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Evaluation of the Rural-Telemedicine Program in Nepal

Study from the selected districts

TLM-3902
Master's Thesis in Telemedicine and E-health

RAMESH BHATTA

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This thesis is submitted as partial fulfillment of the requirement of the degree of Master's of Science (MSc) in Telemedicine and e-Health

Submitted by

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Abstract

Telemedicine is growing both in developed and developing countries and has remained as an integral part of health care delivery system. It includes different health activities and medical services that take place at distance. In the developing countries it supports to improve the accessibility, quality and efficiency of the healthcare services and also reduces the cost of service. It also supports to improve the administrative as well as technical aspect of healthcare system.

Government of Nepal has also implemented the rural-telemedicine program in thirty rural-districts hospitals for providing specialist health care services and also to improve the accessibility of health services for the rural community peoples.

Methods:

This study explores the existing situation of the rural telemedicine program and the challenges and limitations related with its implementation. Similarly it has also highlighted the roles and responsibilities of the government to improve the program. The study data and information were collected from the selected rural-telemedicine sites and it includes various respondents who were involved in the program and were working at various levels under the government health system. This is a qualitative study with interpretative case study approach. This approach is used since it supports to explore and understand the study area and produce deep insights into the context. For collecting the study data, multiple data collection tools (Semi-structured interview, site observation and discussion) were used. The collected data and information were analyzed and interpreted based on the preconception of the researcher and by comparing them with the concept provided by the Information Infrastructure (II) Theory and Actor-Network Theory.

Results:

Study findings shows that the rural-telemedicine service is necessary and important to improve the accessibility and provide specialized healthcare services to the rural community peoples. It has connected the rural-district hospitals with the tertiary level hospital and also supported the health personnel working in the rural areas to get necessary medical support.

However the program is facing various challenges due to the lack of sufficient infrastructure and technology that are needed to support the program. Similarly the study findings show that various other factors have also affected the rural-telemedicine program. Such factors are related with the weak policy of government on rural-telemedicine program, limited fund, lack of trained and motivated human resources, frequent and unplanned transfer of the health personnel, unsatisfactory incentives for those health personnel involved in the program and not having supportive environment.

Conclusion:

Government need to improve on the existing policy and provide sufficient attention to the program. It is necessary to strengthen the infrastructure and technology and make them user-friendly and culturally adjustable. Similarly it should be cost effective and affordable and supportive to the local technology. For the sustainability of the program, government should also focus on the promotional activities and conduct networking and partnering with the related private organizations and external development partners. Similarly regular training and attractive incentives should be provided to the health personnel to motivate them to work in the rural areas.

Government also needs to focus on conducting regular supervision, monitoring and evaluation of the program so that it will provide opportunity to gradually develop the program and timely address the related limitations and challenges.

Keywords: Rural-telemedicine, challenges and limitation, role of government, sustainability, Nepal

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List of Abbreviations

ADSL	Asymmetric Digital Subscriber Line
ANT	Actor-Network Theory
CAHW	Senior Auxiliary Health Worker
DHO	District Health Officer
DoHS	Department of Health Service
EDP	External Development Partners
EHCS	Essential Health Care Service
FCHV	Female community Health Volunteer
HA	Health Assistant
HDI	Human Development Index
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HP	Health Post
ICT	Information and Communication Technology
II	Information Infrastructure
IT	Information Technology
MDG	Millennium Development Goal
MO	Medical Officer
MoHP	Ministry of Health and Population
NDHS	Nepal Demographic Health Survey
NHRC	Nepal Health Research Council
NHSP	Nepal Health Sector Program
NLSS	Nepal Living Stander Survey
NPC	National Planning Commission
OPD	Out Patient Department
OPP	Obligatory Passage Point
PHC/ORC	Primary Health Care/outreach clinic
PHCC	Primary Health Care Center
PHO	Public Health Officer

SAARC	South Asian Association for Regional Cooperation
SHP	Sub-Health Post
STDs	Sexually Transmitted Diseases
UiT	University of Tromsø
UN	United Nation
UNDP	United Nation Development Program
VDC	Village Development Committee
VSAT	Very Small Aperture Technology
WHO	World Health Organization

Chapter one

Introduction

This chapter provides brief introduction on the Information Communication Technology and Telemedicine services. Further it highlights on the study area and the methodology used by the study. Similarly this chapter also discusses on the motivation of the researcher to conduct this particular study and also provides brief information on the contribution that the study can provide to improve the status of rural-telemedicine program in Nepal. Finally, the chapter summarizes the overall structure of the thesis and provides brief glance on the various chapters that are included in the study.

1.1 Introduction:

Use of Information and Communication Technology (ICT) in the delivery of healthcare system support to overcome the challenges related with the accessibility, quality, equity and cost of the health care services. Similarly the use of Information and Communication Technology (ICT) also supports the peoples to seek and exchange the information, which ultimately makes their life better (WHO, 2010).

Telemedicine has been defined by different experts in various ways, American Telemedicine Association has mentioned that telemedicine includes various applications such as *"...video, emails, smart phones, wireless tools and other forms of telecommunication technology"* for two way communication. Similarly it defines telemedicine as *"...use of medical information exchange from one site to another via electronic communication".* (American Telemedicine Association, n.d)

Wootton, Craig, and Patterson (2006) have defined telemedicine as;
"Delivery of health care and exchange of healthcare information across distance"

Telemedicine improve the equity of access to healthcare and decentralize the mode of health service delivery. Similarly, it supports to provide the health services efficiently, enhance the communication among the health personnel and improve the quality of health services (Wootton, Craig, and Patterson, 2006).

Nepal is listed among one of the underdeveloped countries with low human development index i.e. 0.458 (UNDP, 2011). Geographically most of its area is under hilly and mountainous region and 83% of its total population is still living in the rural areas (Census Report, Central Bureau of Statistics, 2011). The government has a challenge to overcome the poverty and geographical barriers to reach the rural peoples and provide them effective and affordable health care services. Wootton, Craig, and Patterson (2006) discuss that the use of Information and Communication Technology (ICT) provides opportunities to overcome such barriers and increase the options to deliver the health services.

Government of Nepal has also endorsed the policy to implement the rural-telemedicine program to support the healthcare delivery system. The main purpose of the program is to enhance the delivery of specialized health care services for the peoples living in the remote areas. Since there is a large proportion of population living in the rural areas that deprived from the basic essential health care services, so the program will support to address their health problems. Similarly the program will also support to improve the utilization of health services among the rural peoples by increases the accessibility, availability and affordability of the health services.

Use of Information and Communication Technology can support the development process of the country. Realizing the importance of ICT in health care system, the concept of telemedicine was already used by some of the private organizations and hospitals before the government started the rural-telemedicine program. However, due to the resource constrain and lack of supporting environment they were not able to take the optimum benefit from the telemedicine applications. Similarly it was also challenge for such organizations to sustain the program with their own resources. Pradhan (2002) has discussed that the main problems that

are hindering the development of Information Technology in countries like Nepal are related with,

"Lack of appropriate technology, qualified professionals, absence of economic incentives and infrastructures and lack of explicit IT policy" (Pradhan, 2002).

Similarly, proper management of Information Technology is one of the essential aspects that are necessary to get the good outcome from it. For the managers it is important to look-upon the various factors that plays crucial role and affect the Information Technology. Pradhan (2002) has stated that the information technology is affected by the various aspects. Such aspects are discussed as,

"…external social, economic, political and cultural factor that vary from one country to another, as well as on the internal forces like organizational culture, and skill that vary from one organization to another" (Pradhan, 2002).

Therefore, the government has an important role in effectively implementing and managing the Information Technology (IT) by designing the effective policy and fostering the supportive environment. It is similar with the rural-telemedicine program, where the government can design the effective policy and create the supporting environment to overcome the social, economic and political constrain. Government should also focus on making the program user-friendly, culturally acceptable and supportive to the local technology. Similarly regular training should also be provided to the personnel involved in the program to enhance their knowledge and skill.

International Conference on Primary Health Care has stated health as *"Fundamental human right"* (WHO, 1978). So it is the responsibility of every country to make the health services accessible for each and every individual so that they can utilize it as they need. Similarly it is also necessary to provide equitable health services both in urban and rural areas without any discrimination between the *"haves"* and *"have-not"*. Hence the implementation of rural-

telemedicine program can support to address such issues by proving specialized health care service to the unreached population and also by increasing the accessibility of service.

1.2 Purpose of the Research:

This study was conducted to explore and understand the ongoing status of rural-telemedicine program in Nepal. To assess its present status and scope in national health care delivery system the study has included the perspectives of various stakeholders who are involved in the program. Similarly the study has also focused to explore the existing strengths, limitation and challenges related with the ongoing rural-telemedicine program.

1.3 Research Objective and Research Questions:

Main objective of this study is to explore the ongoing status of rural-telemedicine program conducted by the government of Nepal in selected districts. To explore the status of the program, researcher has taken the information and views from different stakeholders who are working in the government health sector and involved in the rural-telemedicine program.

1.3.1 Research Questions:

- What is the situation of rural-telemedicine program and its related strengths, challenges and limitations?
- What are the experiences of the health personnel regarding the use and benefits of rural-telemedicine program in the rural areas of Nepal?
- What is the role of government to improve and promote the status of rural-telemedicine program?

1.4 Study area and Methods:

1.4.1 Study area:

This study is conducted in the three different rural-telemedicine sites of Nepal. Necessary information was collected from the Darchula and Sindhupalchowk districts hospitals and also from the Central Coordination Desk at Patan hospital which is located in Lalitpur district. Geographically, Darchula district is located in the far-western part of Nepal, which is about 900 kilometer away from the capital and it takes about three days to reach the site. Sindhupalchowk is also a remote district located in the central region, which is about 100 km away from capital and it takes about four hours to reach the site by using the local transportation services. Similarly the Central Coordination Desk is centrally located at capital, which is responsible for providing specialist health care service and also for providing technical, managerial and other necessary support to the rural-telemedicine team who are working at the rural district hospitals.

Before selecting the study site the Telemedicine Officers and other team members were consulted. Similarly the sites were selected based on their suggestions and as convenient to the researcher so that the information can be collected and completed within a specific study time period and with limited resources.

1.4.2 Study Methods:

This study mainly focused on exploring the status of rural-telemedicine by assessing the perspectives of the different stakeholder who are working under government health system. To understand the study scenario and get the necessary information, qualitative research method with interpretative case study approach was used. This method supported the researcher to have deep insight into the research area and to describe and analyze the complex socio-technical aspect of the rural-telemedicine program. For collecting the data, semi-structured interview, observation and discussion was used. Semi-structured interview was conducted with all-together fifteen respondents working in the various levels of government

health system at different places. Similarly, during the study period the necessary data was also collected by the site observation and having discussions with different stakeholders. In addition to that supporting photographs were also taken to support the study information.

1.5 Personal Motivation:

Before taking this course on Telemedicine and e-health at University of Tromsø, I was working as a Public Health Personnel in various rural districts of Nepal. During my work, I had a bitter experience with many incidents where I saw peoples suffering from extreme severity or some time they even die due to the health problems that could be managed easily. I realized that the main problem behind having such situation is due to the inaccessibility of the basic health services. Similarly other factors have also supported to cause such incidents, such as lack of transportation facilities, unavailability of healthcare personnel, proper medicine and equipments etc. In-addition to that it was seen that the available health service were also not utilized properly due to the lack of information and awareness among the community peoples.

In such scenario the initiation of government to implement rural-telemedicine program to provide specialized healthcare service in the rural areas is admirable. So, my interest is to explore on the existing situation of rural-telemedicine program and to identify its strengths, challenges and limitations. Hence I have expected that this study will support me to visualize the real scenario of rural-telemedicine program that is ongoing in the rural-district hospitals. Similarly it will also provide opportunity to realize the existing strengths, limitation, challenges faced by the program so that necessary measures can be taken to improve and implement the program in better way.

1.6 Expected contribution:

This study provides the glimpse on existing situation of rural-telemedicine program and its related challenges and limitations. The study has also showed the various applications of rural-telemedicine services and has discussed on how they have supported in the delivery of health services in the rural areas. The study information is obtained by exploring the

experiences and views of different stakeholders who are working in the government health system and are also involved with the rural-telemedicine program. It is expected that the findings obtained for the study will support the concerned government authorities to overview the existing status of rural-telemedicine program and its strengths. Similarly it will also provide opportunity to realize the various limitations and challenges that the rural-telemedicine program is facing to effectively deliver the health services in the rural communities. So the information available from study can support the responsible authorities to visualize the scenario and take the necessary actions to address the existing problems. Finally, the study will support to enhance the knowledge and skill of the researcher in the rural-telemedicine program. Similarly the information obtained from the study will also remain as a milestone to conduct further research activities in the related area.

1.7 Structure of the Thesis:

This study has altogether seven chapters and it also includes the references and the appendix. All the study chapters are presented in a sequential way with a descriptive explanation on the related topics;

Chapter 1: This chapter includes brief ***introduction*** on the context and area of the study with its purpose. It discuss on the purpose of the study, which is followed by research objectives and research questions. It also provides a brief description on the study area and methods used by the researcher to collect the necessary information. Similarly this chapter also mention about the motivation of the researcher to conduct the study particularly in this area. Finally it includes the short description on the expected contribution of the study and provides brief information on the structure of the whole thesis.

Chapter 2: This chapter focuses on the definitions of telemedicine provided by various experts and also discuss on the theories that are used to support and justify the study area. The chapter starts with the brief introduction and definitions provided by the various experts and organizations on the Telemedicine and about its various applications. After that it highlights on the telemedicine services in developing countries and also discuss on how it supports to

provide better health care services. Similarly it also discusses on the various limitations and challenges that are faced by developing countries while implementing the telemedicine services. Finally this chapter provides brief introduction on the Information Infrastructure Theory and Actor-Network Theory and discuss how the concept provided by these two theories can be related with the rural-telemedicine program.

Chapter 3: This chapter provides brief description on the study ***methodology.*** It focuses on the research design and approach used in the study. It mainly discuss on the qualitative research and the interpretative case study approach. It further provides information on the data collection process and about the involvement of the researcher as outsider. This chapter also focuses on the ethical consideration and limitation of the study.

Chapter 4: This chapter provides brief introduction of Nepal and status of health system and rural-telemedicine program. It also discusses on the existing health indicators of the country and how the implementation of rural-telemedicine program can improve those indicators. Further, this chapter also focuses on the current policy and situation of rural-telemedicine program and discuss about the potential scope and importance of the rural-telemedicine program in Nepal.

Chapter 5: This chapter presents the ***findings*** that were obtained during the field visit by conducting semi-structured interview, observations and discussion with the different respondents who are working under government health system and are also involved in the program. The study finding shows the existing situation of rural-telemedicine program and its related challenges and limitations. Similarly it also provides information on the various activities that the government has been planning to improve the existing situation of the program.

Chapter 6, 7 and Appendix: Chapter six discusses on the study findings by relating them with the concept provided by the Information Infrastructure Theory and Actor Network Theory. Similarly it also discusses on the sustainability of the program and mentions the

various factors that affect the sustainability of rural-telemedicine program. It also briefly discuss on the role of government to improve the existing program.

Chapter seven provide conclusion on the overall concept of the study. After that the references that were reviewed and cited in the study are listed. Similarly in the appendix, it includes questionnaire, ethical approval letter provided by the Nepal Health Research Council, permission letter provided by the Department of Health Services (DoHS) and the letter provided by the University of Tromsø.

Chapter Two

Theory

This chapter provides definitions and concepts provided by various experts on the Telemedicine and its applications. It also focuses on the importance of telemedicine in the delivery of health-care services. Similarly it also discuss on the possible challenges that are related with the implementation of telemedicine service. Further, the chapter also provides brief information about the telemedicine services in the in developing countries and discuss on its scope and importance.

Similarly, this chapter also highlights the concept on the Information Infrastructure (II) Theory and Actor-Network Theory (ANT). In this study the concept provided by these two theories are interrelated with the rural-telemedicine program activities.

2.1 Introduction to Telemedicine (Concepts and Definitions):

Telemedicine is a growing concept in both developed and developing countries. The word 'telemedicine' is made out of two words; 'tele' and 'medicine', where 'tele' means distance (Wootton, 1998). So it can be simply understood as the process of providing medical services to the peoples who are at distance. Wootton (1998) has defined telemedicine as;

"...medical activities involving distance and cover diagnosis and clinical management, treatment and education (for both health care workers and patients)" (Wootton, 1998).

Telemedicine is taken as a comprehensive term, so Wootton (2001) has discussed it as an *"umbrella"* since it includes different medical activities that take place at distance. There are various terms which are used as similar or interchangeably for the telemedicine like "telehealth", "telecare", "telenursing", "telematics" (Wootton, 1998).

American Telemedicine Association has defined telemedicine as,

"Use of medical information exchange from one site to another via electronic communications to improve patients' health status" (American Telemedicine Association, n.d).

World Health Organization (WHO) has defined telemedicine as,

> *The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of diseases and injuries, research and evaluation, and for the continuing education of health care providers, all in the interest of advancing the health of individuals and their communities"* (WHO, 1998).

World Health Organization (WHO) has focused that the telemedicine and e-health related activities are important for delivering effective and quality health care services both in developing and developed countries, especially to those populations who have limited access to the health care services.

American Telemedicine Association (n.d) has discussed that the telemedicine services can support in specialist referral services, patient consultation, remote patient monitoring, medical education, consumer medical and health information. Various applications of telemedicine can be used to provide quality healthcare to those peoples who don't have proper access to health care services (Grigsby, Schlenker, Kaehny, Shaughnessy, & Sandberg, 1995). It is open and evolving field, since it includes infrastructures and technologies that are appropriate and according to the need and demand of the society (WHO, 2010). The use of telemedicine services differ from place to place, it is depends on the status of infrastructure and technology that is being used. Yellowlees (1997) has discussed that the use of infrastructure and technology vary from country to country and it is influenced by the geographical structure, involved personnel, used application and political perspective of that particular country. Similarly Sood, Mbarika, Jugoo, Dookhy, Doarn, Prakash, et al. (2007) have discussed that,

"Telemedicine's dependence on telecommunications technologies is the major reason for its continuous evolution. This is dependent on networking and communications technologies, which are themselves in the state of flux. Hence, telemedicine can be claimed to have inherited evolution from one of its components, that is, the communications technologies"

Wotton (1998) discuss that the use of telemedicine is linked with the development of telecommunication. It is explained that during 18th century, patient in London used to consult their doctors and also get feedback from doctor through letters (Wotton, 1998). However the scenario has-been changed in the present context, i.e. the patient can use the various means of modern communication technology to communicate with the health personnel for consulting and discussing on their health problems.

In the present scenario, telemedicine services are commonly used in both the developing and developed countries. It has improved the quality and accessibility of health services and supported to reach the unreached communities and peoples. In-case of developing countries, telemedicine applications is mainly used to provide the healthcare service to the peoples living in the rural and remote areas, where the healthcare service is not easily accessible. Wotton (1998) has discussed that in the developing countries the telemedicine is used for the diagnosis and management of the health problems. It is also discussed that the patients at the remote sites can consult the specialist through real-time videoconferencing or by sending the pre-recorded images and data (Wotton, 1998). It shows that the telemedicine applications can be used, both synchronously as well as asynchronously.

In most of the developing countries including Nepal, it is difficult to make the health services accessible for the rural peoples and provide cost-effective and high-quality health care services. The use of modern Information and Communication Technologies (ICTs) has supported the telemedicine to address such problems and also to overcome the geographical barriers. Hence the use of the telemedicine services has supported to reach the underserved communities in the rural areas (WHO, 2010).

For implementing the telemedicine services effectively and successfully, Yellowlees (1997) has recommended seven different principals which are as follows;

> *"1) Telemedicine applications and site should be selected pragmatically, rather than philosophically. 2) Clinician drivers and telemedicine users must own the system. 3) Telemedicine management and support should be from the 'bottom up', rather than from the 'top down'. 4) The technology should be user friendly as possible. 5) Telemedicine users must be well trained and supported, both technically and professionally. 6) Telemedicine applications should be evaluated in a clinically appropriate and user-friendly manner. 7) Information about the development of telemedicine must be shared"* (Yellowlees, 1997).

It is important to focus on these above mentioned principals, especially if the telemedicine program is newly started so that it will provide opportunity to implement the program more effectively and in better way.

2.2 Importance of Telemedicine:

Use of telemedicine has improved the delivery of healthcare services both in developed and developing countries. In the developed and industrialized countries due to the advance use of Information and Communication Technology (ICT), it is predicted that the telemedicine service can shift the health care delivery system from hospital and clinics to home (Heinzelmann, Lugn, & Kvedar, 2005). Similarly in the developing and poor countries with limited health care infrastructure, the use of telemedicine service helps to create a link between healthcare providers serving in the remote areas and the specialist. It also supports in improving the quality, efficiency and accessibility toward the service and also makes the service cost-effective (Heinzelmann, Lugn, & Kvedar, 2005) and (Craig & Patterson, 2005).

Wotton (2008) has shown that the low-cost telemedicine services are clinically useful, feasible, sustainable and replicable in the rural areas and underserved communities. Similarly the use of telemedicine services can also improve the communication in health care pyramid,

so that it supports to decentralize the management of health system and provide the health services more efficiently (Wotton, 1998).

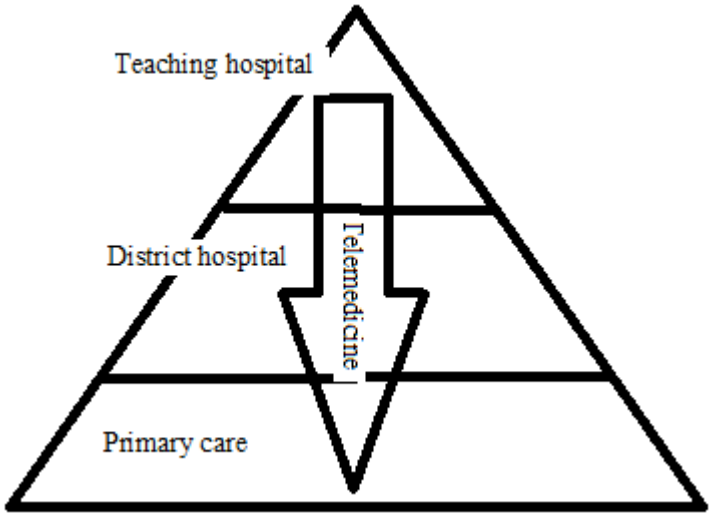

Figure 1 Telemedicine as a technique for decentralization, improving communication down the health care pyramid

Source: Wotton (1998).

