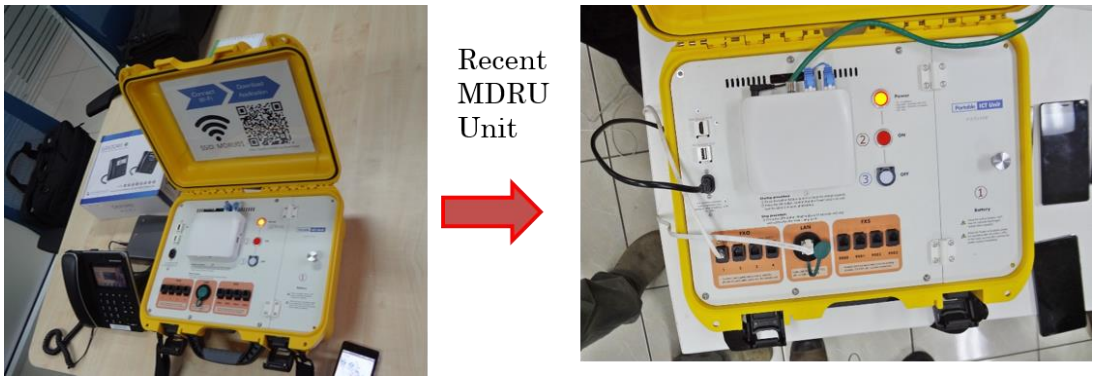
Container Type Full Spec MDRU

Van Type Medium Spec MDRU

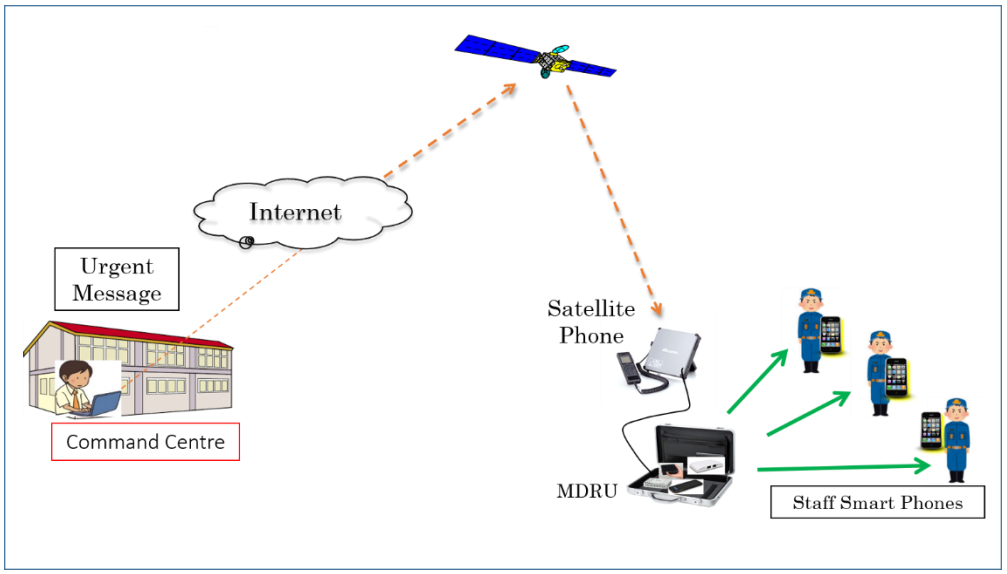


Brief-case Type Portable MDRU

The MRDU comes in three models Van type, Server case type, and briefcase type. The MDRU is also designed to complement the development of all-weather communications system.