Wotton, (1998) has discussed that the telemedicine services improves the accessibility of health care services by reducing the travelling need of doctor and the patient. Similarly such services are mainly beneficial for the rural areas where the specialized health care services and specialist doctors are scare. Similarly it also support in making timely and effective referral, which ultimately improves the quality of healthcare (Wotton, 1998).

2.3 Possible barriers in implementing the Telemedicine Service:

Intervention of telemedicine program supports the delivery of healthcare services and also improves the accessibility of health services for those peoples who are living in the rural communities. However there are various possible constrains and limitations that remain as a barrier to properly implement the service. These possible barriers differ in developing and developed countries based on their technological development and the availability of the

resources. However in this portion it is mostly highlighted on the barriers that are faced by the developing countries.

Wright (1998) has highlighted that the status of the Information and Communication Technology and the availability of the fund and resources affect the implementation of the telemedicine services. Similarly Wotton (1998) has discussed about the various non-technical factors, such as the involved personals and organizational issues which can remain as a barriers to successfully implement the telemedicine program. Such problem occurs while adopting and applying the new technology. When the involved personnel are not trained and motivated to use the program then it will be difficult to implement the program. So they should be provided proper knowledge and skill to implement the services. Similarly the involved organization should also have good vision and proper policy and plans on the program. There is also a need of motivated and committed managers at the organization who should be taking the responsibility to handle and coordinate the telemedicine related activities. In-addition to that the organizations should also be able to afford and maintain the system, so that the program can grow gradually as it is needed. Hence it is necessary to adopt the user-friendly and affordable equipment and technology so that it will sustainable. Similarly the service provided by the program should also be affordable and cost-effective to meet the health need of the rural communities.

Martinez, Villarroel, Seoane, and Pozo (2004) have mentioned that the lack of supporting environment such as electricity problem, difficulty in transportation and unable to afford the expensive infrastructure and technology affect the implementation of the telemedicine services. Similarly Edworthy (2001) has stated that the local support and attitude of the healthcare providers also influence the implementation of the telemedicine service.

Pradhan (2002) has also discussed that in the developing countries, facilities for the computer's hardware and software, training and the organizational strengths to develop and adopt the technology can affect the implementation of the telemedicine program. Similarly it

is also discussed that the social, political, economic, cultural and organizational status and their interaction with each other also affect the development of the telemedicine program.

Similarly the implementation of telemedicine services is also affected by the malpractice that can occur while using various applications of telemedicine program. Wotton (1998) has discussed that to overcome such challenges it is important to follow the standard clinical protocols so that it will minimize the misdiagnosis, malpractices and related such problems.

2.4 Telemedicine in Developing Countries:

Telemedicine has been taken as an innovative solution for the developing countries, especially in the context where the *"…disease is prevalent, doctors are scarce and health care infrastructure is inadequate"* (Eccles, 2011).

Wright (1998) has discussed that the implementation of telemedicine can play important role in the delivery of health services in developing countries. It supports the administrative task of the government for effectively implementing the national health policies by reducing the cost and improving the quality and efficiency of the health-care services. Similarly it also supports to reinforce the national health structure by connecting the rural health facilities with the tertiary level hospitals and by providing the training and education to the health workers serving in the remote areas (Wright, 1998).

Wright (1998) discuss that the healthcare delivery system is affected by the status of Information and Communication Technology that is used. However in the developing countries due to the lack of sufficient resources related with Information Communication and Technology (such as telephone network, computers, internet etc) it is challenge to implement such technology in the health care delivery system. Similarly Martinez, Villarroel, Seoane, and Pozo (2004) also mentioned that *"…limited access to electricity…deficient transportation infrastructure resulting in a lack of appropriate maintenance and control system, limited ability to afford expensive telecommunication infrastructure and poorly trained health personnel"* can be taken as a barriers to implement the information technology. Such barriers

also affect the implementation of telemedicine services. Hence, Wright (1998) has discussed that for successfully implementing the telemedicine services it is important to have sufficient fund and proper resources and expertise in the related field.

Similarly, in the developing countries, there is huge technological gap between rural and urban areas, which has remained as a great challenge to implement the telemedicine services. Martinez, Villarroel, Seoane, and Pozo (2004) have mentioned that due to many such challenges developing countries are not able to take the advantage of the *"Global information society"*. So it is challenging for the developing countries to overcome the different barriers and smoothly implement the telemedicine services.

Wright (1998) has discussed that, in the developing countries it is better to start the telemedicine program in a small-scale pilot projects by selecting the appropriate equipments and technology, so that it will be easy to implement and manage the service within limited resources. However it can be further expanded in the large scale based on the experiences learned from it. Edworthy (2001) has mentioned that, it is also important to understand the existing health status and scenario of the particular country before implementing the telemedicine service, otherwise the implemented telemedicine services can also have negative impact on the health status of that particular country. It is further discussed that the technological and cultural readiness is also equally important for making the telemedicine program effective.

Similarly Edworthy (2001) has mentioned that in the developing countries it is important to get necessary support from the local peoples and at the same time the healthcare providers should also have positive attitude toward the services. Similarly various other factors such as, availability of experts, supporting infrastructure and technology, and the quality of the software that is used by the program is also equally important to make the telemedicine programs effective and successful.

Wright (1998) has discussed that in the developing countries, telemedicine can provide both qualitative and quantitative support in the health system. Such supports can be provided by;

- *"distance consultations, diagnosis and advice for treatment by medical specialists practicing in a national, regional or international hospital center for referrals;*
- *availability of high quality health care in remote areas of the country, by deployment of mobile telemedicine centers travelling from one village to another, or even local community centers which meet joint requirements of several villages;*
- *Opening up new methods of education and training. Rural health-care staff can have regular access to lessons given by specialists in hospitals (e.g. on the management of common and special diseases)*
- *improvements in qualification of national specialist and health technicians, by providing access to international medical databases;*
- *Increasing effectiveness and efficiency, for example in reducing waiting times for consultations and in introducing medical information systems"* (Wright, 1998).

Telemedicine allows health care professionals to diagnose, evaluate and treat patients in remote locations using telecommunication technology and it supports patients in remote locations to access medical expertise quickly, efficiently and without travel. Telemedicine can provide more efficient use of limited expert resources that can support patients in multiple locations wherever they are needed without leaving their facility (Wright, 1998).

Wright (1998) has further discussed that the use of telemedicine services also support to reduce the cost of health services in the developing countries. It is possible since the use of telemedicine services can cut down the travelling time and cost as well as other cost (e.g. Food, lodging) of patient that they spend for visiting the tertiary level hospitals and consulting with the specialist. Similarly the length of stay in the hospital and its related cost is also minimized since the patient can be examined and monitored from the distance (Wright, 1998). Similarly, it will also save the time and reduce the cost of health service providers. Since they don't have to physically travel to rural hospitals for providing specialist services, so it saves their time, reduces the travelling cost as well as other cost. Wright (1998) also discuss that the

telemedicine support to address the distance problems, so it reduces the operating cost by centralizing and optimizing the resources that are used to provide the health service (such as, expert resources, laboratories and other equipment). It also supports to provide distance training and educational activities to improve the knowledge and skill of the health personnel and also improves the medical data base (Wright, 1998). Similarly the proper use of the telemedicine services also support during emergencies and disaster. It also supports to provide necessary information and medical database to the health-care professionals and improve the referral system for the patient to get better service (Wright, 1997).

In some context it could also be logical to say that the implementation of telemedicine should not be taken as priority in developing countries since it could be expensive and unaffordable due to their limited budget in the health sector. However, it will be helpful only if the low-cost equipments are used (Wright, 1997). Telemedicine services that are implemented with low-cost technology can benefit the healthcare delivery system in the rural and remote areas of developing countries.

In the present context, with the rapid development of information and communication technology, the modern world has applied telemedicine as an important part of healthcare delivery system. Nepal has also adopted the policy to use the telemedicine services in the health care delivery system and has already started the service in thirty different rural district hospitals.

In developing countries like Nepal, telemedicine can offers a reduced cost solution to provide health care services in the remote areas without increasing the number of the health staffs and available infrastructure. It also reduces isolation that the health workers experience while working in remote areas where the accessibility of specialized care is limited. Health workers who are working in the remote areas can also use the telemedicine services to consult with other health workers in their related field. Hence, the use of telemedicine services is important in the developing countries to provide effective health services at affordable cost especially to those peoples who are living in the remote areas and are difficult to reach.

2.5 Theory on Information Infrastructure (II) and Actor Network Theory (ANT):

After reviewing various related literatures related with my research area, I have selected the Information Infrastructure (II) Theory and Actor-Network Theory to support my study context. The theory on Information Infrastructure provides basic concept on the characteristics of Information Infrastructure so that it support the researcher to compare them with the rural-telemedicine program activities. Similarly the Actor-Network Theory provide concept on how the heterogeneous elements (i.e. human, non-human, technological and non-technological) within the network are interoperating with each other to make the network successful. Hence in this section Information Infrastructure (II) and Actor Network Theory (ANT) are discussed to support the activities related with the study area.

2.5.1 Information Infrastructure:

"Information Infrastructure" has been used as an integrated term, which is a fusion of information and communication technologies. Information Infrastructure is more open as compared to the traditional way of looking at information systems which were defined as being isolated, local and unique (Hanseth & Monteiro, 1998). Hanseth and Lyytinen (2004) have mentioned that the Information Infrastructure (II) should be *"shared, evolving, heterogeneous installed base of IT, capabilities among a set of user communities based on open and/or standardized interfaces"*.

Information Infrastructure is understood in a broader way than an information system, i.e. it is used at larger geographical locality and shared by a large user community (Hanseth & Monteiro, 1998). However the Hanseth and Lyytinen (2004) have discussed that the information system is used by the particular organization for their specific role and function and it has defined and limited number of users.

Information Infrastructure supports the interaction among the peoples and organizations through communication networks and related software. It bring together different elements, such as information processing applications, communication networks and services, physical and software elements and integrate them through a standardized interfaces (Hanseth &

Monteiro, 1998). Similarly the Hanseth and Monteiro (1998) have discussed that the Information Infrastructure is supported by the *"...political, social, organizational and human aspects"* these various aspects are interdependent and intertwined to each other. Similarly the working ability of the Information Infrastructure becomes complex as it scale-up and it is never transparent (Bowker & Star, 1999).

Hanseth (2002) has mentioned that the Information Infrastructure is taken as a step in the development of Information and Infrastructure Technologies. Hanseth and Lyytinen (2004) have stated that the Information Infrastructure provides *"shared resources"* which support the community peoples to use the information service. Internet service can be taken as one of the successful example of Information Infrastructure. It is further discussed that "*installed base*" of the existing infrastructure influence the design of the new infrastructure. So to avoid the technological traps and to make it simple and useful it is important to consider scope and complexity of the 'installed base' of the existing infrastructure. (Hanseth & Lyytinen, 2004).

Hanseth and Lyytinen (2004) have cited (Markus et al., 2002, Jones et al., 2003, Walls et al., 1992), where it is discussed that the design of the information infrastructure is different due to its various characteristics.

> *"Information infrastructures are large complex and evolve over a heterogeneous set of communities and components…need to adapt to both functional and technical requirements that are unknown during design time…are commonly designed as extension to or improvements of existing ones and they combine and draw upon heterogeneous and diverse components that are not under the control of the designer"* (Hanseth & Lyytinen, 2004).

Hanseth and Lyytinen (2004) have further discussed that the Information Infrastructure is a complex network of various elements, so multiple designers are involved in its design process. Similarly the use of Information Infrastructure is open and it is not restricted for any particular purpose, so the designers cannot control the boundaries of the information infrastructure. It is taken as a holistic term that includes telecommunication solution and

information system which are complementary with each other (Hanseth & Monteiro, 1998). The concept of Information Infrastructure is more complex and diverse, that includes various functionalities, which are discussed below,

Hanseth and Monteiro (1998) have discussed the ***'enabling function'*** of Information Infrastructure. This function support that the Information Infrastructure is designed in such a way, so that it can be shared by the large number of users and user group. Similarly the enabling function also support that the Information Infrastructure is not just tailored for one specific type of application or to fulfill the need of particular user group. It is designed in the way so that it could support the various applications. Similarly the enabling character not only supports to improve the existing systems but it also focus to create and open a new activities within a system (Hanseth & Monteiro, 1998).

'Shared function' of II means that, the system is used by the large communities. All the users use the same infrastructure, although it is used in different ways. Information infrastructure is irreducible, so it cannot be separated into parts for their independent use (Hanseth & Monteiro, 1998). However the infrastructure can be separated into units for design or analytical purpose, but still different elements of infrastructure are linked together with a standardized interfaces.

'Openness' discuss that the Information Infrastructure doesn't have any limitations regarding the *"number of users, stakeholders and vendors involved nodes in the network and other technological components, application area or network operators"* (Hanseth & Monteiro, 1998). It doesn't have strict borders and can interact with external environment and with other II, so that it can integrate or incorporate new things. It has ongoing and continuous development process (Hanseth, 2002), so it is dynamic and changing. Information Infrastructure is not just limited to any particular group of peoples, technology or organization however it is linked with another system or infrastructure.

'Heterogeneity' in the Information Infrastructure means that it is consist of different technological and non-technological components, human and the organizations or institutions that support it (Hanseth & Monteiro, 1998). It has socio-technical network having technological and non-technological components which all have different functionalities and they are linked together with a stander.

'Socio-technical Networks' discuss that the technology and society are interrelated, where the technology shapes the society and get shaped by it (Hughes, 1994). Information Infrastructure consists of various components which are technical, non-technical, humans, organizational and institutional (Hanseth & Monteiro, 1998). Socio-technical networks states that these various social and technological aspects are linked together into a network. Development of Information Infrastructure does not only depend on the technological development, it is also influenced by the social aspects. Actor Network Theory discusses more about how the social and technological aspects are related with each other in the Information Infrastructure.

The character on ***'Installed base'*** discuss that the Infrastructure does not develop from the scratch, it takes time to grow and develop from its existing base by improving and extending it over a time period. With the context of time, the elements of the Information Infrastructure have to be changed and must adopt new infrastructure. So while designing the new version of the infrastructure, it should be linked with the old existing one to make it interoperable (Hanseth & Monteiro, 1998). The concept on 'install base' also focus that while designing the new featured Information Infrastructure, it is necessary to consider the existing status of infrastructure. The 'new' component of infrastructure is only accepted if it is able to integrate, or substitute an existing infrastructure (Hanseth, 2002).

'Install base' is taken as a backbone of Information Infrastructure, since it is always evolving by taking new ideas and recent technological development. For upgrading the Information Infrastructure it is only possible by extending the existing infrastructure or by modifying it. So it is important to have the concept on 'install base' to understand that the Information Infrastructure is evolving, shared, open and heterogeneous.

2.5.2 Actor Network Theory (ANT):

The concept of Actor-Network Theory was initiated by the Michel Callon (1986) and Bruno Latour (1987), which was initially applied in the field of sociology. Latter it focused on the social construction of the information technology, i.e. how the human and non-human elements (peoples, organizations, software, computers and communication hardware and infrastructure standers) coexist in the network (Walsham, 1997). This theory provides new concepts and ideas to understand the socio-technical nature of information system.

In the Actor Network Theory, the different elements of the network are known as "actor" or "actants" that includes peoples, organizations and technologies (Walsham, 1997). It is further discussed that ANT is taken as both theory and methodology. It provides theoretical concepts on how the things exist in the real world. So it supports the researcher to better understand the network and the various elements that support the network. The Actor-Network Theory provides the concept that there are various elements within the network that undergo different process to make network function. Walsham (1997) has mentioned that, in the Actor-Network Theory *"both human and non-human, process of translation and inscription, the creation of black boxes or immutable mobiles and the degree of stability and irreversibility of network and their elements supports the network to be stable and function properly*."

Actor-Network theory has been used explicitly in the information system research since it provides *"new concepts and ideas for the understanding of the socio-technical nature of information systems"* (Walsham, 1997). The empirical focus of Actor-Network Theory is to show how human and non-human (e.g. artefacts, computer, software's, cables, organization) are associated in the development of social network. Similarly, ANT provides systematic understanding on the complex dependencies and interoperability among the various heterogeneous elements.

Technological and social aspect plays equal important role in the development of information system; however their relationship is conceptualized in different ways. Hanseth and Monteiro

(1998) have discussed about ‘technological determinism’ and ‘social reductionism’ as a two extremes that may exist in the development of information technology. It is discussed that the ‘technological determinism’ supports that the technological development follow its own logic and its use is also determined by the technology itself. However the social reductionism support that the society and its actors develop the technology and use it as they want, where the technology itself does not any significant role (Hanseth & Monteiro, 1998). In such context, ANT plays intermediary role between these two extremes and provides concepts on how these two extremes are interrelated.

Actor-Network Theory supports the bottom-up concept of strategy formulation (Monteiro, 2000). It discuss about the heterogeneous nature of the network, and link together technical and non-technical elements. Actor-network theory provides better opportunities to understand the technological and social aspects when implementing and re-designing the information infrastructure in the organizational setting. ANT is taken as possible interpretative lenses that can be used to analyze and interpret the complexity associated with the use of information system (Monteiro & Hanseth, 1996).

> *“Actor-Network theory is concerned with investigating the social and the technical taken together or, putting it another way, with the creation and maintenance of coextensive networks of human and non-human elements which , in the case of information technology, includes peoples, organizations, software, computer and communications hardware and infrastructure standers”*(Walsham, 1997).

“Actor-Network theory treats social and technical as inseparable, and indeed argue that people and artefacts should be analyzed with the same conceptual apparatus” (Walsham, 1997).

Monteiro (2000) has discussed on the two concepts (inscription and translation) from the Actor-Network Theory that are of particular relevance. These two concepts are discussed below;

Inscription: In the ANT, inscription discusses the relationship between various parts of the technical artefacts and its pattern of use. Monteiro (2000) has discussed that the inscription can be misinterpreted by suggesting that action into an artefacts are inscribed, grafted or hard-wired, however it is used to *"describe how concrete anticipations and restrictions of future pattern of use are involved in the development and use of a technology"* (Monteiro, 2000).

Inscription defines the role of the users and system that they have to play. Similarly it discuss about the program of action to be performed by the users. So it ultimately provides implicit and explicit assumption about the competencies that is required by the users and the system to function and maintain the network system (Monteiro, 2000).

Latour (1991) discuss about the problem that occurs when the users does not follow the assigned program of action and use the system in an unanticipated way. It is important for the management to know how to inscribe and into what, for that several trials should be made to identify the strengths of different inscriptions (Latour, 1991) and to match the designers anticipation about users and its use in real scenario (Akrich, 1992). Inscription provide information on the how various kind of materials (artefacts, work routines, legal documents, prevailing norms and habits, written manuals, institutional and organizational arrangements and procedures) can be used in successful way (Monteiro, 2000).

Information Infrastructure become irreversible as it grows due to the relation between the actors, organizations and the institutions involved in the implementation of the II. The strengths of the inscription depend on the irreversibility of the actor-network they are inscribed into (Monteiro, 2000).

Translation: In the ANT, translation discuss on finding out the needs of the users and adjusting them. Monteiro (2000) discuss that, the concept of translation shows that how the designers workout to make the system usable. In this process the interest of the "user" and others is translated into specific "needs", which are further translated into unified needs so

that it will have the same solution. It supports the user to adopt such system and use it as needed (Monteiro, 2000).

This concept explain that there is no any such single network and neither there is single appropriate way for the network to get stable. It supports that the inevitable changes occur in actors, technology and network. Callon (1986) has discussed on the four different moments of translation, i.e. *"Problematization, interessment, enrolment and mobilization"* (Callon, 1986).

In the phase of problematization, the focal actor identifies and defines the relevant actors and their interests to make them consistent and similar to the interest of the focal actor. Similarly the problems are defined in this phase; however its solutions are identified in other phases. An obligatory passage point (OPP) is established between the other actors and the network, where all the actors have to satisfy the interest that is ascribed to them by the focal actors and they have to pass through OPP. The OPP is defined by the focal actors and it supports the focal actor in aligning the other relevant actors accordingly (Callon, 1986).

Interessment is the second moments of translation, where the actors in the network are convince to accept the definition provided by the primary actor. Similarly in the next phase, i.e. 'enrollment', the other actors accept the interest and definition provided to them by the focal actor during the interessement phase. Similarly the mobilization of allies (i.e. other actors) is the final moment of the translation, where these different actors fulfill their assigned roles and responsibilities to make the network successful (Callon, 1986).

Irreversibility: Monteiro (2000) has discussed that Information Infrastructure is an aligned actor-network that constitute various elements by the process of translation. Due to the tighter interconnection between different parts of an Information Infrastructure, it becomes irreversible. Similarly as the technical system grows and become complex it gain a momentum (Monteiro, 2000). Hughes (1994) also discuss on the momentum within a system as a self-reinforcing process of gaining force which is normally difficult to interfere, however the momentum can only be interfered in extraordinary instances.

2.5.3 Information Infrastructure, Actor-Network Theory and Rural-Telemedicine Program:

The concept provided by the Information Infrastructure Theory supports that the rural-telemedicine program is also a part of Information Infrastructure. The various characters that are seen and expected from the rural-telemedicine program are similar with the characters provided by the Information Infrastructure. Definition provided by the Hanseth and Lyytinen (2004) have mentioned that the Information Infrastructure (II) is shared, evolving, heterogeneous installed base of IT and it is open and used with a standardized interface. In case of rural-telemedicine program it seems that the government has considered these various aspects and designed the program accordingly to fulfill the characters of Information Infrastructure.

Similarly the rural-telemedicine program also support the concept provided by the Actor-Network Theory. This theory discusses that in any network the human and non-human elements (peoples, organizations, software, computers and communication hardware and infrastructure standers) coexist and support each other (Walsham, 1997). Similarly these various elements are taken as an 'actor' of the network and each of them plays important role to function the network. In-case of the rural-telemedicine program there are also various elements involved in the network that supports the activities of the program. It is similar to the concept provided by the ANT that the rural-telemedicine program also has peoples, organizations, software, computers, communication hardware and infrastructure standers that are involved in the network. These various elements coordinate with each other to make the rural-telemedicine program functional. So the government authorities who are involved in designing, managing and implementing the rural-telemedicine program should consider these various elements to make the program successful.

For implementing the rural-telemedicine program, it seems that there are also various 'actors' within the government systems who are playing important role to implement the program. Those human 'actors' who are involved at the central level has major responsibility in designing the overall structure of program including its policy and implementation strategies. Whereas the 'actors' at the Central Coordination desk and district level are more involved in

its management and implementation of the program. Similarly various non-human 'actors' such as existing infrastructure and technology, the equipments used, computers and software, internet services and other supporting devices also plays important role to make the rural-telemedicine program functional. If there is any problem in these elements then it will affect the implementation of the whole program.

Similarly the Actor-Network Theory also provides the concept that in every network the technical and social elements are linked together to make the network successful. This concept is also true in-case of rural-telemedicine program. Apart from the technological innovation that is applied in the rural-telemedicine program other social, cultural, and political factors also equally plays an important role to make the program successful. Hence it seems that while designing the rural-telemedicine policy and implementation strategies the government has to considered both technical as well as social factors to adjust them best, so that it will ultimately supports in the sustainability of the program.

Chapter Three

Study Methods

This chapter mainly focuses on the study design and methods that were used to conduct the study. It discuss about the qualitative research and interpretative case study approach. This chapter also provides information about the data collection methods that were used during the study period. It also mention about the details of the respondents that were included in the study. Similarly it also focuses on the reflection of the various methods and discuss about how the researcher get access to the study site and experiences gained while working as an outsider. Finally this chapter also provides information on the ethical consideration and limitations of the study.

3.1 Research Design and Approach used:

In the information system it is important to understand the role of the human within which the information system is functioning (Trauth, 2005). For studying the information system in any context,

"Qualitative methods are chosen as an appropriate method for studying contextual aspects of information systems development, use and impact" (Trauth, 2005).

Myers (1997) has discussed that the qualitative research methods are used to explore the technological, managerial and organizational issues which are also important for the successful implementation of the information system. It supports the researcher to understand the peoples and their socio-cultural aspect.

"Qualitative research involves the use of qualitative data, such as interviews, documents, and participant observation data, to understand and explain social phenomena" (Myers, 1997).

Similarly in the qualitative research various sources of data can be used such as, *"…observation, participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impression and reactions"* (Myers, 1997).

(Myers, 1997) has discussed that the qualitative research can be positivist, interpretive and critical which depends upon the nature of the study. It is important that researcher have to choose the right method that depends upon the phenomenology that is taken under study. The positivist studies are conducted if there are predetermined variables which can be quantified and measured. Similarly it uses the structured instrumentation and support the researcher to test the theories and to draw the inferences about the research area from the sampled population (Orlikowski & Baroudi, 1991). Similarly the critical research focuses that *"social reality is historically constituted and that it is produced and reproduced by peoples"* (Myers, 1997).

Kaplan and Maxwell (1994) have suggested that the interpretive research approach tries to explore the reality and understand the phenomenon through various social constructions. In such research it doesn't have dependent and independent variables that are predefined. In the information system, the interpretive research produces an understanding of the context i.e. how the information system influences the surrounding or is being influenced by it (Myers, 1997).

Qualitative research also uses various study designs such as action research, case study research, ethnography and grounded theory (Myers, 1997). However to explore the issues in the area of information system case study is taken as important method (Orlikowski & Baroudi, 1991). Similarly Benbesat, Goldstein, and Mead (1987) also focused that the case study method is appropriate to study the use of information system within the organizational context.

Researcher use the case studies, if there is need to answer "how" or "why" questions (Yin, 2003). Similarly multiple sources of evidence are used to investigate the phenomenon, while conducting the case studies (Yin, 1989).

Yin (2003) has stated that;
"Case study methods allows investigators to retain the holistic and meaningful characteristics of real-life events- such as individual life cycles, organizational and managerial processes, neighborhood change, international relations and the maturation of industries"

Walsham (1995) has discussed that the case study design with interpretative approach support the researcher to produce deep insights into the information systems. Hence in this study it will support the researcher to understand rural-telemedicine program activities and its existing situation by taking the perspectives of those personnel who are involved in the program and by observing the real scenario at the program implementation sites.

3.1.1 Case Study and Interpretive Research Approach:

In the qualitative research, case study is taken as a well-established study design which is mainly used for the comprehensive understanding of the phenomena that is taken user study (Klein & Myers, 1999). In the information system research, the case study is widely used to understand how the interaction is taking place between information technology related innovations with its related organizations. It is taken as useful method to study about the development of information system, how it is implemented and used in the field setting (Darke, Shanks, & Broadbent, 1998) and (Orlikowski, 1993).

Case studies can be used to describe the phenomena and development of the theory. It supports to explore the areas where the existing knowledge is limited and also provides evidence for hypothesis generation. Case study can be used both in positivist and interpretive philosophical tradition (Cavaye, 1996).

Cavaye (1996) has discussed that in the case study research it *"does not explicitly control or manipulate variable, studies a phenomenon in its natural context, studies the phenomena at one of a few sites and makes use of qualitative tools and techniques for data collection and analysis"*. Similarly it provides opportunity to the researcher to study the phenomena in its natural setting and also support in developing and refining the concepts so that it could also support in conducting further research activities (Cavaye, 1996).

Benbesat, Goldstein, and Mead (1987) have also supported that the case studies are taken as a most appropriate research design when the researcher tires to explore the phenomenon that is not much explored and which is in the formative stage. In the area of information system, constant changes are taking place in the technology, so it supports the researcher to capture in-depth information and explore the phenomenon in its natural setting from peoples, groups and organizations. Similarly in the case study the researcher spend sufficient amount of time and has close contact with the different events and processes that are related with the case (Stake, 1994). So it supports the researcher to get the in-depth information on the research area.

Benbesat, Goldstein, and Mead (1987) have provided eleven characteristics of the case studies which are mentioned as follows;

1. *Phenomenon is examined in a natural setting*
2. *Data are collected by multiple means*
3. *One or few entities (person, group, or organization) are examined*
4. *The complexity of the unit is studied intensively*
5. *Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process; the investigator should have a receptive attitude toward exploration*
6. *No experimental controls or manipulation are involved*
7. *The investigator any not specify the set of independent and dependent variables in advance*
8. *The results derived depends heavily on the integrative powers of the investigator*

9. *Changes in site selection and data collection methods could take place as the investigator develop new hypothesis*
10. *Case research is useful in the study of "why" and "how" question because these deals with operational links to be traced over time rather than with frequency or incidence.*
11. *The focus is on contemporary events* (Source: Benbesat, Goldstein, & Mead, 1987).

It is important for the researcher to have careful plan for effectively and efficiently collecting the case study data. Similarly the researcher also needs to have sound background and detail information and knowledge on the case study before collecting the information. Details of the participants (i.e. their names and position) should be obtained, before they are contacted and participated in the study (Darke, Shanks, & Broadbent, 1998). For successfully completing the case study, it is important for the researcher to be enthusiastic and curious about the area that is under study.

This study applies the interpretive approach to collect the necessary study information. In the interpretive approach, researcher uses his or her own subjectivity during data collection and analysis period. Similarly the researcher provides the information that they have interpreted from the responses provided by the respondents.

The study by Walsham (1995) has suggested that the interpretive approach should have details on *"... the research sites chosen, the reason for this choice, the number of peoples who were interviewed, what hierarchical or professional position they occupied, what other data sources were used and over what period the research was conducted".* This approach tries to explore the subjective reality. Such reality is taken as social product which is based on the beliefs and values of the human as a social actor (Darke, Shanks, & Broadbent, 1998). In the interpretative case studies its main aim is to *"understand the phenomena from the point of view of participants directly involved with the phenomena"* (Cavaye, 1996).

In the interpretive approach, researcher tries to realize the scenario by taking the perspective of the participants and by accessing the meaning from the participants (Orlikowski &

Baroudi, 1991). Similarly it supports the researcher to investigate the phenomenon deeply and provide their own subjectivity in the research process.

The study by Walsham (1995) has discussed that in the interpretative research, *"the value of an explanation is judged in term of the extent to which it allows other to understand the phenomena and makes sense to those being studied."* So in the field of information system the interpretive approach support the researcher to understand the scenario through the meanings provided by the actors, but not in-term of 'facts' regarding their information processing power. Similarly objective data cannot be obtained from the interpretive methods, since the area of research is based on the researcher's preconception (Walsham, 1995b).

Walsham (1993) has discussed that the case study design with interpretive approach is taken as the most appropriate method for exploring the information system. While conducting the interpretive case studies, Walsham (1995) has showed that they can be generalized by four different ways,

- Development of concept
- Generation of Theory
- Giving specific implications and
- Giving rich insight

Walsham (1995) has mentioned that it is important to *"... 'capture' people's interpretations in as effective way as possible, while at the same time conducting the normal social interchanges of interviews"*. So it is important to tape-record the interview or take the intensive notes during the interview process. Tape recording support the researcher to get the detail description of the conversation that was conducted during the interview; however sometimes the respondents don't feel comfortable to record their interview if they are discussing in any sensitive issues. In this study only interviews and discussions conducted with district rural-telemedicine team were recorded, but in other cases the researcher took the intensive notes during the interview and discussion process.

Walsham (1995) has stated that for collecting the data as an outsider in the interpretive case studies;

"…interviews are the primary data source, since it is through this method that the researcher can best access the interpretation that participants have regarding the action and events which have or are taking place, and the views and aspiration of themselves and other participants".

For effectively conducting the interview, it is important to record the full description of the interview. However it may not be effective to record the interview in the sensitive issues. In such condition it is necessary to make the detail notes while conducting the interview. Similarly to make the interview more effective and to explore the real situation on the study area, researcher should have *"good social skill and personal sensitivity"* (Walsham, 1995). However other methods should also be used to supplement the interview data. Other sources of data can be *"...press media and other publications on the sectoral context of the organization being studied…strategies, plans and evaluation and direct observation or participant observation of action"* (Walsham, 2006).

Yin (1989), has mentioned that researcher requires multiple sources of evidences to conduct the interpretive case studies. It has further discussed on the six different sources of evidence which include interviews, direct observation, documentation, archival records, participant/observation and physical artifacts (Yin, 1989).

To collect the related data and information during the study period, semi-structured questionnaire with interview was mainly used as a major tool and technique for the data collection. Similarly necessary information were also collected by observation, taking supporting photographs, reviewing the articles published in the newspaper and also reviewing the policy and strategic documents of government on rural-telemedicine program.

There were altogether twenty-one semi-structured questions, which were used during the interview process. The designed questionnaires were divided into three categories. One

category of questions was only asked to the staffs working at central level (i.e. Ministry of Health and Population, Department of Health Service and at the Central Coordination Desk). Similarly another category of questions were designed for interviewing the district level rural-telemedicine team and third category of questions were used for the both respondents at the central level and at the district level. Similarly as a researcher, I was involved as a non-participant observer. During the observation, I took the intensive notes on the various important facts that were related with the study.

3.2 Data collection:

After getting the ethical approval from the Nepal Health Research Council (NHRC) and permission letter from Department of Health Service (DoHS), I visited the study sites to collect the data. Before visiting the study sites, I had made a detail pre-plan about the schedule of my visit and about the appointment date and time provided by the respondents for interview. Respondents were taken as a representatives working in various positions in different places within the government health system and are involved with the rural-telemedicine program.

For collecting the necessary data and information, different study sites were visited (i.e. Ministry of Health and Population, Department of Health Service, Central Coordination Desk, and rural-telemedicine program sites at the Sindhupalchowk and Darchula district hospitals). Before conducting the interview, the respondents were clearly explained about the purpose of the study and they were requested for their voluntary participation. During the interview and discussion sufficient time was provided to collect the detail information. The interview and discussions conducted at two district hospitals were recorded, which supported the researcher to get the comprehensive information provided by the respondents. However the interviews conducted at the central level were not recorded, since the respondents felt uneasy while recording it. So, during such interviews intensive notes were taken. All the respondents who were approached for interview participated voluntarily in the study and provided good support during the data collection process.

Table 1: List of the Respondents included in the Study

Sn	Hierarchical Position	Government body	Number of personnel
1	Focal Person for Rural-Telemedicine Program	Department of Health Service	1
2	Chief of Monitoring and Evaluation Unit	Ministry of Health and Population	1
3	Telemedicine-Officers for Rural-telemedicine Program	Central Coordination Desk	3
4	Medical Officers	Central Coordination Desk	2
5	District Health Officers	District Health Office at Sindhupalchowk and Darchula District	2
6	Medical Officers	District Hospital at Sindhupalchowk and Darchula District	2
7	Health Personnel (Health Assistant and Staff Nurse)	District hospital at Sindhupalchowk and Darchula District	4
Total number of respondents interviewed			**15**

The data collection was initially started from the Central Coordination Desk with the Telemedicine Officers and Medical Officers. Semi-structured interview and discussion was conducted with them about the ongoing rural-telemedicine program. After that the interview was taken with the Focal Person of the rural-telemedicine program and with the personnel working at the Ministry of Health and Population. At the central level the data were collected

from 10th December to 20th December 2012. For conducting the semi-structured interview and other necessary discussion at the Central Coordination Desk, it took about a week (about ten hours) to interview three different Telemedicine Officers and two Medical Officers. The time spent for conducting each interview was from ninety minutes to maximum two hours. Similarly, the interview with the Focal Person was short, with just about thirty minutes. The Focal Person highlighted on the existing situation of the rural-telemedicine program and responded to few related questions. In-addition to that it took about two hour to take interview with the personnel at the Ministry of Health and Population. So altogether it took about thirteen hours to complete the interviews and discussions at the central level. The interviews taken at the central level were mainly related with the rural-telemedicine policies and its planning, management and implementation.

After completing the interview at the central level, then it was conducted at the district rural-telemedicine program implementation sites. In each districts two days were spend to conduct the interview, observation and discussion with the respondents. The study data and information were taken from the District Health Officers, Medical Officers and other paramedics and staff nurses who were involved in the rural-telemedicine program. The semi-structured interview was conducted to collect the data and each interview took about forty-five minutes to one hour depending upon the discussion made with the respondent. Altogether it took about ten hours to take the interview with the different respondents in both the district rural-telemedicine sites.

In addition to the semi-structured interview, supporting information and data were also collected through observation. Site observation was conducted both at the Central Coordination Desk and rural-telemedicine sites of Darchula and Sindhupalchowk districts.

Walsham (2006) has discussed that in the interpretive research, data obtained from the observation supports to get better understanding on how the program is functioning and used in practice. Similarly it is taken as a useful tool that provides more breadth and depth of the certain situation so that it could be understood more easily (Owens, 2007).

During the observation, sufficient time was provided at the study sites. Observation supported to understand the work setting of the program implementation site and provide detail information about how the program was implemented. At the central-coordination desk it was interesting to observe how the various applications (such as telephone based consultation (hello-health), video-conferencing, store and forward method) were functioning and supporting to provide health care services to the rural community peoples.

During the observation period, I also got opportunity to practically see the different applications that were used to provide rural-telemedicine services. It was also interesting to observe the way how those applications were handled by the health workers and how they were functioning. During the observation I got opportunity to observe how the health workers conducted the video-conference with the rural-district hospitals. Similarly tele-consultation through "hello-health" program was also observed during the study period. During the observation, it provided a clear idea on the strengths and limitations that were related with the use of those applications. Similarly it also provided the opportunity to know the real scenario of the program and closely understand their working environment. During the observation process I had tried my best to maintain the ethical stances regarding the privacy and dignity of respondents who were working at the site. Similarly during this period I also tried to observe some of the managerial aspect of the rural-telemedicine program by reviewing the existing policy documents, records and reports that were available at the sites.

Observation is important to support the data obtained from the interview process. As sited by the Owens (2007) that, *"...observational methods alongside interviewing attempts to explore, understand and interpret how others construct and experience their world"* (Walmsley & Johnson, 2003).

To observe the different aspects of rural-telemedicine program at the Central-Coordination Desk, it took about one week (i.e. altogether about ten hours). During the period of one week, I spend about one hour to ninety minutes each day at the study site for the observation.

Similarly at the two rural-district hospitals, I spend altogether twelve hours for observing the various activities related with the rural-telemedicine services. In the each district I spend two days, so each day the observation was conducted for about two to three hours. The observation supported me to find out the real practices that were conducted at the rural-telemedicine sites. Similarly it also provides me better opportunity to learn about the rural-telemedicine activities and explore additional information that was not covered during semi-structured interview.

To complete the whole data collection process (i.e. interview, observation and discussions) it took about sixty hours. The study data collection process started from 7th of December 2012 and was completed by the 12th January 2013. During the data collection process various supporting devices and stationeries were also used to support the data collection and to gather a comprehensive data. The used devices and stationeries were; Laptop, Tape-recorder, Camera, Sticky Notes Pad, Note Copy, Loose White Paper, Pencil, Eraser, Sharpener etc.

3.3 Reflection on the Method:

The selected research topic was the area of my interest. When taking the theoretical classes at the university related to the telemedicine and its application in various developed and developing countries, I was interested to explore and find out the situation of rural-telemedicine program conducted by the government of Nepal. Before finalizing the area of my interest, I discussed the topic with my supervisor and got approval to work on the selected area. Although the area of research was my interest, but it was challenging for me to approach the government authorities and get the necessary information related with rural-telemedicine program. Similarly the program was also newly implemented by the government, so I expect that it would be more challenging for me to get the related reports, documents and necessary information related with the program. During the field visit I found that except the policy related documents and news published in the national newspaper, there were no other supporting documents and articles related with the program.

During my visit to Nepal, I tried my best to meet with the responsible personnel who were involved in the rural-telemedicine program. One of my friends working at the Department of Health Service suggested me the names of the personnel who were related with the program and can support me by providing necessary information about the rural-telemedicine program and its ongoing activities. So, based on his suggestion, I first visited the Central-Coordination Desk at Patan hospital and met with the one of the Telemedicine Officer. Before asking more about the rural-telemedicine program, firstly I introduced myself and about my purpose, then I further requested him to discuss briefly about the rural-telemedicine program and about the team involved in implementing the program. The Officer provided updates on the program and also mentioned about the team who were involved in the implementation of the program. He also further suggested me the name of the personnel to whom I can meet and discuss about the rural-telemedicine program.

Similarly, to get the additional information related with the program, I also searched the information by using various search engines, but the available information was very general and superficial. The information related with the rural-telemedicine program was only available in few sites with apparent information. So I planned to explore the necessary information by using various qualitative techniques (such as semi-structured interview, observation, formal and informal discussion and taking photographs).

3.3.1 Getting Access:

In the interpretive case study, it is important for the researcher to have *"good social skills and personal sensitivity"* (Walsham, 1995). So that the researcher could easily access to the people's thought, views and aspirations (Walsham, 1995). To get such in-depth information about any program, it is important that the researcher should get entry into the work setting, and should be accepted by the members in the organization. Similarly the researcher should be able to *'hang around'* in the organization to observe the setting and ongoing activities (Randall, Harper, & Rouncefield, 2008).

To conduct this study in Nepal, I requested a letter from my supervisor so that I can submit it to the concerned authorities in Nepal (i.e. mainly for, Nepal Health Research Council and Department of Health Service). This letter supported me to introduce myself to these different concerned organizations as a student of Telemedicine and e-health and also explain why this study was conducted.

For collecting the necessary information and data I have to get the permission letter from the Department of Health Service (DoHS) and meet with the various government personnel who are related with rural-telemedicine program and working under Ministry of Health and Population. Due to the complicated bureaucratic system and their hierarchical ego problem that exist among the government staffs, I was skeptical about the response and support that I will get during my research process. However I was determined with my plans, so I planned for my journey to Nepal for conducting the research work.

Randall, Harper, and Rouncefield (2008) have suggested that due to the complex organizational settings it is difficult to find the right person in the organization. It may take weeks to know the peoples in the organization and getting access to the site. It is further suggested that the researcher should get the access mainly for two things, i.e.

"Getting permission for the research" and *"getting accepted in the research site"* (Randall, Harper, & Rouncefield, 2008).

In my case, I submitted the research proposal to the Nepal Health Research Council (NHRC) for ethical approval and for getting the permission to conduct the research. Nepal Health Research Council (NHRC) took about a month to review the proposal and finally provided the ethical approval letter. The approval letter from NHRC was submitted to the Department of Health Service, so that I could get the permission letter to visit the various study sites to collect necessary data and information. Hence the ethical approval letter from the Nepal Health Research Council was the important document to get access to the research sites and to get permission for conducting the research. After receiving the permission letter from the

Department of Health Service, I managed to visit the study sites to meet the different personnel involved in the rural-telemedicine program. In that duration, I initially tried to meet with the Focal Person of the rural-telemedicine program. However it was really difficult for me to get appointment with Focal Person due to his busy schedule.

Randall, Harper, and Rouncefield (2008) have mentioned that to make the 'access' better in any organizations it is necessary to make a good relation with the 'front desk' staffs, so that they can support in such conditions. I was also having problem to get appointment with the Focal Person of rural-telemedicine program for discussing on the program activities. So, I tried to introduce myself with the Personal Secretary of the Focal Person and mention about my research briefly. I requested him for scheduling appointment with the Focal Person, so that I could meet him personally. Similarly I also requested him to provide other necessary information related with the rural-telemedicine program. Personal Secretary suggested me to visit the Central Coordination Desk at Patan Hospital and meet with the Telemedicine Officers so that they can provide me the necessary information for the study. He also suggested that they have the detail information about the overall situation of the ongoing program, since they were directly involved in the management and implementation of the rural-telemedicine program. Similarly he also supported me to meet with the Focal Person by scheduling the appointment date after a week period.

Robson (2002) has mentioned that, *"interpretive researcher needs to gain and maintain good access to appropriate organizations for their fieldwork. In-order to get access, they need good social skill"*.

In the process of data collection, it really took a long time for me to meet with the right personnel that I have included as my study respondents. However I tried my best to meet with the different peoples and build a good rapport with them. Among the various persons that I met during that time, one Officer at Department of Health Service who was working as a Personal Secretary of the Focal Person supported me to get access with the Central Coordination Desk and with the Focal Person. Personal Secretary suggested me the right

person to whom I can meet and get necessary support and information about the ongoing rural-telemedicine program. After getting the detail information, I visited the Telemedicine Officers at the Central Coordination Desk. I introduced myself and about the purpose of my visit. It was really good moment for me when they showed the positive response toward me and took interest on my research study. They gave me a warm welcome with a cup of tea and asked me about the support that they can provide.