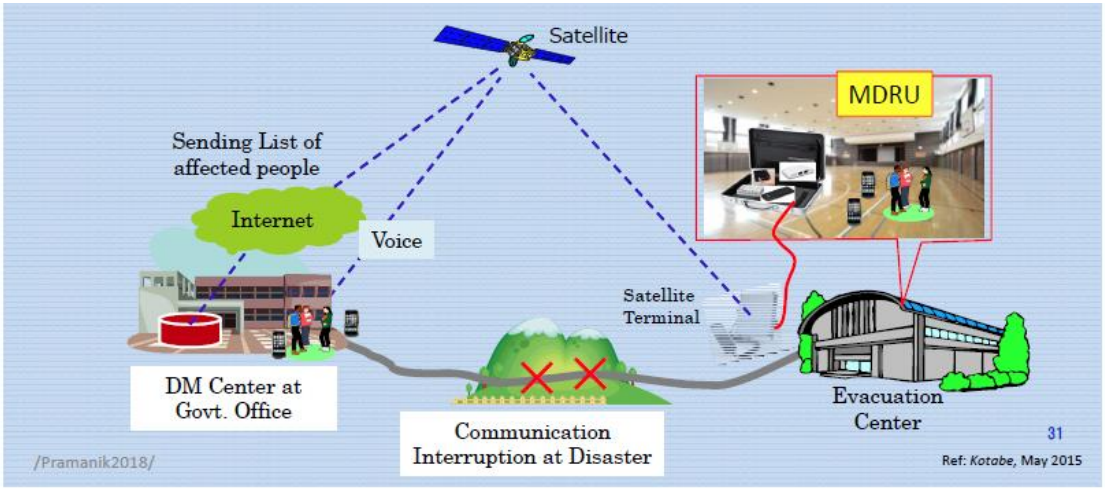
The MDRU provides immediate ICT services such as Internet connectivity, phone services and disaster information system in disaster-hit areas at a low cost with guaranteed sustainability. The unit has an added benefit of being able to be used during non-disaster time with phone, Internet and beneficial information systems to meet the client's needs.

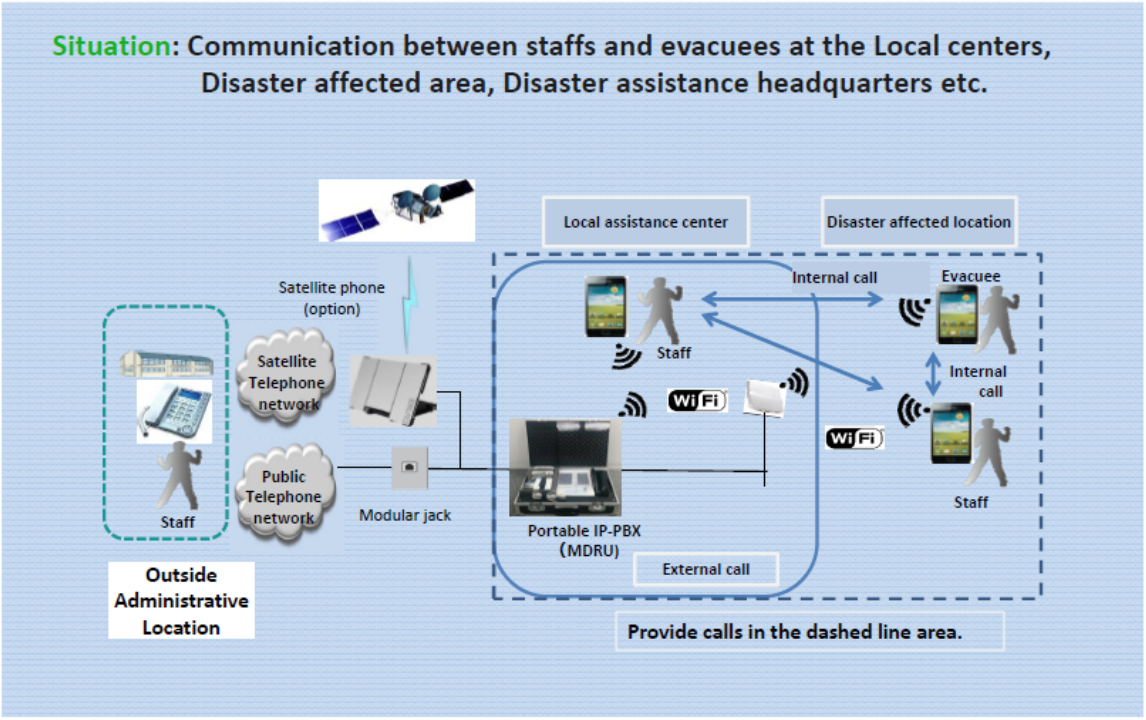


Application example at communication failure

Case 1: Mobile phone fails to work
- When Mobile base station damaged.
- When Interruption of Communication link for mobile phone connection failed (Interruption of long haul links (microwave)