For me, this was a good entry point in the research area. I discussed about the program, its management aspect and how it is implemented in the various districts. The Telemedicine Officer responded me and told detail about the infrastructure and technology that is being currently used by the rural-telemedicine program. During the visit at the Central Coordination Desk, I got opportunity to see the various equipments that were used for providing the rural-telemedicine services. The Officer also provided the brief description about the status of telemedicine program conducted in the rural district hospitals. During the visit, I also discussed about the appropriate rural-telemedicine program implementation site that I can visit to collect necessary data and information. Similarly after getting the information on the program implementation sites, I selected the two rural-telemedicine program implemented districts hospitals (i.e. Sindhupalchowk and Darchula) for collecting necessary information and data.

Similarly as scheduled appointment made by the Personal Secretary, I also got chance to meet with the Focal Person of rural-telemedicine program. During the meeting, I mainly discussed on the existing policy of government on rural-telemedicine program and its future direction. Similarly the Focal Person also provided information on the existing structure of the program and the future plans of the government to strengthen the ongoing program. Further it was also discussed on the managerial aspect of the program and existing challenges faced by the government to implement the program.

During the meeting with the focal person, I also requested for the letter of permission for visiting the two selected rural-telemedicine sites to collect necessary study information

through interview, observation and discussion. Finally, I also got the permission letter from the Department of Health Service to take the necessary information on the rural-telemedicine program conducted at Darchula and Sindhupalchowk district hospital. Before visiting the rural districts, Telemedicine Officer made by visit easier by making a call to the Medical Officers of the both the district and inform them about my visit and introduced me. So the telephone call made by the Telemedicine Officer and the permission letter provided by the Department of Health Service were taken as key channel, that supported me to get access to the research site at two rural districts hospitals.

The permission letter provided by the Department of Health Service and the telephone call made by the Telemedicine Officer made easy for me to approach the rural-telemedicine team at the Darchula and Sindhupalchowk district. In both the districts, the team members positively accepted me and supported by providing necessary information that I required. During the data collection process, I was able to collect the required information timely and in managed way. I realized that the reason behind of getting timely information and support was due to the proper selection of channel to get permission and get accepted for conducting the research. During my whole data collection process, I got good cooperation and support from the various officials and respondents that I had approached. I also realized that, getting good access to the research site, being accepted by the respondents and getting right person to give information support the researcher to get insight views and explore the phenomenon more deeply.

3.3.2 Being an Outsider:

In the interpretive case studies, role of the researcher as an outsider and as an insider is important while collecting the study data. In such studies the researcher has a challenge of,

"accessing other people's interpretations, filtering them through their own conceptual apparatus, and feeding a version of events back to others, including in some cases both their interviewees and other audiences" (Walsham, 1995).

Walsham (1995) has discussed about the involvement of the researcher as an "outside observer" and as "involved researcher" in the interpretive research studies. Similarly in this study the researcher can play both roles during the data collection period for exploring the existing scenario of the rural-telemedicine program and to collect the perspectives from the various respondents. Such roles support the researcher to gather necessary information and data, however in the collection and analysis of such data researcher's subjectivity also plays an important role.

In this study I participated as an outsider during the data collection period due to the limitation of time and resources. So being outsider, I realized that it was difficult to have accessibility with certain information that was related with the internal management of the program. Walsham (1995) has mentioned that if the researcher is able to develop a good rapport with the respondents then they will be frank enough in expressing their views. So during the data collection period, I tried my best to develop good rapport with the respondents. I realized that in the different sites I got a good support and positive response from all respondents during data collection. In addition to that they also showed their warm welcome by providing a cup of tea and even snacks in some of the visited sites. During the data collection, I tried to maintain the ethical aspect by not being bias with the information provided by the respondents. I also showed my respect for providing their valuable time to answer my interview questionnaire and for discussing on the related issues.

Similarly, I also observed the rural-telemedicine implementation site and its related ongoing activities. During the observation period, I tried to maintain the environment intact, without disturbing the respondents working atmosphere and their job privacy. Walsham (1995) has discussed that, in certain situation the research can be *"...debarred from access to certain data and issues which are regarded as too confidential and sensitive to be shared with outsiders"*. During the observation I tried my best to observe the scenario, however I was also conscious about the sensitive and confidential issues.

During the interview and discussion with the respondents I realized that being outsider I was missing some of the important data and information related with the program. The respondents were not comfortable to mention about the existing weakness and limitations related with the rural-telemedicine program. Since the respondents were working under the government health system, so they felt uneasy to express the weakness of the government staffs working at higher post at Ministry of Health and Population and at Department of Health Service.

Similarly there were also some other issues related with the program, that the respondents did not like to response. I realized that such issues could be confidential and sensitive for the respondents related with their job, so I did not tried to probe more on such issues.

3.4 Ethical consideration:

Before visiting Nepal for study purpose, the research proposal was reviewed by the supervisor and supporting letter was provided from the Department of Clinical Medicine, University of Tromsø. Since the study is conducted in Nepal, so the research proposal was also submitted to the Nepal Research Health Council (NHRC) for the ethical approval. After getting the approval from the Nepal Health Research Council, permission letter was requested from the Department of Health Service (DoHS) to visit the study sites. All the necessary information and data were only collected after receiving the permission letter from the DoHS.

This study does not include any patients; necessary information was only collected from various government employees working at different level under Ministry of Health and Population. Before taking interview and conducting the discussion all the respondents were informed about the purpose of the study. Similarly verbal consent was taken before including them in the interview and discussion. None of the respondents were forced to participate, they all participated voluntarily. Researcher had also maintained its ethics by respecting and making the respondents comfortable during the data collection. Similarly the data and information that were collected from the respondents were presented as they were without any bias.

3.5 Limitation of the Study:

This study is conducted in the selected rural-telemedicine implementation sites, which includes only few representative respondents working under the government health system. Hence, the study findings cannot be generalized to describe the whole situation of rural-telemedicine program in the country. Similarly due to the lack of research papers and other supporting literatures related to the rural-telemedicine program, it was challenge for the researcher to get the necessary information to support the study findings.

Similarly this study is a part of an academic curriculum, so it was conducted within a limited duration of time and also with a limited resources and fund. So the research has to manage the study accordingly and selected the study site and respondents according to his convenience.

Chapter Four

Country Background, Status of Health System and Telemedicine in Nepal

4.1 Introduction to Nepal:

Nepal is landlocked country between India and China with a diverse topographical structure having Himalayas in the north, hilly region in the central and terai (or plains) in the south. It has cool summer and severe winter in the north, similarly subtropical summer and mild winter in the south. It is a beautiful country having immense amount of natural resources. It is well-renowned in the world for the ranges of Himalayas, having eight out of ten world's tallest peaks including Mt. Everest, the highest peak of the world. Similarly it is also the birth place of the Buddha, which is taken as symbol of peace.

Considering the economic progress of Nepal, it is in the group of least developed countries having per-capita income 750 US dollar. Similarly more than 25% of the total populations are still living under the poverty line (World Bank Report, 2012).

The Human Development Report published by the UNDP in the year 2011 has ranked Nepal at 157 out of 187 countries. This shows that the Nepal is in low human development group, with human development index 0.458 (UNDP, 2011). For administrative purpose, Nepal is divided into five development region, fourteen zones and seventy five districts. Districts are further divided into Municipalities, Village Development Committees (VDCs) and wards. Its total population is 30, 485,798 out of which 83% of the population is still living in the rural areas (Census Report, 2011). Similarly agriculture is taken as major source of occupation, with 76% of the total household involved in agriculture activities (Census Report, 2011).

Figure 2: Map of Nepal

Figure 3: National Flag of Nepal

4.2 Health System in Nepal:

After the endorsement of National Health Policy 1991, Nepal has made remarkable progress in the health care system. The policy has mainly focused on extending the primary health care services to the peoples living in the rural areas of the country so that they could be benefitted from the modern medical facilities and can get health care from the trained health personnel (National Health Policy, 1991). The main aim of the policy is to develop the health infrastructure, community participation, multi-sectoral coordination, mobilization of local resources and decentralize the planning and management (WHO, 2007).

The National Health Policy is supported by the Second long term health plan (1997-2017), which has also focused on improving the health status of women and children, poor, underprivileged and marginalized population living in the rural areas. It has given more emphasis on redirecting resources from high-cost, low impact intervention to the low-cost high impact essential health care services (EHCS) by improving the effectiveness and efficiency (WHO, 2007).

4.2.1 Organogram of Department of Health Service (DoHS):

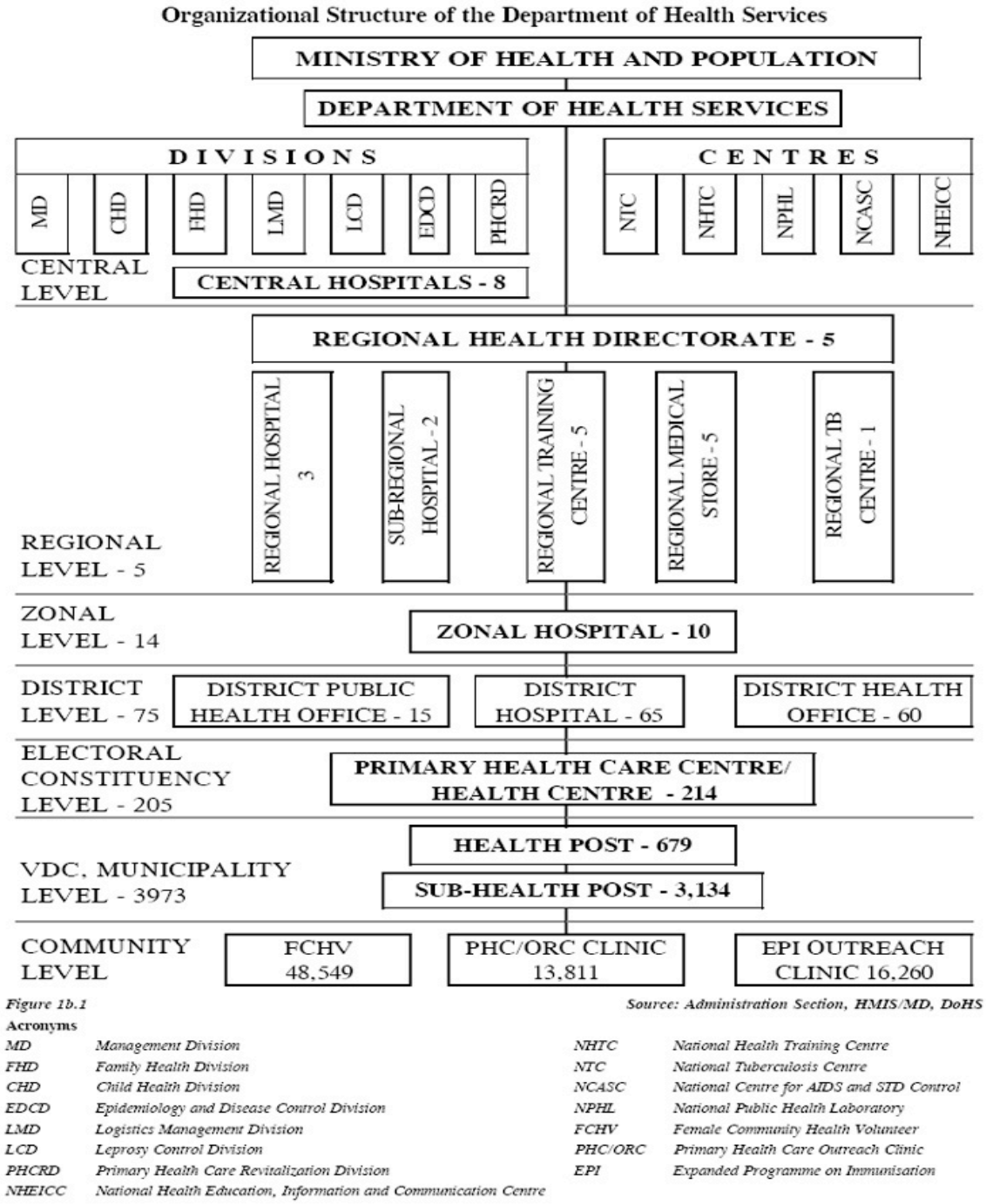

Figure 1b.1 *Source: Administration Section, HMIS/MD, DoHS*

Acronyms

MD	*Management Division*	*NHTC*	*National Health Training Centre*
FHD	*Family Health Division*	*NTC*	*National Tuberculosis Centre*
CHD	*Child Health Division*	*NCASC*	*National Centre for AIDS and STD Control*
EDCD	*Epidemiology and Disease Control Division*	*NPHL*	*National Public Health Laboratory*
LMD	*Logistics Management Division*	*FCHV*	*Female Community Health Volunteer*
LCD	*Leprosy Control Division*	*PHC/ORC*	*Primary Health Care Outreach Clinic*
PHCRD	*Primary Health Care Revitalization Division*	*EPI*	*Expanded Programme on Immunisation*
NHEICC	*National Health Education, Information and Communication Centre*		

Figure 4: Organogram of Department of Health Service (DoHS)

Source: Organogram (2012). Department of Health Service, Ministry of Health and population Government of Nepal (Available from: http://dohs.gov.np)

For improving the health status of the Nepalese peoples and to deliver the health services effectively, Department of Health Service (DoHS) under Ministry of Health and Population (MoHP) is playing the major role. It has a centralized structure, where the policy designing, planning and budget allocations are done at the capital. However the Department of Health Service (DoHS) has implemented and extended its health care services to up to grass root level through hospitals (at the regional, zonal and district level), PHCs, HPs, SHPs, Outreach Clinics and by the mobilization of Female Community Health Volunteers (FCHVs).

It is the responsibility of every country to ensure health as a fundamental human right to every citizen and make sure that everyone has equal accessibility to the basic health care services. The Universal Declaration of Human Right, article 25 (1) has stated that,

> *"everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control"* (UN The Universal Declaration of Human Rights, n.d)

As defined by the World Health Organization (WHO), *"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"* (WHO, 2003).

In this definition WHO has broadly defined the health which includes different dimensions, so it is challenging for the underdeveloped countries like Nepal to fulfill all the dimensions of health and provide a comprehensive health care service. However the government of Nepal has focused to extend the primary health care services and also increase the accessibility of the essential health care services by increasing number of the Sub-Health Post (SHP), Health Post (HP) and Primary Health Care Centers (PHCC). These various health centers serve the rural community peoples at Village Development Committee (VDC) level. Similarly the Female Community Health Volunteers (FCHVs) has also been supporting in such activities

(NHSP, 2010). In present scenario telemedicine services can be used to make the health services more accessible to the peoples living in the rural and remote areas of the country. Similarly it will also support to effectively deliver the primary health care service that is provided through the Sub-Health Post, Health Post and Primary Health Care Centers by connecting them with the specialized hospitals or tertiary health care centers.

In present scenario, large number of population living in the rural areas are still deprived from the basic health care facilities although government has established various health service providing centers at different level. Presently there are 13811 Primary health care/Outreach clinic (PHC/ORC) and 16260 outreach clinic serving at the grass-root level, 3134 Sub-health Post (SHP) serving at ward level, 679 Health Post (HP) serving at Illaka level, 214 Primary Health Care Centers (PHCs) serving at constituency level. District hospitals, Zonal hospitals and Regional hospitals are also providing service at district, zonal and regional level. Similarly specialized tertiary hospitals are mostly located at capital and proving the tertiary level care (DoHS, 2012).

To increase the access of the health care services to the poor and marginalized peoples, government has emphasized and implemented the free health care policy since October 2007(NHSP, 2010). Government has also been providing essential health care services at free of cost at health facilities (i.e. SHP, HP and PHC). The district hospitals has also been providing free service in the outpatient, inpatient and emergency services including 40 essential medicines to those who are poor, vulnerable and marginalized (NHSP, 2010). Similarly, to improve the number of institutional deliveries among the pregnant women, government has also been providing free delivery service (NHSP, 2010).

The government has been putting its best effort to improve the health status of the peoples. However while considering the source of funding for utilizing the health care services, major portion i.e. 62% of the expenditure is being made from the household level (i.e. out of pocket), whereas only 17% is contributed by the government and remaining 11% by the international non-governmental organizations and 10% by the official donors (WHO, 2007). It

is really difficult situation for the peoples of Nepal to bear such high proportion of expenses from their pocket. So the implementation of rural-telemedicine program can support to reduce the proportion of expenditure that is made from the household level, since it can reduce the travelling time, waiting time of the patient and also reduce the cost of service required for getting specialist care.

4.2.2 Status of Health Indicators in Nepal:

Health status of the Nepalese population is poor and also has possibility of becoming worse. There are various reasons contributing to such condition such as, low adult literacy rate (i.e. 55%), political instability, extreme poverty and economic crisis, extreme rise in the food price, constant power outages, regular strike and street demonstrations and lack of proper law and order (NHSP, 2010). These various factors have threatened the health status of the peoples and worsen the health indicators. Regarding the health status of the Nepalese population, it shows that in last fifteen years period i.e. from 1995/1996 to 2010/2011 the incidence of chronic diseases has increased from 6% to 12% and the incidence of acute disease has also increased from 9% to 20% (NLSS, 2011).

National data shows that pregnant mother who receives at least one antenatal care during their pregnancy from the skill health worker is also only 55% in the rural areas and 88% in the urban areas (NDHS, 2011). The data also shows that only 36% of the babies are delivered by doctors or nurse/midwifes (i.e. skill birth attendant) and only 28% of the deliveries are conducted at the health centers (NDHS, 2011). So it reflects that still 72% of the deliveries occur at home and 64% of the babies' doesn't get any skill birth attendant support during their birth. Similarly only 32% of the deliveries are being conducted by the trained health personnel in the rural areas, whereas in the urban areas it is comparatively better. Regarding the site of delivery, only limited number of cases are delivered at the health facilities which is also different according to the geographical localities, i.e. in the mountainous region only 17% of the deliveries occur in the health facilities as compared with hilly region (27%) and terai (31%) (NDHS, 2011). These data reflects that the maternal health status is poor in Nepal. WHO report shows that the maternal health and newborn health can be improved and

promoted by the use of telemedicine services (WHO, 2010). Similarly one of the studies from Mongolia shows that, implementation of telemedicine has supported pregnant women to get the expert consultation for early detection of complicated pregnancy, which has ultimately reduced the maternal and newborn morbidity and mortality (Baatar, Suldsuren, & Bayanbileg, 2012). In the context of Nepal, similar positive effect can be made on the maternal and new-born health by the proper implementation of the rural-telemedicine services.

Nepal is also facing high morbidity and mortality among the children. Acute Respiratory Infections (ARI) and dehydration from severe diarrhea is mainly taken as important causes of their mortality (NDHS, 2011). National data shows the high mortality rate among the children (i.e. Under-five mortality is 54/ 1000 live birth, Infant mortality is 46/ 1000 live birth and Neonatal mortality is 33/ 1000 live birth) (NDHS, 2011). Due to the poor nutritional status, many children are malnourished. It shows that 41% of the children in Nepal are stunted (height for age) and 29% of the children are underweight (weight for age). Similarly about 46% of the Nepalese children of age 6-59 month are found to be anemic (NDHS, 2011). It is urgency for the government to address the various health needs to reduce the existing morbidity and mortality and to improve their health status.

Kattlove and Shaw (2008) discuss that the use of rural-telemedicine program can be used to provide health care services to the children living in the underserved rural and urban areas of underdeveloped countries. Study from Tanzania shows that e-IMCI (electronic- Integrated Management of Childhood Illness) has been more effective in training the health care personnel as well as it increases the adherence and quality of care for the children (De Renzi, Parikh, Mitchell, Chemba, Schellenberg, Lesh & et al., 2008). Hence, the use of rural-telemedicine application in the delivery of child care service can also support to improve the health status of the children in Nepal.

In the developing countries communicable diseases had remained as a major public health problem and have affected the health of the many peoples. In Nepal it is estimated that about 45% of the total population is infected with the Tuberculosis (TB) and every year 40,000

peoples develop the active TB (NHSP, 2010). So in such context, telemedicine services can be used in the treatment process of tuberculosis. It can be used for the providing the health reports, tele-diagnosis, and support in providing tele-education and in DOTS (Directly Observed Treatment Short-course) to monitor the patient to ensure that the patient takes the drug correctly and timely. Similarly the study had showed that the use of videophone can support to increase the adherence to the TB drug in a cost-effective way (DeMaio, Schwartz, Cooley, & Tice, 2001).

4.3 Telemedicine Program in Nepal and its Current Situation (Policy and Status):

Telemedicine program is a newly implemented by the Government of Nepal and it is named as 'rural-telemedicine program'. The government has prioritized the use of rural-telemedicine program and it had been included in the three-year interim plan (2007/2008-2010/2011) of government. Similarly, the government has also focused to set-up and expands the rural-telemedicine services within the health care delivery system to provide quality health service with decentralized management (National Planning Commission, 2007).

The rural-telemedicine program was initially implemented in 25 district hospitals of hilly and mountainous districts (Achham, Bajhang, Bajura, Darchula, Jajarkot, Humla, Jumla, Kalikot, Rukum, Rolpa, Pyuthan , Dolpa, Mugu, Manang , Mustang, Gorkha, Dolakha, Rashuwa, Sindhuli, Sindhupalchowk , Khotang, Okhaldhunga, Sankhuwasabha, Solukhumbu and Taplejung), of Nepal from 22nd January 2011 (The Himalayan Times, 2011) and (DoHS, 2011) . Similarly in the year 2012, government further extended the program in 5 more districts hospitals (i.e. Dailekh, Baitadi, Salyan, Dadeldhura and Doti). So in the present context the Telemedicine program is implemented in total 30 districts out of 75 districts of the country (The Kathmandu Post, 2012).

In the each program implemented districts government has trained at least 3 health personnel to function and support the ongoing telemedicine program activities (DoHS, 2011). To

effectively conduct the rural-telemedicine program at the district hospitals, district telemedicine implementation sub-committee is formed by including 9 members. In this committee Medical Superintendent of the district hospital work as the coordinator of the team and other members are in-charge of district Public Health Office, Medical Officer working at district hospital, hospital development committee member, Indoor In-charge Nurse, X-ray technician or assistant, lab technician or assistant, and two health assistant (HA) or Senior Auxiliary Health Worker (CAHW) who have received the training on the rural-telemedicine program. Role of the member secretary is taken by one of the trained health assistant (HA) or Senior Auxiliary Health Worker (CAHW). It is mandatory that, all the members involved in the committee must be working at the district hospital (DoHS, 2011).