Case 2: Wi-Fi internet interruption
- Damage to feeder radio system connecting Wi-Fi at sites
- Damage to microwave relay station





MDRU immediately applicable situations

MDRU function	Connection	Transmission signal	Mode
(1) Using Inmarsat BGAN	IP connection	Phone, SMS, Data file, Applications, Picture, Video, IP camera Image	1 to 1 (individual) 1 to n (Broadcast)
(2) Via Satellite (Inmarsat etc.)	IP network connection	Phone, SMS, Data file, Applications, Picture, Video, IP camera Image	1 to 1 1 to n

8.2 Satellite applications for Disaster and Climate Monitoring services

Japanese most reliable and almost failsafe satellite network is the Local Govt. Satellite Communication System commonly known as LASCOM system. (http://www.lascom.or.jp/)

This system originally utilized one 27MHz transponder for uses by the 44 prefectural Govt. of Japan which was centrally operated for common functions but independently operable from individual local Governments including cities and towns. Later it was expanded to include online training, data transmission, picture and video transmission. HD quality video is being transmitted from disaster sites in recent disaster situations. This system now uses 3 transponders of 27 MHz for exclusive use.

The LASCOM System transmit and receive voice, data or video between local governments, disaster prevention related organizations, covering wide area all over Japan enhancing and strengthening the information transmission function in the event of a disaster by streamlining administrative information transmission, and enhancing information dissemination from the region. The most well-known services are J-ALERT and L-ALERT system that transmits real time alarm and information signal to individuals by broadcasting media as well as mobile phones and SMS, SNS services.

The LASCOM network offers but not limited to the following services.

(1) Individual communication
(2) Direct communication (pay service)
(3) Batch command
(4) Consigned broadcast
(5) Digital Image transmission
(6) Digital video transmission
(7) IP video relay service
(8) Helisat video transmission

And many other pay services as required by the local Govt & Agencies.

The details are beyond the scope of this survey and thus not included here in this report.

Chapter 9 Conclusions and Recommendations

The Disaster Risk Management Strategy, is formulated as mandated under the Disaster Management Act of Bhutan 2013. The National Disaster Management Administration is responsible for, among other things, allocation of DM related funds; directing agencies to mainstream disaster risk reduction into their development plans, policies, programs and projects. The Royal Government of Bhutan established National Fiber Network connecting its districts and villages with fiber optics down to the block level. The telecommunication/broadband network is based on terrestrial systems, existing network infrastructure is vulnerable to disasters and emergency situation. The Govt. has a plan to use GSAT-9 satellite to improve broadcasting and ICT services by establishing backup channels for communication in disaster management and recovery needs.

The Govt. is to guide industry in the restoration of telecommunications services using emergency telecommunication network in the disaster affected areas, and thus requested APT for technical experts' services assistance to establish robust Emergency Communication Network.

Therefore a preparatory survey is carried out where the experts collect information on the existing telecommunication systems, and survey on the establishment of emergency/disaster information network including satellite systems. A national emergency communication needs outline as well as technical personnel training needs also surveyed.

The team proposed an ICT networks with affordable services indispensable for Emergency Telecommunications in Disaster Management monitoring and day to day observation for public safety.

National and local level capacity development is essential to achieve the vision as developed by the Government. Consequently, trainings of local population to develop knowledge on preparedness and response needs, and practical trainings for transferring knowledge into practical skills is necessary.

In this report the process of Information Gathering from remote areas, disaster emergency communication satellite network applications, capacity building for emergency and disaster preparedness as an essential part of knowledge development is described. Finally new technologies & equipment for disaster emergency communications is included in the included for future reference and uses.

Chapter 1 begins with collecting existing information and verifying facts leading to the need of new system in line with the survey needs.