Government started the rural-telemedicine program with a high priority. The program was inaugurated by the Prime Minister by giving it a national importance and it was publicized through various local newspaper and TV channels. During the inauguration of the program Prime Minister has also focused on the importance of the program and mentioned that, rural-telemedicine program will help to improve the healthcare services at local level so that it will support to decrease the case load at the tertiary level hospitals (The Himalayan Times, 2011). Prime-Minister also showed the significance of rural-telemedicine program and focused on the fact that large populations are living in the rural areas with the limited access to medical care, whereas most of the healthcare experts and physicians are urban-centric. Telemedicine program can be an alternative for proving health care services to the peoples in the rural areas of Nepal, where the existing health infrastructure are poor and the accessibility to road and transportation is limited (The Himalayan Times, 2011).

During the inauguration program Focal Person for rural-telemedicine program had told that the rural-telemedicine service would support to provide the specialist services in the rural areas and extend the healthcare facilities for larger population. He has also emphasized that the use of rural-telemedicine services will support the peoples to get timely treatment and also support them to get necessary health information from their own local place (The Himalayan Times, 2011).

4.4 Importance of Telemedicine Program in Nepal:

In the context of Nepal, there is great disparity in the distribution of healthcare facilities and availability of health services. Most of the healthcare facilities and the services are urban centered. Similarly due to its rugged geographical structure it is challenge to deliver effective health services to the remote areas (Pradhan, 2009). The road density is also very low as compared to other South Asian countries. World Bank report shows that one-third of the peoples in the hilly region are living more than four hours away from an all-weather road. Similarly 15 district headquarters still need to be connected by a road-way system (World Bank, 2012). Due to such condition it is difficult to set-up the modern infrastructure and equipments in such areas and to provide the specialized health care services. Hence, implementation of rural-telemedicine services can address such needs of the community and support in delivering specialized health care services.

World Health Organization has listed Nepal as one of the country having critical shortage of human resources in the health sector (WHO, 2007). The report on "Millennium Development Goals (MDGs) Needs Assessment" states that Nepal requires additional 2,448 medical doctors, 3,418 nurses and 9,202 paramedical staff to deliver minimum level of medical services to the population (UNDP, 2010). Similarly the existing human resources are also not willing to work in the rural areas due to the lack of attractive incentives, not having facilities to upgrade and update the existing knowledge (Pradhan, 2009). So they prefer to stay in urban areas and work in the private sectors.

In such condition, government's single effort is not only sufficient to provide basic health care service to the peoples of remote and rural communities. It is also challenge for the government to deploy and retain health care providers, especially the doctors and nurses in the remote areas. Such activities creates problem in the delivery of quality health service at such places (NHSP, 2010). Wotton, Jebamani, and Dow (2005) discuss that the use of telemedicine make the health services easily available so it can overwhelmingly increase the use of health services.

Similarly, the implementation of rural-telemedicine programs will support the health workers to reduce the gap of professional isolation. It supports the health care providers who are working in the remote areas by providing *"medical education, medical care and collegial support"* (Pradhan, 2009). Study have shown that in the poor countries where the health care infrastructure are limited the use of telemedicine service can help to create a link between healthcare providers serving in the remote areas and the specialist serving at the tertiary care center (Heinzelmann, Lugn, & Kvedar, 2005). Such services also support the doctors and other health workers to interact with the medical experts.

Nepal is committed toward attaining the Millennium Development Goal (MDG). To achieve the MDG in time, it is important to address the existing burden of various communicable diseases such as Malaria, HIV/AIDS and Tuberculosis, as well as maternal and child health by making the health care service more accessible and effective. Hence, the rural-telemedicine program can support to increase the accessibility of health services by the use of Information Communication Technology (ICT) and by overcoming the related barriers (WHO, 2010). So, it is important to provide training and exposure to the health professionals on the ICT equipments and technology so that they will not have technophobia (Pradhan, 2009) and they will be encouraged to use the technology.

Hence, the implementation of rural-telemedicine program will support to reach the unreached population of the country to deliver the health care service by combating the specialist inaccessibility issues. Similarly it can be also taken as a proper solution for developing countries like Nepal to overcome the various challenges that exist in the healthcare delivery system.

Chapter Five

Study Findings

5.1 Motivation for the Rural-Telemedicine Program in Nepal:

Development of Information and Communication Technology (ICT) has widely spread throughout the world and it has been taken as an integral part of health care delivery system. It has supported in the delivery of health care services especially in the context where the health care providers are limited and the peoples living in communities doesn't have easy accessibility with the health services.

In Nepal, health services in the rural communities is limited due to the various challenges such as shortage of sufficient health care providers (WHO, 2007), difficult geographical structure, lack of proper transportation facilities and other related socio-cultural and economic barriers. In such scenario, implementation of telemedicine program will support to provide the healthcare services to the unreached population in the rural areas.

Realizing the importance of Information and Communication Technology (ICT) in the health care delivery system, government of Nepal has endorsed the related policy and has also started the rural-telemedicine program in remote district hospitals. One of the Telemedicine-Officers working at the Central Coordination Desk told that;

> *"Use of ICT in health care is like using salt and spices in the food, so that it improves its flavor and importance"*

During the interview with another Telemedicine-Officer about the importance of rural-telemedicine program, he mentioned that;

> *"Telemedicine service will be especially helpful for those rural district hospitals where the transportation is not accessible"*

Figure 5: Central Coordination Desk at Patan Hospital, Lalitpur

In the context of Nepal large proportion of population (i.e. about 80% of total population) are living in the rural areas so it is difficult for the government to deliver the specialize care to these peoples. The rural areas of Nepal have inaccessibility with proper transportation system, so it is difficult for the community peoples to reach the health facilities. The medical doctors, staff nurse and other health personnel are also not motivated to work in such remote areas due the lack of proper facilities and due to the various other reasons. Similarly at the district hospitals the available health facilities are also not used properly due to the lack of skilled human resource and other supporting environment such as lack of regular electricity supply, not having sufficient rooms and space to conduct the service and also due to poor management of the hospital.

Telemedicine Officers working at the Central Coordination Desk told that, due to the rugged topography, lack of proper roadways and absence of sufficient transportation facilities it is difficult to travel in the rural areas from one place to another. In such condition, it is a great challenge to provide the health services in the remote areas. Similarly deputing the skilled

human resources especially the specialists to these rural areas is also another challenge for the government. Although the government has policy to depute the specialist medical doctors in the district hospitals, however it is difficult to retain them in the rural areas for the long period. So the peoples living in the rural areas are always deprived from the basic health care services. He also added that health is taken as "fundamental human right" and it is also the responsibility of the country to provide basic health services to all the peoples without any bias and discrimination. So the government has initiated the rural-telemedicine program to increase the accessibility and provide the specialized health care service. Similarly it is also expected that the rural-telemedicine program will support to decentralize and extend the health care service to the remote areas of the country.

Focal Person for the rural-telemedicine program mentioned that the program has supported the peoples living in the rural areas by increasing their accessibility for the specialist services. He told that the,

> *"Implementation of telemedicine program has been supporting the rural population to get the specialist service at their own local place without travelling to any other tertiary level hospital"*

He further focused that the use of telemedicine services will also support to address the epidemic out-breaks, that are frequently seen in the various rural areas. It is always challenging for the Ministry of Health and Population (MoHP) to address the epidemic issue instantly due to the lack of sufficient healthcare personnel at the district level and due to lack of proper transportation facilities. In such condition necessary specialist support and medical consultation can be provided by using the rural-telemedicine services.

5.2 Government Program on Rural-Telemedicine:

Rural-Telemedicine Program is newly initiated by the Government of Nepal. This program is managed under the Logistic Management Division (LMD) which is one of the divisions working under Department of Health Service (DoHS). Logistic Management Division is mainly responsible for purchasing, supplying and managing the logistics that are required by

the health care delivery system. Rural-telemedicine program was formally started from 22nd January 2011 in the different 25 hilly and mountainous districts. The program was initially implemented in those selected districts having lowest human development index (HDI) as compared to other districts. Latter on this program is further extended in five more districts from the August 2012. So in the present context the government has implemented the program in altogether 30 rural district hospitals of Nepal.

Figure 6: Map of Nepal showing the Rural-Telemedicine Program Implemented Districts

This study is conducted to explore the situation of ongoing rural-telemedicine program in Nepal. Necessary information was collected from different personnel working at Ministry of Health and Population (MoHP), Department of Health Service (DoHS), Central Coordination Desk at Patan Hospital and from the rural-telemedicine sites of two rural district hospitals. Study information was taken by conducting semi-structured interview with all-together fifteen respondents. In-addition to that necessary discussion was also conducted among the

respondents. Similarly the observation was made at the Central Coordination Desk and at the rural-telemedicine implementation site of two district hospitals.

Government has named the program as "rural- telemedicine program" since it mainly focuses to provide healthcare services to the rural population. Focal Person for the rural-telemedicine program also told that, the program is expected to provide specialist health care service and improve the accessibility services to the peoples of the rural communities, so it is also named as rural telemedicine program. Similarly it will also support the medical doctors and health personnel who are working in the remote district hospitals by providing them technical and moral support so that they will be motivated to work in the rural areas. The healthcare providers at the district hospitals also need specialist support from the tertiary level hospitals for further consultation, in such condition the rural-telemedicine program support them technically to enhance their knowledge and skill. Due to such support doctors and other health workers are motivated work in the remote areas of the country.

To support the delivery of health services in the remote areas, rural-telemedicine program is using store and forward method, video-conferencing and telephone based consultation (i.e. hello-health). Telephone based consultation (i.e. hello health) and store and forward method is used in most of the program implemented districts where as video-conferencing is only used in three districts.

In the store and forward method, the medical officers or the healthcare providers working at the district hospital, send the details of the patient through the email in an especial format that is designed for rural-telemedicine program. The sent mail is received at the Central Coordination Desk at Patan Hospital (tertiary level hospital) by the Medical Officers or by the Telemedicine Officers working at the desk. The e-mails are screened on the basis of the health problems and then it is forwarded to the concerned specialist. The specialist doctor replies the email as soon as possible with appropriate suggestions and feedback to the district hospital.

Similarly, the videoconference is conducted weekly in the three district hospitals. However during emergency and for special cases it is also conducted as needed. This method has remained most effective for providing medical consultation to the patients and also for providing necessary medical assistance to the medical doctors and health workers. Similarly patients were also happy and satisfied with the consultation provided by the specialist doctors through video-conferencing. Usually during the video-conference, the Medical Officer at the district hospital keeps the patient together to consult with the specialist, so that good discussion occurs among them. In other case Medical Officer and other health personnel also discuss on the patient problem separately without the involvement of the patient. It provides support to the health-team at rural hospital to treat the patient better and also gives them opportunity to learn more on the treatment procedures. However there were still many ongoing challenges that have created the problem to smoothly conduct the videoconference in the rural districts. Telemedicine Officer told that, due to the slow internet service sometime the images are not clearly displayed on the screen and the sound is also not clear. He also added that due to the frequent power-cut, the videoconference cannot be conducted as scheduled.

Another commonly used method is tele-consultation which is also named as "hello- health". Government has installed toll free number at Central Coordination Desk. The Medical Officer and other healthcare providers working at the district hospital can use the “hello-health” service to consult and discuss with the specialist doctor at Patan hospital on the medical issues and get the necessary support instantly. This service is also used by the general peoples to discuss on their health problems that they are facing or discuss on the medication that they are taking. However this service is only limited during the day time and within the office hours (i.e. 10am to 4 pm). During the office hours the Medical Officer on duty at the Central Coordination Desk receives the telephone call and answers the questions that are asked to them by the peoples or discuss on their related health issues.

The Telemedicine Officer at the Coordination Desk responded that the official hours for the tele-consultation need to be extended, so that phone calls can be received 24 hours. He

expressed that, extending the hours will support the health workers at the remote districts to get consultation during the emergency and off-office hours. Medical Officer working at the desk told that;

"Hello-health provides service on various health issues, however most common cases are related with sexually transmitted diseases (STDs), HIV/AIDS and consultation on general medications"

Figure 7: Medical doctor involved in Telephone Consultation "Hello-Health" Service

He also mentioned that sometimes it is annoying and tedious to receive the unnecessary and bluff calls, so the service could be better if we can screen the calls. This will support to answer only to the necessary and needy calls.

5.2.1 Government Policy and Implementation modality for Rural-Telemedicine service:

Regarding the implementation structure of rural-telemedicine program, Telemedicine Officers at the Coordination desk told that, the program is solely implemented by the Ministry of Health and Population (MoHP). He added that the Medical Officers and health personnel at the district hospital are involved in implementing the rural-telemedicine service at the district hospitals. Similarly the medical teams including the specialist doctors from the Patan hospital are responsible for providing the necessary technical and specialist medical support to the rural-telemedicine program. Government has also deputed the three Telemedicine Officers for managing the rural-telemedicine activities at the Central Coordination Desk.

He added that, for implementing rural-telemedicine program at the district level government has made the policy to train at least three health personnel in each district hospitals. Such training is provided to a medical doctor and two other health personnel (nursing staffs and paramedics) working at the district hospital.

For the management of the rural-telemedicine program at the district hospital government had made policy to form the district level telemedicine implementation sub-committee that includes nine members. All the sub-committee members must be working at the district hospital. The sub-committee is headed by the Medical Superintendent of the district hospital and other members are district Public Health Officer (PHO), Medical Officer (MO), representative from the Hospital Development Committee, Nursing in-charge, X-ray technician or assistant, Lab technician or assistant and two Health Assistant (HA) or Senior Auxiliary Health Worker (CAHW) who have received the training on the rural-telemedicine program.

Regarding the implementation modality he added that, the district hospital is equipped with the necessary infrastructure and system so that the trained teams at district hospital can consult with the doctors and specialist at the Patan Hospital through video-conferencing or by sending the e-mail (store and forward method). Similarly they also have the facility of telephone based consultation ("hello-health").

For consulting through ‘store and forward method’, Central Coordination Desk has designed especial formats, which needs to be filled at the district hospital including all the supporting documents and patients reports. The e-mails forwarded by the district hospitals are screened and reviewed by the Medical Officers or the Telemedicine Officers at Central Coordination Desk and then they are forwarded to the concerned specialist. Finally the specialist replies the e-mail with necessary suggestion and feed-back.

Telemedicine Officer told that, videoconferencing is conducted only in three district hospitals (Darchula, Sindhuli and Sindhupalchowk). In these districts necessary medical support is also provided through videoconferencing. Medical Officer or other health personnel at the district hospital consult with the specialist at Patan hospital. During the videoconference the patient can directly consult their problem to the specialist and get necessary medical support. Medical Officer working at the Central Coordination Desk told that, specific date and time is allocated for each district to have videoconferencing. On the scheduled date and time, the district health personnel inform about the type of case that they are presenting, so that the related specialist can be called for the conference. In the present situation, specialist consultation service is mainly provided for general medicine, pediatric, orthopedic, gynecology, dermatology and surgical cases.

Medical Officer at the Central Coordination Desk told that the telephone based consultation or "hello-health" is also popular among the general public. Those peoples who need medical assistance or information can make calls to the “hello health” where the Medical Officer receive the call and provide necessary information and support to the patient. He added that government has used the toll-free number for the “hello-health” program so that the public can make the calls at free of cost.

Telemedicine Officer at the Central Coordination Desk told that, the rural-telemedicine program has used the simple infrastructure and easy technology to provide the rural-telemedicine services. However government is planning to implement more efficient

technology and extend the level of service to the grass root level with the support of External Development Partners (EDPs). Government is also planning to provide necessary training to all the health workers working under Ministry of Health and Population (MoHP), so that they could internalize the concept and importance of rural-telemedicine program.

Focal Person of the rural-telemedicine program told that, implementation of telemedicine program is a new initiation and it is expected to give better result in the delivery of health services. He added that, before the implementation of the rural-telemedicine program by the Government of Nepal, the telemedicine services has already been implemented by some of the private hospitals of Kathmandu. The private hospitals have implemented the service with their own resources, so it is difficult for them to sustain the program and the outcome of the services is also not much effective. So the government is now planning to coordinate with such private hospitals and organizations to have partnership with them. It will support to strengthen the overall status of the telemedicine program in Nepal and also make the existing services more cost effective, affordable and sustainable. Similarly it will also support the government to expand program throughout the country.

Chief of Monitoring and Evaluation Unit at Ministry of Health and Population (MoHP) told that, it is necessary to initiate partnership with some International Non-governmental Organizations (INGOs) and private organizations to extend the level of service and increase the coverage. He added that the existing rural-telemedicine program needs much resources and expertise, so the involvement of such organizations will support the Ministry of Health and Population (MoHP) to upgrade the service. Similarly, Focal Person for the program told that due to the lack of fund and sufficient infrastructure, government is not able to implement the latest technology related with the telemedicine. So the government has to encourage the INGOs and private organizations to provide necessary technical as well as financial support for improving the program.

5.2.2 Status of Telemedicine program in Rural Districts:

Rural-telemedicine program is implemented in 30 rural districts out of total 75 districts. All the program implemented districts are hilly and mountainous having low human development index (HDI). This study explore the views of different personnel involve in the program to find out the status of the rural-telemedicine program in Nepal. Similarly the researcher has also interpreted the scenario from his perspective by combing the experiences that were gained during the site-observation, interview and discussion that were made with the various respondents. For collecting the study information, two program implemented district hospitals were also visited. The study data and information at the rural district hospitals were collected by conducting semi-structured interview, site observation and discussion with the health personnel and medical doctors involved in the rural-telemedicine program. In both the visited districts, health personnel told that the rural telemedicine program is regularly conducted and it has supported the district hospital team to get the expert medical support. Similarly they also mentioned that after the implementation of the rural-telemedicine program the patient flow in the hospital has also improved and the patients are also happy due to the availability of such service in the hospital.

Medical Officer at Sindhupalchowk district hospital told that,

"All the three application of telemedicine are regularly used at Sindhupalchowk, however videoconferencing is most effective for getting medical support and treating the patient"

She emphasized that the services provided by the rural-telemedicine program should be made user friendly, so that every health workers can use it easily. She also focused that the use of videoconferencing will be more effective if it is installed in the Out Patient Department (OPD), so that the doctors could use the service while examining the patient. Presently it is installed at the separate room, so it is difficult for the doctors to manage the time for conducting videoconferencing during the busy hours.

Figure 8: Videoconferencing equipment at the Sindhupalchowk District Hospital

Telemedicine Officer at the Central Coordination Desk told that, in the program implemented districts the rural-telemedicine related services are provided by the Medical Officers, Nursing staffs and paramedics (Health Assistant (HA) and Auxiliary Health Worker (AHW)). Similarly the telemedicine program covers all the specialty of medicine that is available at the district hospital, so it supports to fulfill the need of health personnel working at the rural-district hospitals. However District Health Officer (DHO) at Darchula district told that,

"The rural-telemedicine team members at the district hospital are not sufficient, so the government should train more health workers".

Similarly he also focused that the program should be extended to the peripheral level health facilities (Sub-Health Post, Health Post and Primary Health Care Centers) so that it will support the government to address the various public health problems that exist in the rural communities. Rural-telemedicine program can support to improve the maternal and child health status, reduce the burden of HIV/AIDS, improve the health status of patient suffering

from Tuberculosis and also contribute in the prevention of various other communicable and non-communicable diseases.

District Health Officer (DHO), Darchula mention that it is a great challenge for the patients in the rural area to get information about the appropriate referral center. So, by extending the "hello-health" service, it will also support the patients of the rural communities to get necessary medical consultation and also to get the right information on the referral centers.

Regarding the effectiveness of rural telemedicine program, Medical Officer at Sindhupalchowk district hospital told that although the programs has various limitations, however it has supported the medical team working at the district hospital to get the necessary medical support and information. Similarly patients also feel comfortable when they get opportunity to consult with the specialist doctors.

Figure 9: Telemedicine Implementation Site (Darchula District Hospital)

Figure 10: Telemedicine implementation Site (Sindhupalchowk District Hospital)

5.2.3 Strategies for successful implementation of Rural-Telemedicine Program:

Medical Officers working at Sindhupalchowk district hospital told that, rural-telemedicine program is effective approach to reach the unreached population. It should be implemented with cost-effective approach and with affordable technology so that it will be sustainable in the rural districts. Similarly to make it better and successful it should be managed with a limited cost and resources.

Focal Person for the rural-telemedicine service told that due to the limitation of sufficient fund, infrastructure and lack of sufficient trained human resources, it is challenging for the government to properly function the rural-telemedicine related activities. So to implement the rural-telemedicine program effectively the existing services need to be affordable, simple to handle and cost-effective.

Telemedicine Officers at the Coordination desk told that it is necessary to improve the existing infrastructure and technology and it should be replaced with the comparatively modern and affordable one. He added that,

"Government is in the process of replacing the old internet system which was used through VSAT (Very Small Aperture Technology) application and now it is planned to be replaced with the ADSL (Asymmetric Digital Subscriber Line) lease line by coordinating with Nepal Telecom Corporation. After using the ADSL lease line, internet service will be regular with more bandwidth and so that the emails will be send faster and the quality of teleconference will also be better. Similarly maintenances will also be done by local Telecom staffs, so it will be more efficient and faster"

Health personnel working at Darchula district hospital told about the frequent and unplanned transfer of health workers from one health facility to another. Such activities lower the motivation of health workers to sincerely work in their position. Similarly it will also affect in the implementation of the program, since the newly deputed staff doesn't have skill and training on the rural-telemedicine activities and it takes times for them to learn about it. So it will be better to minimize the unplanned and frequent transfer of staff and also focus on providing timely training and support to those health workers who are newly deputed at the district hospitals. Similarly it will be better if the government can manage to provide orientation to all the health workers about the rural-telemedicine program and its importance.

For the better implementation of the ongoing telemedicine service, one of the Telemedicine Officers told that the attitude of the health workers and service users toward the importance of telemedicine is very important. If the health workers sincerely use the services, then it will support the rural-telemedicine program to grow well. But sometime the health workers try to escape from their responsibilities due to the difficulty that they face while using the system. So it is important to provide regular training and exposure to the health workers to improve their confidence and skill on using the existing services. Similarly it will be better if the

government can provide some extra incentives to the health personnel working under rural-telemedicine program to improve their motivation.

Medical Officer at the Darchula district hospital told that, it is important to aware the local health service users about the rural-telemedicine program and its importance. Usually in the rural areas when the peoples suffer from any sorts of illness, they usually prefer to get treatment from the local healers and if it doesn't work well then they give priority to visit the Indian hospitals or the private hospitals which are comparatively much costly then the government hospitals. He added that,

"…they have to travel a long distance to reach such hospitals and spend much money in travelling, lodging, food and for high healthcare charges".

Similarly the patient has to also spend long duration of time for the treatment. So, if the service users are aware about the rural-telemedicine services, then they will use the district hospitals more and they can also get specialist consultation from their local place. It will ultimately support to reduce their medical expenses, save their travelling time and also reduces other costs.

Chief of Monitoring and Evaluation unit at Ministry of Health and Population (MoHP) told that, continuous research activities should also be conducted, so that it will support to improve the existing systems and rural-telemedicine related activities. Such research activities will provide information about the technology and system that can be best adopted in the rural setting of the Nepal. Similarly it will also provide information on the specific modality which is effective for implementing the rural-telemedicine services.

One of the Telemedicine Officer at the Central Coordination desk mentioned that it is necessary to conduct regular research activities on the relevant area. Findings obtained from such research will support to better implement the program, and it will also help to find out the specific areas that need to be improved

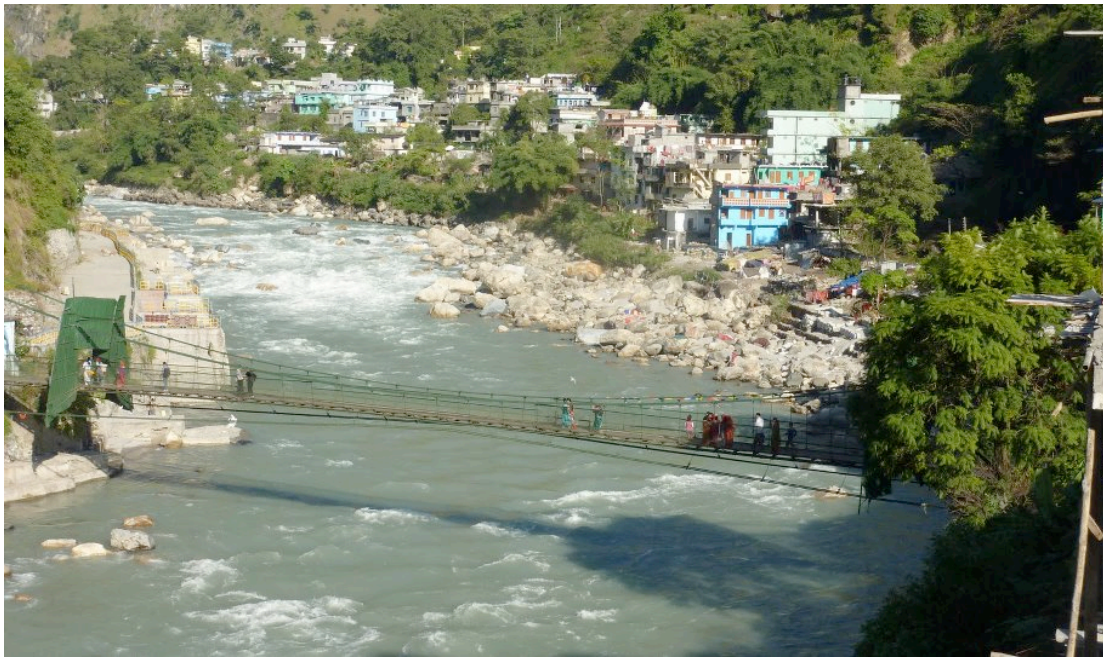

Figure 11: Darchula District Headquarter with District Hospital

5.2.4 Existing Challenges and Limitations:

Focal Person for the rural-telemedicine program told that,

"Appropriate infrastructure, relevant technology and trained human resources should be the most focused part of rural-telemedicine program to make it successful"

He added that, rural-telemedicine program is facing various challenges to smoothly conduct the program. One of the most prime challenges is related with the human resources, i.e. not having sufficient human resources who are trained and motivated to work in rural-telemedicine program.

Telemedicine Officer at the Central Coordination Desk told that the government has provided training to at least three health personnel from each program implemented district hospitals. However in the present scenario, these trained human resources are not sufficient since they are transferred frequently in an unplanned way to other places and those who are newly deputed are not trained on the program activities. To overcome such problems government is

planning to provide basic orientation to all the health workers who are working in the government health facilities. It will support to improve the scenario because when the new staffs are deputed for the rural-telemedicine program they can easily take-over the responsibility and continue the related activities.

He added that to strengthen the existing situation of the program the government also needs a separate unit of rural-telemedicine program under Department of Health Service (DoHS) with responsible management team. It will encourage and motivate the rural-telemedicine team working at the district hospitals to work better. Similarly it will also improve the existing management of the program and provide support to the rural-telemedicine team for effectively implementing the program. However in present situation it is managed under Logistic Management Division (LMD) and there is no such specific team to look after the overall management of the program. Telemedicine Officer also suggested on enhancing the capacity of the rural-telemedicine team working at the Central Coordination Desk by providing regular training and exposure on the related subject matters so that they can better manage the program.

During the discussion, health personnel and Medial Officers working at the two rural district hospital told that there is no such attractive incentive for the rural-telemedicine team working at the district hospital. They expressed that,

"Other health workers at the hospital do their normal activities, where as we have to spend more time working with rural-telemedicine applications which also increases our work burden, so the government should provide extra incentives to those who are involved in the rural-telemedicine program"

Another challenge for the rural-telemedicine program is related with its sustainability. Due to the lack of sufficient fund the government is not able to implement the modern and latest information technology to support the program. Similarly the used information technology are also not managed and maintained properly due to the various constrains and lack of

supporting environment. So it is challenge for the government to maintain the quality of the service and sustain the program. Focal Person for the program told that,

"In the international scenario technology is updated and changing day by day, so it is challenge for the government to adopt the latest technology and purchase the new equipment and infrastructure to meet such needs".

For the developing countries like Nepal, it is really difficult for the government to financially sustain the program. So it is important to use such technology which is financially affordable and easy to use among the health workers and the patients. Similarly the government should also initiate the policy to coordinate and have partnership with the private organizations who are involved in the Information Technology (IT) sector and also with the external development partners so that rural-telemedicine program can be supported both technically and financially.

Chief of Monitoring and Evaluation unit at the Ministry of Health and Population (MoHP) told that, it is necessary to develop the regular monitoring plan and allocate budget for it so that regular monitoring can be conducted at the program implemented sites. It will support the government to identify the areas that needs to be improved so that necessary measures can be taken to make it better. He also suggested that the government should give more priority on the improving the existing policy related with rural-telemedicine service. The government should focus on such technology that is affordable and easy to replicate in the rural areas. He suggested that the use of mobile phone based services (m-health) could be effective and cost affordable in our context where the resources are always a great challenge.

Lack of expertise in the Information Technology is also a challenge for implementing the rural-telemedicine services. Telemedicine Officer working at the Central Coordination desk told that, government has recruited the external IT consultants for the rural-telemedicine program who provide the maintenance service only if they are informed about the problem. Usually when the problem occurs in the district rural-telemedicine sites, sometime they are

not willing to travel to the rural districts. In such case the rural-telemedicine services does not function even for weeks or months due to the lack of timely maintenance and support. So the government should hire a fulltime IT expert, so that he could sincerely work for the program and also travel to the rural districts to provide necessary technical support and timely maintain the applications. Similarly the government should also focus on providing basic maintenance skills to the Medical Officers and other health personnel who are involved in the program.

District Health Officer (DHO) at Darchula also supported that the health personnel involved in the rural-telemedicine program don't have sound knowledge and skill on the Information Technology (IT) so it difficult for them to use the rural-telemedicine services. For correctly using the rural-telemedicine services, one should have proper knowledge on the Infrastructure Technology (IT) and good computer skills. Similarly they should also internalize the importance of using such program in the delivery of health services. Since most of the health personnel working in the districts doesn't have such background, so they are not comfortable to use the rural-telemedicine services and they don't want to get involved into the program. He supported that, the program will function better if the government could provide regular training and exposure to the involved health personnel and also conduct necessary advocacy to promote the program activities.

He added that, in the district hospitals the medical doctors has a major role to properly implement the rural-telemedicine program. Although the government has deputed and trained the team of three health personnel, however the other health personnel apart from the medical doctors are not willing to use the service. It may be due to being uneasy to use and adopt with the new system and technology.

It is still a challenge for the government to enhance the skill and confidence of the health workers who are involved in telemedicine program. Telemedicine Officer at the central coordination desk told that, there is usually only one medical doctor working at the district hospital. Due to the overload of patients at Out Patient Department (OPD) and other clinical work, they are not able to give sufficient time to the rural-telemedicine activities. So it is also

one of the challenges for the government to depute the trained and qualified health personnel at the district hospitals especially to support and manage the rural-telemedicine program.

Similarly, lack of efficient infrastructure and supporting environment has also remained as a challenge to implement the rural-telemedicine programs. District Health Officer of Darchula district told that,

"…due to the irregular supply of electricity and slow internet service, it is sometime problem to send the emails. Especially during the videoconferencing, it is frequently disconnected and the images that appear in the screen is also blurry and the sound is also not clear"

So it is important to improve the bandwidth of the internet service and also install strong electricity back-up system which could manage sufficient electricity during power-cut period. Similarly during the discussion, Medical Officers working at both Sindhupalchowk and Darchula district hospital told that, sometime the computers and its system does not work at all, so in such situation it is really difficult to use the service. For the maintenance of the system the experts have to come from Kathmandu, which might take several days. In such condition if the district has its own maintenance team, then it will be easy for timely maintenance the service and use it regularly without interruption.

Increasing the accessibility of rural-telemedicine services is important so that more peoples will be benefitted from the program. Telemedicine Officer expressed that the telephone based consultation "hello health" is only centralized at the Central Coordination Desk and it is limited for only certain proportion of population. Medical Officer working at the Central Coordination Desk also told that the 'hello-health' program has a high pressure with the telephone calls, so it is difficult to manage the calls and provide sufficient time for consultation. Hence they suggested that it would be better if the service is expanded at the regional or zonal hospitals so that more peoples will get benefit from the program. Medical Officer at the Central Coordination Desk also added that,

“Hello-health program has also a load of unnecessary calls, so it should be screened before it is received by the Medical Officer”

Challenges are also seen among the service users. Medical Officer at Darchula district hospital told that due to the high illiteracy, lack of confidence and shyness that exist among the rural patients (i.e. especially seen among the female and elderly patients) it is difficult to present them in-front of the videoconferencing screen. When such patients visit to the hospitals they are usually accompanied by someone from their families who have to speak for them. Medical Officer mention that,

"Usually the patients do not express their health problems on their own; the patient’s family members have to express their problems for them so it is difficult and time consuming to use the rural-telemedicine services for such patients"

The Chief of Planning and Evaluation Unit at Ministry of Health and Population (MoHP) told that since it an initial phase stage of program so the government is facing various challenges. However it is also a good opportunity to learn new experiences from the existing program so that in coming days it could be improved and implemented in better way. He expressed that the major challenges that are presently faced by the program are mainly related with the technological resources, allocation of sufficient fund and skilled human resources for supporting the program activities. Hence the government should focus on involving private organizations and initiate networking with the international partners to overcome such challenges and to ensure the financial sustainability. Similarly it is also necessary to strengthen the skill and capacity of the health personnel working in the rural district hospitals by providing sufficient training, encouragement and motivation. Government should also focus on the improving the existing environment by improving the telemedicine and e-health related policy and strategies. Similarly it is also necessary to have friendly working environment for the involved health personnel without any political pressure and bias.

He added that allocation of sufficient fund and other supporting resources is important to successfully implement the rural-telemedicine program. Especially in the context of Nepal, limited resources and lack of expert has remained as a big problem to implement the program. Similarly due to the geographical difficulty, it is hard to carry and construct the necessary infrastructures and equipment to the remote areas. It is also expensive to deliver the necessary items to those areas, due to the lack of transportation. Other challenges are related with regular supply of electricity as well as with the availability of internet service. So for the government it is a challenge to maintain these various things which are costly and need lot of resources. Hence it is urgent for the government to coordinate with some of the external donor partners who can provide necessary technical and financial support to better conduct the program.

It is also important for the rural-telemedicine program to comply with the quality and stander of the technology that is internationally used by the telemedicine services. So the government should be updated with the improving technology and upgrade the rural-telemedicine services accordingly to make it compatible in the international scenario. Similarly regular training should also be provided to the health care providers on such improved technologies to enhance their knowledge and skill.

5.3 User Experiences:

Medical Officer at the Darchula district hospital told that, rural-telemedicine service has supported many patients by providing appropriate service as well as the right consultation and information. He added that the program has benefited especially those patients who cannot afford the expensive specialist service at the tertiary level hospitals and those who cannot travel. Medical Officer shared one of the remarkable cases that he had experienced;

"One young girl from a remote village of Darchula district was suffering from dermatological problem (fungal infection) on her body. Her family took her to the various local healers and nearby health centers to treat her problem. Similarly, the family members followed the suggestion provided by the local healers, where the local healers told that the problem was due to the curse of devil-sprit, so she has to offer various gifts and sacrifice the

animals for it. They did as they were told by the local healers but it also did not show any effect on her problem. Similarly the girl also took the medications provided by the local health workers but it also did not work well. Her family was not able to take her to any specialist or outside hospitals due to the financial problem and due to the distance, i.e. they have to walk and travel at least three days to reach such hospitals. So it was great frustration for the young girl and for her family. Similarly her family also had threat that if the problem is not timely treated it will affect her personal life, i.e.it will be difficult for her to get married and incase if she got married also she will not get the good bridegroom. So the family members have strictly told the girl not to expose the problem to anyone and they had also limited her movement going outside with friends and in other social gathering activities. However one day the girl got chance to visit the district headquarter for buying certain stuffs from the market, where the district hospital is also located. With the support of her friends she managed to visit the district hospital to show her problem. When she presented her problem to the Medical Officer, doctor advised her to participate in the videoconference and get the consultation from the dermatology specialist. She agreed to participate in the videoconference with the dermatology specialist. During the discussion the specialist took the history of the patient and observed her skin problem on the screen. Specialist suggested her that it is not a big issue and will recover soon if she takes medicine regularly for 6 months. Specialist recommended the Medical Officer to dispense the particular medicine and told him to follow up the case on monthly basis. The girl started to get recover gradually after taking regular medication, which finally supported her to expose her hidden life in the society and also created happiness in her personal and family life."

Similarly the Staff Nurse working at the Sindhupalchowk district hospital told that the rural-telemedicine program has made the health services more regular at the hospital and also supported to improve the quality of service. She expressed that *"after the initiation of rural-telemedicine program the scenario has improved within the district hospital. These days the presence of the doctor at the hospital is regular and the trend of patients visiting to the hospital has also improved. In the previous days the health staffs and the doctors were usually not regularly attending their duties in the hospital. During their duty hours either they used to*

be away from the districts for their personal work or if they were within the district also they used to be absent in their duties and were busy with their other businesses. There was no any such immediate action taken against them because such information does not reach up to the central management level due to the improper source of information and lack of proper means of communication. The monitoring and supervision from the central level was also rarely done due to being remote and lack of supporting environment. So due to the unavailability of the doctors and health personnel in the hospital the patients visiting the hospital sometime have to return back without getting any services. In-addition to that those patients have to visit the private hospitals and spend more money for travelling and getting treatment from such hospitals. Such situation has reduced the faith of the patients toward the district hospital due to which the patients were also not willing to visit the hospital. Similarly it was easy for the medial doctors and other health personnel to escape from their task and it seems they were not accountable with their roles and responsibilities. In-addition to that the medical doctors and health personnel who were deputed at the hospital were also promptly transferred to other urban and better places, so they don't have to spend more time in the rural hospitals. Due to this reason there was always the deficit of the medical doctors and health personnel in the hospital. However after the rural-telemedicine service has started at the hospital the doctors seems to be more regularly working at the hospital, since they have to regularly contact with the telemedicine team at the central level to deal with the patient issues. It has enhanced the means of communication between the district hospital and officials at the central level. So this can also be taken as one means of controlling, monitoring and supervising the staffs at the rural district hospitals. Now days the doctors are also motivate to stay at the hospital for the longer time as compared to the past days. It is because they also get necessary medical support from the specialist at the tertiary hospital, as well as they can also discuss with other medical personnel and friends and take necessary medical support as well as other support that they need by using the rural-telemedicine services. Such scenario has encouraged them to stay and work in the rural district hospitals. Similarly after the implementation of the program the flow of patient has also improved at the hospital as compared to the past years. It is due to the reason that, now days the patient can easily meet with the medical doctors at the hospital and they can also get specialist consultation at free of

cost through the rural-telemedicine services. So the patients are also encouraged to visit the district hospital to take the necessary medical services. Hence, the rural-telemedicine program has supported the whole hospital team who are involved in treating and caring the patients and it has also encouraged the rural patients to visit and take the service from the district hospital."

Chapter Six

Discussion

This chapter discusses on the study findings and relates it with the Information Infrastructure Theory and the concept provided by the Actor-Network Theory. It mainly focuses on the various characters of the Information Infrastructure and compares them with the characters of rural- telemedicine program. Similarly this chapter also discusses on the concept provided by the Actor Network Theory and relates it with the rural-telemedicine program activities, i.e. how the technical and non-technical elements are connected with each other and support the rural-telemedicine program.

Government of Nepal has started the rural-telemedicine program in the 30 different rural district hospitals. The main purpose of initiating this program was to provide the specialized health care service to the peoples living in the rural and remote areas of the country. The government has started this program with its own resource without being dependent on any of the external donors. However, the present status of program reflects that the government's policy, strategy and planning seem to be weak to implement the program in better and sustainable way.

Various literatures show that in the developing countries telemedicine services can improve the health status of peoples. In the context of Nepal it is expected that the use of rural-telemedicine program will increase the accessibility of heath care services for the peoples living in the rural and remote communities and it will also support the government to achieve the Millennium Development Goal (MDG). Telemedicine applications also support to provide distance education on the health related matters and training to the health personnel who are working in the remote areas. It is used in various medical sub-specialties like; dermatology, psychiatry, obstetrics and gynecology, radiology, pediatric, cardiology, pathology etc. Similarly the use of telemedicine also supports the health care providers in decision-making

process and enhances the accessibility of health care services to the rural communities and underserved populations (Edworthy, 2001).

6.1 Information Infrastructure and Rural-telemedicine Program:

Rural-telemedicine program as an Information Infrastructure is open, enabling, shared and installed based. It is also a heterogeneous network of various social and technological components, and is shared by the large number of peoples and organizations. It has an install base character, so it is build on the basis of the infrastructure that already exists and it is also gradually evolving. Similarly to support the character of Information Infrastructure, the rural-telemedicine services should also be changed according to the requirement of the user group. Similarly the service should also be shared by the large number of users and stakeholders, and it should not have strict boarders for its growth and development.

Rural-telemedicine program has also an '***open'*** characteristic, similar to Information Infrastructure. Hanseth and Monteiro (1998) have discussed that due the open nature; the Information Infrastructure has number of users and stakeholders and it does not have any restrictions in its borders. This character is also applicable for the rural-telemedicine program conducted in Nepal. Due to its open nature, the program has successfully included different stakeholders and personnel working at different level, i.e. from central level (Coordination desk) to district level (district hospitals). Government has been training paramedics, nurses, doctors and managers as needed by the program. However in the present scenario it seems that the rural-telemedicine program does not fully support the fact that it is 'open' since it has limited its services only at the district hospital level and the users of the service are also limited. So it is necessary to extend the program to the peripheral level health centers (Sub-health Post, Health Post and Primary Health Care Center) and to other tertiary level hospitals as well as in the private sectors so that it can cover more service area and also include more users who are in the real need of rural-telemedicine services.

Being 'open', it supports the users to use the technology as they need and can modify according to the changing need of the users. However due its open character the Information

Infrastructure is also influenced by the external surrounding environment (Hanseth & Monteiro, 1998). In-case of rural-telemedicine program study findings supports that various external environmental factors such as irregular electricity supply, slow internet, lack of proper infrastructures and technology, illiteracy among the patients (i.e. user group) and lack of sufficient skill and motivation among the health personnel to use the existing services has affected the rural-telemedicine program in Nepal.

Information Infrastructure does not have strict borders, so it can freely interact with the external environment. This character allows the Information Infrastructure to grow and develop as per need of the organization and users group. In case of rural-telemedicine program, it should also be able to consider the need of the rural communities and develop accordingly to provide effective health services. However due to the various constrains such as, insufficient fund, lack of trained experts on the related technology and unavailability of supporting infrastructure the program is not able to adopt the advance technology and extend the program as needed by the community.

Rural-Telemedicine Program has aim to support the diverse group of peoples focusing on their health problems by using the different application of telemedicine, so this aspect supports that the program has an '***enabling'*** character. Study findings show that, the rural-telemedicine services is used in various medical sub-specialties (i.e. general medicine, pediatric, orthopedic, gynecology, dermatology and surgery) that are available at the district hospitals. Similarly it has enabled the knowledge, skill and confidence of the doctors and the health personnel working in the remote districts, since they are able to consult with the specialists and discuss on the patient case and on other medical issues. So it provides opportunity to share their problems and get necessary information and support that they need. Similarly it also supports the health worker at the district hospitals to give information on the appropriate referral centers to those patients who are referred by district hospitals. Hence the rural-telemedicine program has enabled the health workers working in the remote areas to improve their knowledge, skill and capacity. However, there are still more areas where it needs to focus in future to broaden its scope.

Rural-telemedicine program has been providing service to the large group of population. The program has benefitted both the patients as well as the health personnel working in the rural areas. It shows that the program has a '***shared'*** character similar to the Information Infrastructure. In the context of Nepal, the rural-telemedicine program is shared by the different stakeholders and the user groups. The program has also supported to share the medical issues handled by rural district hospitals with the tertiary level hospital (i.e. Patan Hospital). However the government should also expand the services in private health care sector and to the peripheral health facilities so that the services provided by the rural-telemedicine program can be shared among more users and it can benefit more peoples.

To effectively implement the rural-telemedicine program, there should be proper coordination between the different human and non-human elements that are linked with the program. Hanseth and Monteiro (1998) have stated the Information Infrastructure as a network of heterogeneous elements. Similarly the rural-telemedicine program can also be taken as a network of heterogeneous elements, since it includes various applications, equipment and other human and non-human artifacts. However still there is a need of harmonious coordination and interaction between the users and the technology that they are using. The study finding shows that in the district hospitals the users are not able to easily use the services due to the lack of information, knowledge and skill on the related technology. Similarly the findings also show that the existing rural-telemedicine services are also not functioning well due to the lack of supporting infrastructure. For example one of the study respondents mentioned that during the video-conferencing the images are not clearly displayed in the screen and the sound is also interrupting. In addition to that in some of the program implemented districts the services are not yet started due to the lack of trained human resources.