Chapter 2 outlines the existing Govt. rules regulations and plan practiced in Bhutan to implement disaster management network and services successfully.

Chapter 3 explains the existing infrastructure and services that could be incorporated in to the new satellite based disaster management (DM) and disaster risk reduction (DRR) system. Damages experienced in recent years owing to various types of disasters are gathered and noted. Dzongkhag wise Disaster Management & status is also

considered and summarized as preliminary useful information.

Chapter 4 is mainly considered with the infrastructure and services related to information gathered in different forms and means. By interviewing executives as well as man on the ground as well as studying available documents from Ministries, Telecom operators and service providers and summarized. Existing Govt. ICT network is studied and utilized in this report as references

In Chapter 5 deals with Disaster Emergency Communication Satellite network for necessary services are stated. Technology and network that are realized most appropriate in Bhutan perspective is described. Infrastructure need for DM & DRR is also worked out and presented. Services possible to provide through the emergency satellite network with outline of future network including monitoring and dissemination process with modern low cost equipment is explained.

Chapter 6 under the head "Early warning systems disaster emergency communications" explains the network for emergency Telecom & Disaster Preparedness. Satellite network & applications for Local Govt., and ICTs for emergency response and early warning systems (EWS/EWBS) is described.

In chapter 7 Capacity Building for Emergency and Disaster Preparedness as an integral part of effective disaster management for public safety is explained. The most applicable mode of human resources development is recommended and method of training in different groups and levels are pointed as the need varies from location to location, locality to locality.

Chapter 8 includes proven technologies & equipment for emergency Communications including applications of new technology using the movable & deployable ICT resource unit (MDRU), and other applications are considered as applicable to Bhutan.

Finally, The satellite System should transmit and receive voice, data or video between local governments, disaster prevention related organizations, covering wide area all over Bhutan enhancing and strengthening the information transmission function in the event of a disaster by streamlining administrative information transmission, and enhancing information gathering from the remote locations. The system should be designed such that it is able to transmit real time alarm and information signal to individuals by broadcasting media as well as mobile phones and SMS, SNS services.

The satellite network should be designed as a shared bandwidth network and coding should be implemented to attain maximum bit rate out of the limited satellite segment bandwidth. In future when more bandwidth available the services can be expanded to distance education, group training, regular drills on important needs, and many others.

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Annex 1

Related International Organizations in Bhutan

United Nations Development Program (UNDP)

http://www.undp.org/content/bhutan/en/home.htmlUnite Nations

UNDP has been working with the Royal Government and the people of Bhutan since 1973 to reduce inequality build resilience and empower the disadvantaged to achieve Gross National Happiness. UNDP continues to support Bhutan through innovative partnerships, cutting-edge global knowledge, and technical and financial assistance.
UNDP's current areas of focus are:
1. Economic Integration and Innovation: To reduce poverty to less than 5 percent and multidimensional poverty to 10 per cent by the end of 2018.
2. Inclusive Governance: To ensure transparent, accountable and inclusive development with efficient public service delivery.
3. Climate Change Mitigation and Energy: To address emerging environmental issues into national policies, plans and programs and to enhance human development.
4. Climate Change Adaptation and Disaster Risk Reduction: To promote policy and implementation of community-based disaster risk management and to build community resilience to climate change by diversifying livelihoods.

The World Bank Group:

https://www.worldbank.org/en/country/bhutan

The Global Facility for Disaster Reduction and Recovery (GFDRR) provides global knowledge and good practices, technical and financial assistance to high-risk low and middle-income countries based on a business model of ex-ante support to high risk countries to mainstream disaster risk reduction in national development strategies and investments, and ex post disaster assistance for sustainable recovery. Bhutan has a stable political and economic environment. It has made a tremendous progress in reducing extreme poverty and promoting gender equality, while attention is needed to address inequality issues.
World Bank Group (WBG) support is guided by the Country Partnership Strategy (CPS) FY2015-2019 and the 2017 Performance and Learning Review (PLR). It focuses on improving fiscal and spending efficiency, increasing private-sector growth and competitiveness and supporting green development.

World Health Organization (WHO)

http://www. who.int/bhutan/en/

Bhutan joined WHO on 8 March 1982. The WHO Country office for Bhutan was established in Thimphu in 1983.
However the country had commenced to engage with WHO many years prior to this , the most significant being participation in the International Conference on Primary Health Care, in Alma Ata in September 1978. Bhutan formally adopted the Alma Ata Declaration of 'Health for All', in 1979, as the guiding principle for the development of modern health services in the country.
Within the context Bhutan joined WHO to seek its support and technical guidance to develop and promote a modern health care system in the country.
WHO is the lead technical partner of Royal Govt. of Bhutan in health and works very closely with other sectoral ministries and national agencies.

Japan International Cooperation Agency (JICA)

https://www.jica.go.jp/bhutan/english/office/index.html

Japan's assistance to Bhutan is greatly significant in terms of not only strengthening of cooperative relationship in the international arena by promoting friendly relationship with Bhutan, but also contributing to stabilization of the entire region through assistance to development needs which supports Bhutan's democratization efforts while respecting its basic philosophy.
Based on the priority areas of the Government of Bhutan, JICA is focusing aid programs on four main sectors:
1. Agricultural and rural village development,
2. Economic infrastructure development,
3. Social development, and
4. Strengthening governance.

UNISDR

www.preventionweb.net/go/sfdrr
www.unisdr.org
isdr@un.org

Chart of the Sendai Framework for Disaster Risk Reduction 2015-2030

Scope and purpose

The present framework will apply to the risk of small-scale and large-scale frequent and infrequent, sudden and slow-onset disasters, caused by natural or man-made hazards as well as related environmental, technological and biological hazards and risks. It aims to guide the multi-hazard management of disaster risk in development at all levels as well as within and across all sectors.

Expected outcome

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries

Goal

Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience

Targets

Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015

Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015

Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030

Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030

Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020

Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030

Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030

Priorities for Action

There is a need for focused action within and across sectors by States at local, national, regional and global levels in the following four priority areas.

Priority 1
Understanding disaster risk

Disaster risk management needs to be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment

Priority 2
Strengthening disaster risk governance to manage disaster risk

Disaster risk governance at the national, regional and global levels is vital for the management of disaster risk reduction in all sectors ensuring the coherence of national and local frameworks of laws, regulations and public policies that, by defining roles and responsibilities, guide, encourage and incentivize the public and private sectors to take action and address disaster risk

Priority 3
Investing in disaster risk reduction for resilience

Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment. These can be drivers of innovation, growth and job creation. Such measures are cost-effective and instrumental to save lives, prevent and reduce losses and ensure effective recovery and rehabilitation

Priority 4
Enhancing disaster preparedness for effective response and to «Build Back Better» in recovery, rehabilitation and reconstruction

Experience indicates that disaster preparedness needs to be strengthened for more effective response and more capable recovery in place for effective recovery. Disasters have also demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of the disaster, is an opportunity to «Build Back Better» through integrating disaster risk reduction measures. Women and persons with disabilities should publicly lead and promote gender-equitable and universally accessible approaches during the response and reconstruction phases

Guiding Principles

Primary responsibility of States to prevent and reduce disaster risk, including through cooperation

Shared responsibility between central government and national authorities, sectors and stakeholders as appropriate to national circumstances

Protection of persons and their assets while promoting and protecting all human rights including the right to development

Engagement from all of society

Full engagement of all State institutions of an executive and legislative nature at national and local levels

Empowerment of local authorities and communities through resources, incentives and decision-making responsibilities as appropriate

Decision-making to be inclusive and risk-informed while using a multi-hazard approach

Coherence of disaster risk reduction and sustainable development policies, plans, practices and mechanisms, across different sectors

Accounting of local and specific characteristics of disaster risk when determining measures to reduce risk

Addressing underlying risk factors cost-effectively through investment versus relying primarily on post-disaster response and recovery

«Build Back Better» for preventing the creation of, and reducing existing, disaster risk

The quality of global partnership and international cooperation as an effective, meaningful and strong

Support from developed countries and partners to developing countries to be tailored according to needs and priorities as identified by them

www.preventionweb.net/go/sfdrr
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