The study findings support that to implement the rural-telemedicine program there should be good coordination between different elements. So, the rural-telemedicine program can also be taken as ecology of network where different elements of network are strongly aligned

together which helps to make the program more effective and function better. However in the present situation it is seen that the elements of the rural-telemedicine program are not strongly aligned with each other due to various constrains, which has also affected in the implementation of the rural-telemedicine program.

Telemedicine services have an ***evolving*** character, since it uses new systems and applications according to the gradual growth and development of the infrastructure and technology. It grows continuously and improves the existing system by including more advance and effective technology. The evolvement process supports the telemedicine program to make it user friendly and also to address the health need of those peoples who are using it. In the context of Nepal, the evolvement of rural-telemedicine program is also important to make it user-friendly and to fulfill the need of the health personnel and local peoples. For making the evolvement process effective it is necessary to have information about the system that can best adjust in our context. So to get such necessary information on the issues, related research studies need to be conducted.

It is similar to the character of Information Infrastructure that the Telemedicine services also grow continuously based on the existing system, so it has also an 'installed base' character. 'Installed base' concept focus that the new technology has to be connected with the old one to make them interoperable (Hanseth & Monteiro, 1998). Wright (1998) has discussed that in the developing countries, where the telemedicine programs are newly started, it is better to initially start with a small-scale project and latter expand and replicate it based on its effectiveness. However, the study finding shows that although the rural-telemedicine program in Nepal is newly started but it has been implemented in a large scale (i.e. in 30 different districts hospitals) in an ad-hoc way without having proper allocation of resources and estimation of the infrastructure and technology available at the district hospital. Due to this reason in many rural-telemedicine programs implemented districts the services are not yet started although the government has purchased the necessary equipment and installed them. The health personnel who were involved in the rural-telemedicine program mention that the program is completely new for them, so they don't have sufficient knowledge and skill to use

and operate the new technology. Similarly they also expressed about having problem in using the computers and internet services due to the lack good knowledge and skill. So it reflects that enhancing the knowledge and skill of the health personnel in the related technology and in operating computer systems is most essential to make the rural-telemedicine effective.

Similarly to overcome such challenges government should provide regular training to the involved health personnel to enhance their knowledge, skill and confidence. In-addition to that there should be close monitoring and supervision to assess how effectively the services are implemented and to encourage and motivate the staffs who are involved in the program. The government should also focus on designing the relevant and strong policy and strategy on rural-telemedicine program, so that it will support to implement the program in effective and better way.

6.2 Limitation and Challenges:

The effectiveness of the telemedicine program differs with place and depends upon the knowledge, attitude and skill of the users. Aanestad and Hanseth (2000) have discussed that the technology grows and diffuses gradually to align the technology with the interest of the users. Similarly the perception toward technology also differs according with the nature of the user and how it is used (Aanestad & Hanseth, 2000). It is similar that the Telemedicine program should also grow together with the development of the technology i.e. it should also grow gradually by aligning the technological development with the interest and demand of the users.

Walsham (1997) has mentioned that, *"Successful network are created through enrollment of sufficient body of allies, and the translation of their interests so that they are willing to participate in particular ways of thinking and acting which maintain the network"*

To make the rural-telemedicine program successful and effective, every elements of the rural-telemedicine program must be smoothly align with each other. As discussed by the Actor Network Theory (ANT) that, both the technical as well as non-technical elements interact and

align together to make the irreversible system. In case of the rural-telemedicine program, various technological as well as non-technological elements are linked together to support the program. Therefore, to make the program effective and sustainable the various technical and non-technical elements must be strongly aligned with each other.

Actor Network Theory (ANT) empirically focus on how the various human and non-human actors (such as, artefacts, computer, software's cables, organization and users) are associated in the development of the network. Similarly ANT also provides systematic understanding on the complex dependencies and interoperability among the various heterogeneous elements. Rural-telemedicine also has network in between various human and non-human elements, which are interrelated and interoperating with each other. However to make the rural-telemedicine program effective and successful, the various individual elements of the system have to be strongly linked and operate with each other. At the same time it is important to realize that, it may take some time to have smooth alignment in-between the different elements of the network and to have interoperation between them since it is newly implemented program.

ANT discusses that both the technological and social aspects plays important role in the development of the information system, which is also similar in case of rural-telemedicine program. Henseth and Monteiro (1998) have discussed about the two extreme concepts on technological determinism and social reductionism. The technological determinism gives more importance to the technology that determines the use of technology, whereas the social reductionism gives more emphasis to the social aspects and discuss that society determines how the technology should be and where it should be used (Hanseth & Monteiro, 1998). However the Actor-Network Theory provides the intermediary concept and provides equal importance to both technical as well as social aspects. It emphasize that the Information Infrastructure is a heterogeneous network that includes different technological and social elements and each individual element have its own importance to make the system successful.

"Actor-Network theory treats social and technical as inseparable, and indeed argues that people and artefacts should be analyzed with the same conceptual apparatus" (Walsham, 1997).

In the present context the rural-telemedicine program is facing a range of challenges to implement the program and provide the services to the rural peoples of Nepal. In some of the program implemented districts, the services are not yet started although the government has set-up the equipment and necessary infrastructure. Similarly the study findings shows that the major challenges of the rural-telemedicine program are mainly related with the human resource, existing infrastructure, technology and lack of supporting environment at the district level. So, it is important to consider both the technological as well as social aspects to successfully implement the rural-telemedicine program.

Actor Network theory focus that the *"...stability, technological and social order, is continually negotiated as a social process of aligning interests"* (Aanestad & Hanseth, 2000). For the implementers it is challenging to implement the appropriate technology at the starting phase of technology implementation. However as time go its strengths and limitations can be analyzed and the technology can be modified according to the need of the users and organization. Similarly it will also support to align the technological and social aspects of the network and make the network stable. In case of rural-telemedicine program, it is also important to analyze it's the strengths and limitations to make it more effective for the user groups. Similarly such findings will also support the government to implement the program in better way and to improve the quality of service.

Pradhan (2002) has cited (Shrestha, 1989), where it is discussed that in the context of Nepal the implementation of technology is made on the ad-hoc basis without proper planning (Pradhan, 2002). In case of rural-telemedicine program the existing status of program shows that the government also does not have any serious plan and specific implementation strategy related with the rural-telemedicine program. Similarly the status of the program reflects that the government has also implemented the program in an ad-hoc basis. In the present scenario

it seems that the government is not able to maintain the existing rural-telemedicine services due to the lack of sufficient resources and supporting infrastructure and technology. So it is challenging for the government to sustain the existing program and improve the quality and stander of the services. Aanestad and Hanseth (2000), have discussed that in the resource constrain condition the technology should be applied and adopted in a smaller user group in the initial phase and it should be gradually expanded base on the experiences gained by using the technology. Such process support in aligning the technology and users together and also support in the sustainability. Similarly during the technology design process the interest of the various actors are translated on the basis of the technological solution, organizational structure and based on the procedures to be followed to make the technology work properly (Aanestad & Hanseth, 2000).

Aanestad and Hanseth (2000) have mentioned that;

> *"...there is not one single universally "right" solution or resulting condition of an implementation process. One may envision several equally probable end results, depending on the character of the network(s) involved, the actors' strategies, the success of enrolment attempts, the appeal of translations and the strength of the inscriptions"*

The elements of the technology become effective only if they are aligned toward common goal, which is only possible by translation process. The alignment is possible by enrolling various heterogonous elements in the network and translating their interest. When the elements are aligned, then it supports to form the strong and irreversible network. (Aanestad & Hanseth, 2000) and (Hanseth & Monteiro, 1997). Similarly it is also important to know that, the problem occurs in the network when the alignment breaks between the different actants and when the risk and ambiguity occurs among the users. So in term of Actor-Network Theory,

> *"Successful" implementation is a 'stabilized network', where the actants are aligned"* (Aanestad & Hanseth, 2000)

In-case of rural-telemedicine program, it is also important to make a strong alignment between the different actants that are playing important role to carry-out the function of rural-telemedicine program. Once the actants are properly aligned then the program will also get stabilized, which will also ultimately support in its sustainability.

6.2.1 Sustainability and role of various actors:

Role of users and government:

In term of Actor-Network Theory, various actants in the network are responsible for the sustainability of the program. In case of the rural-telemedicine program the resources (i.e. human resources, fund and necessary infrastructure and technology) and the organizational status (i.e. related policy, plan, implementation strategy) can be taken as an actants. These various actants have significant role in determining the status of rural-telemedicine program. So it is important to have proper alignment among these various actants to make the program effective and stable.

Klein and Myers (1999) have stated that, *"organizations are not static and that the relationship between peoples, organizations, and technology are not fixed but constantly changing"*

This aspect shows that the sustainability of rural-telemedicine program is affected by the peoples (i.e. the user group), the organization (i.e. the government body responsible for implementing and maintaining the program) and the type of technology that is used by the program. If the service users are skilled and motivated, it supports the program to develop and expand. However the study findings show that the users of the rural-telemedicine program (health personnel working at the district hospitals), does not have sound knowledge and skill to function the available technology related with the rural-telemedicine program. At the district level, some of the involved health personnel even do not have a basic computer skill which is most essential to support the program. Similarly the involved health personnel were also found to be less motivated for being involved in the rural-telemedicine program, which

may be due to the lack of attractive incentives that they were expecting from the program and also due to the technophobia, i.e. not being able to handle and use equipment and software related with rural-telemedicine program.

Similarly, government itself have strong and prominent role to develop, maintain and sustaining the rural-telemedicine Program. Pradhan (2002) has discussed that the culturally sound national strategy is important to develop the status of Information Infrastructure in the developing countries like Nepal. It is further stressed that such strategy must address the *"…issues of resistance to change due to cultural, personal and infrastructure factors, be very culturally sensitive and give the rate change of technology, …constructed as an evolving and learning system"*(Pradhan, 2002).

In case of rural-telemedicine program the government can play a role of *"regulator, promoter and diffuser"* (Pradhan, 2002), that will support in the sustainability of the rural-telemedicine program. Government has taken the telemedicine and e-health as a national priority and included in the three-year interim health plan (2007/2008-2010/2011) however in the implementation aspect the study finding shows that the government does not have strong implementation strategy and plan. So it seems that the government should more focus on the program to regulate the existing policy and implement the program more effectively by promoting the program activities and diffusing and adjusting the rural-telemedicine services into the healthcare delivery system.

Pradhan (2002), discuss that in the developing countries increase in the use of information technology also increases the problems associated with it. This is mainly due to the *"... lack of appropriate technology, qualified professionals, absence of economic incentives and infrastructures and lack of explicit IT policy"* Pradhan (2002). Similarly other problems are related with the supporting environment which is necessary to function and maintain the information technology, such as, *"…facilities for training and communication infrastructure, provision for maintenance facilities for computer hardware and software and organizational mechanism for procurement, development and application of the technology"* Pradhan (2002).

While implementing the rural-telemedicine program in the various district hospitals, the study findings also supports the issues discussed by the Pradhan (2002). In the program implemented districts, the application of the telemedicine program were not functioning properly due to the lack of supporting technology. District Health Officer of Darchula district told that,

"...due to irregular supply of electricity and slow internet service, it sometime difficult to send the emails. Especially during the videoconferencing, it is frequently disconnected and the images that appear in the screen is also blurry and the sound is also not clear"

Focal Person of the program told that,

"In the international scenario technology is updated and changing day by day, so it is challenge for the government to adopt the latest technology and purchase the new equipment and infrastructure to meet such needs".

The study findings also show that in the district hospitals the rural-telemedicine services are closed even for weeks due to the lack of timely maintenance. The repairing and maintenance of the rural-telemedicine related equipment and software is slow and it is not done timely. Due to such problem it is reducing the scope and effectiveness of the program among the community peoples. If the services are provided in such irregular way then it will lose its faith among the users and ultimately affect in the sustainability of the program. Hence, the government should timely address such issues and resolve the problem by developing the mechanism for effectively and timely maintaining the equipments and software used by the rural-telemedicine program in the district hospitals.

As discussed by the Pradhan (2002), the government must have sound policy to support the rural-telemedicine program activities. It is true that the strong and sound policy support to implement the program in better way as well as it also support in the sustainability of the

program. The Chief of Planning and Evaluation Unit at Ministry of Health and Population (MoHP) also emphasized that the government should focus on conducting regular supervision, monitoring and evaluation of the program so that it will support to improve the rural-telemedicine services. Similarly regular research activities should be conducted to find out the strengths and limitation of the program and to improve the status of program. Such findings especially support to focus on the specific areas that need to be improved.

The overall management of the program also affects the sustainability of the program. So it is important to have sound management team to manage the program activities. Telemedicine Officer told about establishing a separate unit of rural-telemedicine program under Department of Health Service (DoHS) with a trained and technically expert team. Similarly the government should also have full time IT experts so that they can support the rural-telemedicine program by timely maintaining the equipment and software that often creates problems in the rural districts. Presently, it seems that the program is not seriously managed by the government and it neither has any specific team of expert. So whenever any problem occurs within the program it takes long time to sort-out it.

The continuity and sustainability of the program is also affected by the knowledge and skill of the service users. So the government should focus on enhancing the capacity of the rural-telemedicine team by providing regular training and exposure. District Health Officer (DHO) of Sindhupalchowk told that the health professionals involved in the program are not comfortable to use the services since they don't have sound knowledge on the related subject area. Similarly, there is usually only one medical doctor at the district hospital who is responsible for both clinical as well as managerial activities of the hospital. Due to the work pressure, the medical doctors are not able to give sufficient time to use the rural-telemedicine services. So the government also needs to address this issue by deputing a separate health personnel who is fully responsible for managing the overall activities of the rural-telemedicine program.

The Chief of Planning and Evaluation Unit at Ministry of Health and Population (MoHP) also mentioned about the various challenges faced by the government to implement the rural-telemedicine program. However he mainly focused that the major challenges were related with; allocation of sufficient fund for the program and related with the capacity of the service users (i.e. health personnel involved in the program). He suggested that to overcome such challenges the government has to initiate the networking and partnership with the private organizations and international partners. It will support the program to improve both technically and financially. Similarly to improve the capacity of the involved health personnel they should be provided with necessary knowledge and skill. In-addition to that the health personnel should also be provided supportive environment to motivate them to actively participate in the program activities.

The Chief of Planning and Evaluation Unit at MoHP also focused on the need of regular monitoring and supervision of the program activities. He recommended that such activities will improve and maintain the quality of rural-telemedicine services and also support the policy makers, planners and implementers to find out the specific areas that need to be improved.

Fund:

Availability of continuous and sufficient *"fund"* is another important actants that affect the sustainability of the rural-telemedicine program. Pradhan (2002) discussed that in the context of Nepal, Information Technology can be used as tool for socio-economic development. However it is difficult to implement and use the Information Technology due to the lack of proper related policy and planning, implementation strategy, necessary infrastructure and experts. Similarly such programs are also more dependent on the donor's support (Pradhan, 2002). In the developing countries it is challenge to purchase and afford the latest technology due to the lack of sufficient fund. So such countries have to depend upon the donors or supporting agencies to implement and maintain such technology. In such case, although the donors support to implement the technology at the beginning phase however it effects on the sustainability of the technology, i.e. once the donors stop providing the support the used

technology will also be phased-out. Donor based program does not have possibility of getting continuous support. Similarly the fund provided by the donor is also mostly used on the area of their own interest. So the fund received from the external donors does not support in the sustainability and also it is important to know that the programs that are designed based on the interest of the donors usually do not address the real need of the community.

In-case of rural-telemedicine program, although it is solely implemented by the government's own sources, however the study findings shows that the allocated fund is not sufficient to effectively implement the services and to upgrade the infrastructure and technology as needed. Due to this reason, it is difficult for the government to improve the status of ongoing rural-telemedicine program. To improve the existing status of the program it seems urgent to upgrade the existing infrastructure and technology such as increasing the bandwidth of the internet, use the appropriate and latest equipments and software to improve the efficiency of the program. Similarly, the government should also ensure sufficient fund for hiring the experts, providing the regular training to the involved health personnel and for conducting regular monitoring and supervision of the program activities.

Similarly the fund is also necessary for providing incentive to the health personnel who are involved in the program. Study finding shows the dissatisfaction among the health personnel and Medical Officers related with the incentives and facilities that they get for being involved in the rural-telemedicine program. They had expressed that,

> *"Other health workers at the hospital do their normal activities, where as we have to spend more time working with telemedicine applications which also increases our work burden, so the government should provide extra incentives to those who are involved in the rural-telemedicine program"*

So it seems important that the government have to focus on this issue and allocate fund for providing some extra incentives and facilities to the health personnel and medical doctors who are involved in the program, to motivate them to work better.

Hence from these various contexts it shows that the rural-telemedicine program needs sufficient fund to implement the program in better way. In addition to that it also supports the fact that having sufficient fund will also make the program effective and sustainable.

Improve and Standardize the Infrastructure and Technology:

The used infrastructure and technology should be gradually standardized and improved to make the program sustainable. Hanseth and Monteiro (1998) discussed that the infrastructure should be able to integrate independent components and make them interdependent. Similarly the used infrastructure and technology should be standardized so that it can provide common and consistence interface to the user group (Hanseth & Monteiro, 1998). The infrastructure should be implemented in such a way so that it can be continuously used and last for the period of time. This concept is also supported by the '*enduring'* character of Information Infrastructure which is discussed by Hanseth and Monteiro (1998). Similarly it is also discussed that Information Infrastructure should change incrementally and in economically feasible way and it should be able to adjust with the changes and maintain the consistency (Hanseth & Monteiro, 1998). Similarly the character *'scalability'* focuses that the Information Infrastructure should gradually expand in a planned manner, so that it can provide service regularly. However, it seems that the rural-telemedicine program is not able to completely fulfill the both characters i.e. *'enduring'* and *'scalability'*. Since the government has implemented the program without preplanning and proper allocation of resources, so the infrastructure and technology used by the rural telemedicine program are not able to adjust and function well at the rural district hospitals. Similarly due to the resource constrains and lack of proper supporting environment the program is also not able to expand its capacity as it was expected. District Health Officer of Darchula district told that,

> *"...due to the irregular supply of electricity and slow internet service, it is sometime problem to send the emails. Especially during the videoconferencing, it is frequently disconnected and the images that appear in the screen is also blurry and sound is also not clear"*

In the existing situation, it seems challenge for the rural-telemedicine program to scale-up its services due to the resource constrains and lack of supporting infrastructure and environment. Study findings shows that the computers installed at the district hospital for the rural-telemedicine program sometimes does not works at all for several days. For its maintenance also it takes several days to get it maintained since the IT experts have to travel all the way through Kathmandu. So in such condition the district hospitals cannot use the rural-telemedicine services for several days until it is maintained.

Similarly to support the *'open'* character of Information Infrastructure, the rural-telemedicine program should not strict its borders and should be able to make the services accessible for every user group without any restriction and limitation. However the study finding shows that the services provided by the rural-telemedicine program are limited only for the certain group of users which may be due to the limited capacity of the program. For example the telephone base consultation ('hello health' service) is only installed at the Central Coordination desk and its services are just limited for the certain proportion of population. The service is provided from the capital so many needy peoples of rural areas even don't know about that service and they are not able to utilize the service. Similarly other rural-telemedicine services are also only limited to the few selected district hospitals, so it need to be scaled-up and extended to the regional, zonal and in peripheral level health facilities. It is also necessary to extend the service to the private health sector so that it could also provide support the more needy peoples.

Another important challenge is to economically sustain the technology. As discussed by Hanseth and Monteiro (1998), that the technology should be able to meet the need of both customers and providers. In the present context, it is challenge for the government to update the technology and meet the international stander which is important for both the implementers and service users. Focal Person of the program also highlighted the fact that the technology is rapidly changing in the international scenario; however it is challenge for the

rural-telemedicine program to adjust such technology due to the lack of sufficient fund and resources.

It is challenge for the government to implement the technology that meet the international stander. However, the Chief of Monitoring and Evaluation unit at Ministry of Health and Population (MoHP) emphasized that the technology that have shown better outcome in other developing countries also need to be piloted in Nepal, so that it can further be implemented in large scale. He emphasized that the use of mobile phones (m-health) seems to be more cost effective and affordable in the context of Nepal. Similarly it is also easy to use and common among the general population. So the government should initiate such technology which is easy to afford and sustain without depending on any other donor agencies and private organizations.

Strengthen Organizational Capacity (Infrastructure and Human Resources):

For the sustainability of the program, organizational capacity is important. In the context of Nepal, the existing infrastructural capacity and trained human resources are most important to successfully implement and sustain the rural-telemedicine program. Focal Person for the rural-telemedicine program also stressed the importance of infrastructure and trained human resources. He told that,

"Appropriate infrastructure, relevant technology and trained human resources are the most focused part of telemedicine for making it successful"

So the government should focus on the technology that is affordable and relevant in the context of Nepal. It is also necessary to produce the trained human resources by providing knowledge and skill on the Information Technology and also on the rural-telemedicine program activities. Similarly they should also be motivated to use their acquired knowledge and skill to implement the program and make it successful and effective in the rural communities.

In the context of Nepal, governments' single effort is not only sufficient for strengthening the organizational capacity. So the necessary technical or financial supports also need to be received from the private organizations as well as from the external donors. Wright (1998) discuss that the developing countries has huge technological gap between rural and urban areas. For reducing such gap, government alone cannot handle these issues so it should be addressed together with the involvement of private sector, external development partners and government. Hence, for improving the status of rural-telemedicine services and minimizing the technological gap it is urgent for the government to initiate the networking and partnership with the related private organizations and international donor agencies that can provide both technical as well as financial support.

Chief of Monitoring and Evaluation unit at Ministry of Health and Population (MoHP) also supported on the need of initiating partnership with International and National Non-Governmental Organizations (I/NGOs) and private organizations to extend the services. Similarly the Telemedicine Officer at the Central Coordination desk told that the rural-telemedicine services also need to be expanded to the grass-root level so that it will help to address real health need of the rural communities. So for extending the program in the grass-root level the government must have stronger organizational capacity with sufficient resources and fund.

Create Supportive Environment:

The use of the Information Infrastructure is affected by the various involved human and non-human as well as technical and non-technical actors (Hanseth, 2002). Similarly the rural-telemedicine program is also supported by the various technical as well as non-technical elements. These different elements should create supportive environment so that the program can be implemented effectively. As discussed by the Hanseth and Monteiro (1998) that due to the *'open'* character of Information Infrastructure, it is interacting with the external environment. Similarly it has to include the new technologies and also adjust with the organization changes. It is similar in-case of rural-telemedicine program, i.e. for making the

service better it needs support from various stakeholders who are involved in the program. Similarly the used infrastructure and technology should also support the program activities.

Pradhan (2002) has discussed that the implementation of the Information Technology also increases the problem associated with it. The problems are associated with lack of appropriate infrastructure and technology, unqualified professionals, absence of economic incentives and lack of explicit IT policy (Pradhan, 2002). It is clear that these mentioned problems arise mainly due to the lack of supportive environment from the government and other related stakeholders. Hence, for implementing the program in better way and making it sustainable the supporting environments plays important role. Pradhan (2002) has discussed about the role of government in creating such supportive environment. The government can also create supportive environment to implement the rural-telemedicine services by improving the infrastructure and technology, making the involved health personnel trained and qualified, improving the status of fund and designing and implementing the appropriate policy and strategy.

Similarly the study findings also supports that the government need to address various existing problems that has affected the implementation of rural-telemedicine services. Such problems are related with the irregular supply of electricity, lack of basic infrastructures to support the existing technology, illiteracy among the patients and lack of sufficient and trained health personnel. To minimize the problem related with the human resources, the government should also have control on unplanned and frequent transfer of staff from one health center to another.

Similarly the administrative authorities working under Ministry of Health and Population should be allowed to work independently and in systematic way so that they can make fair decisions in transferring and deputing the health personnel as they are needed. They should not be politically pressurized to make a forceful and unplanned transfer of health personnel. However in the present context, it seems that the transfer of the health personnel is biased and done under political pressure. Such activities discourage the health workers to sincerely work

in the remote areas. The Chief of Planning and Evaluation Unit at Ministry of Health and Population (MoHP) also emphasize that the government should strictly discourage on the frequent and un-planned transfer of staffs.

6.2.2 Social, Political and Cultural Challenges:

Aanestad and Hanseth (2000) have discussed that once the technology grow and diffuses; the perception may differ in term of usability and nature of its use. Therefore, the technology and users are changing continuously and aligned with each other in a network by the process of reinterpretation and translation (Aanestad & Hanseth, 2000). In such network the technology and user have to align together to make the network functioning. The alignment process between the technology and users is affected by the social, cultural and political issues. Pradhan (2002) has cited (Mitroff & Linstones, 1993) and discuss that the acquisition of Information Technology is influenced by the complex and dynamic interaction of social, political, economic, cultural and organizational as well as technological factors (Pradhan, 2002).

Obstfelder, Engeseth, and Wynn (2007) have showed that, while implementing the telemedicine applications the design and its performance should be socially acceptable. Hence it is important to consider the status of society, their need and demand and also understand the relationship between technical and social aspects to successfully implement the telemedicine application (Obstfelder, Engeseth, & Wynn, 2007). Similarly Pradhan (2002) has cited (Madon, 1997), where it is mentioned that the lack of sufficient trained personnel in the field of Information Technology is one of the social problems seen in developing countries (Pradhan, 2002). Study finding shows that, rural-telemedicine program also have problem with the trained health personnel to work under the program and support the rural-telemedicine activities in the remote areas. Focal Person of the program also emphasized on the need of having trained and motivated health personnel to support the ongoing rural-telemedicine program activities. Similarly, District Health Officer (DHO) at Darchula also supported the fact and told that, *"The rural-telemedicine team at the district hospital is not sufficient, so the government should train more health workers."*

So these different scenarios shows that lack of sufficient and trained human resources is also one of the social problem that is affecting the implementation of the rural-telemedicine program.

Political system and politics of the country is important for the development of the Information Infrastructure. Especially the political status of the country affects the policy design process. Hence, for effectively implementing the Information Infrastructure it is necessary to have supportive policy. Pradhan (2002) discuss that, if the peoples involved in the policy making are from non-technical background, then the designed policy is unfriendly. In Nepal due to the unstable political situation and frequent change of government the policy related with the health care delivery system is not well implemented. When the government changes they try to focus on their own priority issues and give less priority to the ongoing activities that were implemented by the previous government. In case of rural-telemedicine program it seems that the government has initiated the program in large scale without proper plans and estimation of resources. In-addition to that due to the unstable political condition and weak policy, the government is not able to strongly enforce the health personnel to work in the rural district hospitals and make them involved in the rural-telemedicine activities. Similarly those health personnel who are working in such areas are also frequently transferred from one place to another in an unplanned way. So there is always scarcity of trained health personnel in the rural district hospitals and also in the rural-telemedicine program. Hence, the unplanned transfer of staffs and biased political decisions taken by the higher authorities hold-back the development of the rural-telemedicine program and also discourage the personnel working under program.

Similarly due to the unstable politics and frequent change of government, it also affects the managerial aspect of rural-telemedicine program. During the change of government, the higher officials working at the central level are also transferred from one place to another and the governments usually bring-up those staffs at the central level who works in favor of that particular government's priority. So during such transition period the priority of program are

not considered by the officials at the central level, which ultimately affect the status of program as well as discourage the health personnel who are involved in the program. Hence, proper implementation and development of rural-telemedicine program also depend upon the stability of the politics and the priority of the government.

In the developing countries cultural issues have also profound effect in the implementation of Information Technology. Pradhan (2002) discuss that, the technology must be accepted by the receiving society to make it effective. This aspect is also supported by the concept of *'installed base'* which is discussed by the Hanseth (2002), as one of the important character of Information Infrastructure. The concept of *'install base'* is also related with the acceptance of new technology. Edworthy (2001) discuss that, it is necessary to analyze the technological and cultural readiness of the country before implementing the telemedicine program. Similarly Pradhan (2002) has discussed that in the developing countries the Information Technologies are directly adopted from other developed countries. In such case the adopted technology may not meet the local need of the peoples. Similarly in case of rural-telemedicine program, the applications that are used by the program must be friendly with the local technology and it should be culturally acceptable. Otherwise the available technology will be unfamiliar among the users and they will not be able to use it properly. So it is important to consider the cultural need and their readiness to accept the new technology before implementing the telemedicine program. In-case of rural-telemedicine program it also need to be adjusted with the context of local culture and according to their need. Similarly Pradhan (2002) has also further focused that Nepalese social practices, cultural values and attitude are different than the western countries, so it is also important to consider these various factors while implementing the Information Technology.

Pradhan (2002) has cited the (Bista, 1994), where it is discussed about culture within a bureaucracy, i.e. it has a hierarchical structure with top-down authority where the seniors authorities just delegate and supervise and even avoid their responsibility, whereas the junior staffs has to implement it as they are told (Pradhan, 2002). So such scenario can also be related with the implementation of rural-telemedicine program. The study finding shows that

there was controversy between the views of the authorities who were involved at the central level and the team who were using the rural-telemedicine service at the district hospitals. Central authorities expressed that the program is well managed from the central level, where as the related problems are more created at the district level. However the district team blamed the central authorities for designing the weak policy and for their unplanned management. District team complains that the authorities at the central level are not serious about the program activities. They expressed that sometimes it takes several weeks to make a minor decisions and to sort-out the problems related with the program at the district level.

Similarly while using the rural-telemedicine services; it was found that sometime the specialist doctors were not regularly providing their time to the program due to which the patients at the district hospital were not able to get timely consultation. In the district hospitals also the doctors were not willing to contribute their time and work with the rural-telemedicine services, so it was seen that the most of the rural-telemedicine related activities were found to be done by the paramedics or the nurses. So such situation may affect the quality of services provided by rural-telemedicine program and it also increases the burden of work for other paramedics and nurses who are forcefully involved. Hence it is important for the concern authorities to realize this work-culture and improve the scenario so that it will support to improve the status of the program.

6.2.3 Satisfaction among the Planners, Implementers and Users and their Attitude:

Rural-telemedicine program is newly implemented in the health care delivery system of Nepal. From the discussions made with the various stakeholders it was realized that the planners and implementers of the program were still not fully convinced on the scope and importance of the rural-telemedicine program in the healthcare delivery system. Hanseth (2002) discuss the concept of *'Install base'* as one of the character of Information Infrastructure, which also focus on the acceptance of the new technology. The concept support that the new technology is only accepted if it is designed based on the existing technology so that it will be integrated and interoperable with the existing one. The rural-

telemedicine program seems to be implemented in an ad-hoc way without proper planning and estimation of the available infrastructure and technology at the district hospital, which can be reflected by the existing situation of the program. Similarly in the rural districts there is a need of trained health personnel and sufficient infrastructure and technology to implement the rural-telemedicine services. The health personnel who were involved in the program told that various areas need to be improved for better implementing the rural-telemedicine program. So the government should timely take such initiatives to improve the program and make it user friendly.

To make the program successful the implementers at the rural-district hospitals (i.e. medical doctors and other health personnel) also have the important role. They should be satisfied with their work and working environment to support the program activities. The concept of *'Interessment'* provided by Actor-Network Theory focus on how the various actors in the network are convinced with the concept of the primary actor and then work together to achieve it. As discussed by the Callon (1986) that during the process of interessment the actors in the network are convinced to accept the definition provided by the primary actors. Similarly in case of rural-telemedicine program, health workers will only be convinced to work sincerely under rural-telemedicine program if it supports to reduce their work pressure, save time, gives them better income and support them to provide better health care services. So it is important for the policy designers and managers to consider this aspect to make the health personnel actively involved in the program.

Similarly the concept on *'mobilization of allies'* by Callon (1986), supports that the network become successful when different actors involved in the network fulfill their assigned roles and responsibilities. It is similar that the planners, managers, implementers and users (different actors) should properly fulfill their assigned role and responsibilities to make the rural-telemedicine successful and effective. However, from the study findings it seems that the personnel involved in the program were not fully motivated to work under rural-telemedicine program. Similarly, sometime they also try to escape from their responsibility due to the lack of supporting environment.

For the rural patients the program seems to be effective, since it provides opportunity to get specialist health care service from their local health facilities and ultimately support them to save their time and money. Similarly the rural-telemedicine service has also supported the patients to get the right information on the referral services and also about the right person that they should visit for getting referral treatment. So the government should give special emphasis to grow and develop the existing rural-telemedicine program by implementing the appropriate and user-friendly technology so that it will be affordable and sustainable in the rural communities of Nepal. It is also necessary for the government to allocate sufficient fund and resources to maintain and sustain the existing program activities. Similarly the government should also give more emphasis on extending the existing rural-telemedicine services to the peripheral level health facilities (i.e. sub-health post, health post and primary health care centers) and up to grass root level, so that it will be able address the health need of the rural communities who are still deprived from the basic health care services.

Chapter Seven

Conclusion

Telemedicine is an innovative solution for the developing counties (Eccles, 2011) and it has remained as an integral part of health care delivery system. It plays important role in the delivery of the health services by providing technical as well as administrative support. Similarly, the telemedicine services also supports to improve the quality and efficiency of the healthcare service by connecting the rural health facilities with the tertiary level hospitals (Wright, 1998). It also supports in providing tele-education, training, and also reduces the cost of the healthcare service (Wright, 1998).

In the present context health care is becoming more specialized and centralized, so by the use of the various telemedicine applications it supports to decentralize the health services and makes it easily accessible for the service users. Similarly it also supports the health personnel to interact with the patients at the distance and provide the health care services as required by the patient.

Government of Nepal has also initiated the rural-telemedicine program in thirty different rural district hospitals. The main purpose of implementing this program is to provide the specialist health care service and improve the accessibility of health care services to the peoples living in the rural and remote areas.

The existing rural-telemedicine program is using video-conferencing, telephone based consultation ('hello-health'), and store and forward method (i.e. sending the necessary information through emails) to provide the telemedicine services. Study findings support that the telemedicine services has benefitted the peoples living in the remote areas. Similarly, it has supported the health care providers working at the rural district hospitals to get necessary technical support from the tertiary level hospitals. The program has also supported to increase the confidence and motivation of the health workers who are working in the rural areas. It is

due to the reason that they get necessary medical support from the tertiary level hospital so it is easy for them to handle the complicated cases as well as they also don't feel the professional isolation. However, the study findings also support that due to the various constrains and challenges, the rural-telemedicine services are interrupted time to time. So in such condition it is difficult to get the necessary support from the tertiary level hospital and also to provide the specialist healthcare service to the community peoples.

Past studies and literature support that it is better to implement the telemedicine program in a small scale in the initial stage and then gradually expand it based on the experiences and its outcome. However, in case of rural-telemedicine program it seems that the government has implemented the program in quite a large scale without proper planning, estimating the existing situation of infrastructure and technology at the district hospital and allocation of sufficient resources. The study finding shows that the rural district hospital does not have sufficient infrastructure and resources to support the program activities. Similarly, the government also does not have sufficient fund to upgrade and maintain the existing infrastructure and technology. In-addition to that it has been also challenge for the government to manage the trained health personnel to implement the rural-telemedicine services at the rural district hospitals. In present scenario although the government has already installed the infrastructure and equipments for implementing the rural-telemedicine program in rural district hospitals but due to the lack of trained human resource the program is still not functioning properly. During the discussion the involved respondents told that in most of the rural districts hospitals the program is not conducted regularly due to the scarcity of trained human resources. Similarly they also mentioned that the rural-telemedicine services are interrupted and not implemented properly due to the various other problems such as lack of regular electricity supply, low bandwidth internet and problem in the timely maintenance of the equipment and software that often creates problem in the rural district hospitals.

In Nepal, about eighty-three percentage of the total population are still living in rural areas. Due to the difficult geographical structure and lack of proper roadways and transportation system many rural communities does not have easy accessibility with the essential health care

services. In such scenario, it is important to promote and expand the rural-telemedicine program. It is important to develop the existing infrastructure and technology at rural district hospitals to provide effective rural-telemedicine services. Government needs to redesign the existing policy and make it more effective by including the specific strategies and implementation plans. It is also important for the government to give more priority to promote the user-friendly technology so that everyone can easily use it. Similarly it will also be able to adjust with the local technology and surrounding environment. It is also necessary that the infrastructure and technology used by the rural-telemedicine program should adjust the cultural values and meet the social needs. In addition to that the rural-telemedicine program should also be expanded to the peripheral health facilities (PHCCs, HPs and SHPs) and to the grass root level, so that it will be able to address the health need of the rural communities who are really in-need of basic health care services.

Similarly, the government should also focus on managing the necessary resources and sufficient fund so that the program can be sustained and implemented easily. For strengthening and promoting the program activities and ensuring the sustainability government should also initiate networking and partnering with private organizations (especially private hospitals and IT companies) and also with the related International and National Non-Governmental Organizations (INGOs and NGOs).

To improve the status of the rural-telemedicine program, government should regularly conduct the monitoring and supervision of the program. Such activities support to find out the limitations of the program so that the related issues can be timely addressed. Similarly, it also provides information on the areas that need to be improved. Hence the regular monitoring and supervision support to gradually develop the program and implement the rural-telemedicine services in better way. In addition to that government should also focus on conducting regular research activities based on the program, which supports to analyze the effectiveness of the program and provide information on the areas that need to be strengthen and improved.

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Annex

Questionnaires:

1. When was the rural-telemedicine service started by the government in Nepal? (Date of start)(Central team)
2. How has the government defined the rural telemedicine service? (Is it just interaction between two health personnel in telephone, mobile phone, through internet or videoconference or it also includes more?)(Central team)
3. Why rural telemedicine service is necessary in the context of Nepal? (Due to the pressure of the international market or due to the real need to expand service in rural communities to make the health service more accessible) (Central team)
4. How is rural telemedicine services conducted in Nepal? (In term of place, and its implementation modality and networking) (Central team)
5. Do you think that the technology used by the rural telemedicine service is appropriate in the context of Nepal? (Right technology) (Both)
6. What are the strategies taken by government for successfully implementing the rural telemedicine program in Nepal? (Central team)
7. What types of service are mainly focused by the rural telemedicine program? (Both)
8. Does the government have sufficient, trained and qualified human resources for implementing the rural telemedicine service? (Both)
9. Is it necessary to further extend the telemedicine service in Nepal? (Both)
10. Do you think that ongoing telemedicine service is effective in Nepal? (Both)
11. Which type of telemedicine service do you think will be most suitable in the context of Nepal? (Both)
12. Are you satisfied with the ongoing telemedicine services in Nepal? (Both)
13. What can be further done to better implement the ongoing telemedicine services? (Both)
14. How is the attitude of the telemedicine service users? (At district level)

15. What types of human resource (Doctor, Nurse, Paramedical person) are mainly involved in implementation of rural telemedicine services. (Both)

16. Are the rural-telemedicine services implemented based on any protocol? (District level)

17. Are the services used at the district reliable and easy to use? (District level)

18. How is the user volume (how many users)? (District level)

19. (Frequency of use) How often do you use the rural-telemedicine services ? (District level)

20. Are you satisfied with the existing skill of the rural telemedicine service users? (Both)

21. What problems are you presently facing in the overall implementation of the rural telemedicine activities? How it can be improved (Both)

Letter from University of Tromsø:

UNIVERSITETET I TROMSØ UiT

FACULTY OF HEALTH SCIENCES
DEPARTMENT OF CLINICAL MEDICINE

Your reference:
Our reference:
Date:

To whom it may concern

It is to confirm that Mr. Ramesh Bhatta is a Master student at University of Tromso (UiT). He is studying MSc in Telemedicine and e-health. As a part of his master's curriculum he is conducting his thesis entitled ***"Evaluation of ongoing Telemedicine program in Nepal"*** under my supervision and guidance.

In order to collect data for the master's thesis he needs to do interviews (autumn of 2012 and spring 2013) with administrators, policy-makers and health professionals in Nepal.

The data collection will not include interviewing patients and will not include asking professionals about patients. The data collection will focus on the Governmental policies and strategies related to the ongoing Telemedicine program in Nepal as well health professional viewpoints on using telemedicine technology.

I am therefore grateful if he is granted the support needed to facilitate his data collection

Sincerely

.....

Prof. Gunnar Ellingsen

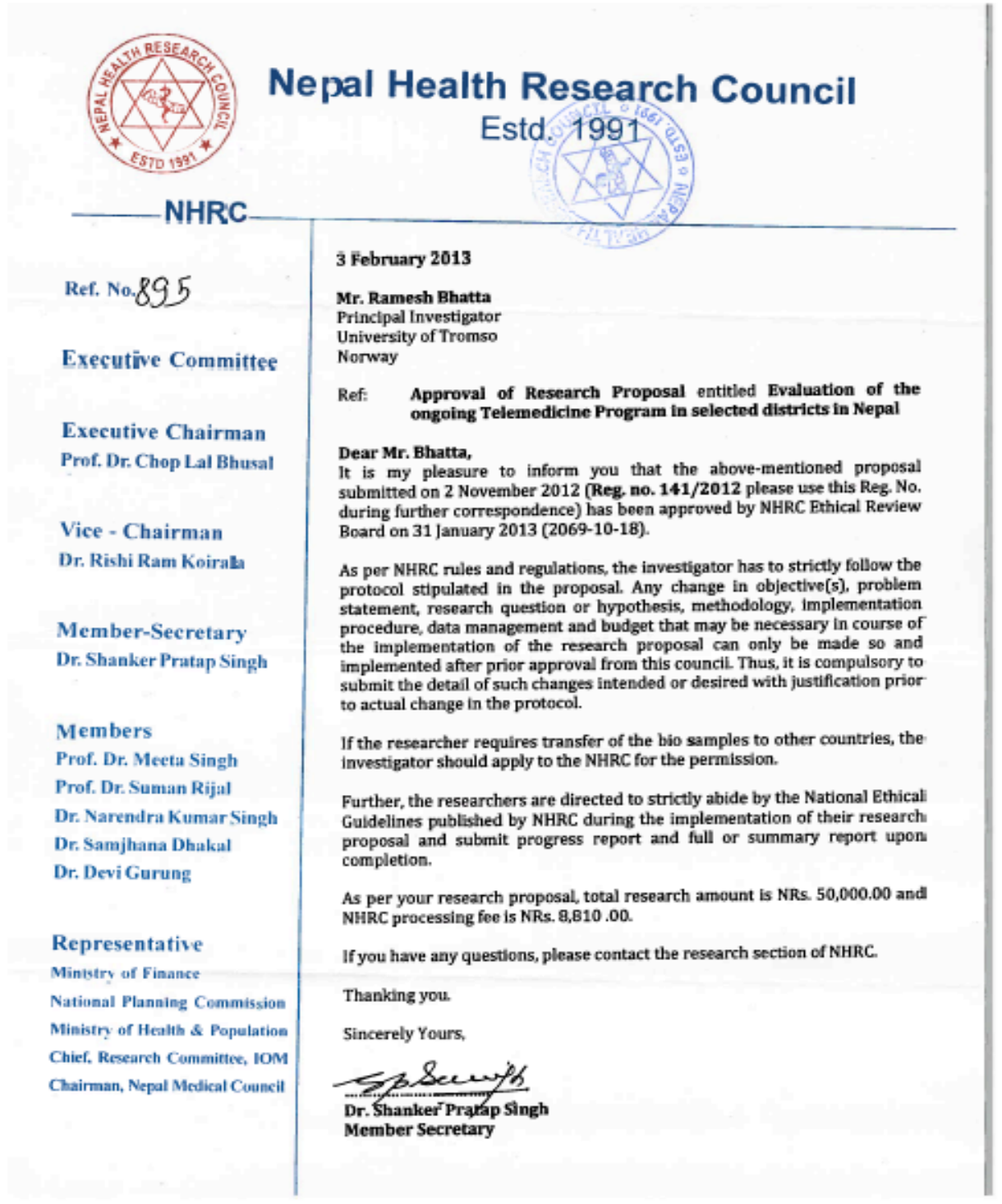
www.gunnarellingsen.net

Head of Department

Department of Telemedicine and e-health

University of Tromso, Norway

Ethical Approval Letter from Nepal Health Research Council (NHRC):



Nepal Health Research Council
Estd. 1991

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Chief, Research Committee, IOM
Chairman, Nepal Medical Council

3 February 2013

Mr. Ramesh Bhatta
Principal Investigator
University of Tromso
Norway

Ref: **Approval of Research Proposal** entitled **Evaluation of the ongoing Telemedicine Program in selected districts in Nepal**

Dear Mr. Bhatta,
It is my pleasure to inform you that the above-mentioned proposal submitted on 2 November 2012 (**Reg. no. 141/2012** please use this Reg. No. during further correspondence) has been approved by NHRC Ethical Review Board on 31 January 2013 (2069-10-18).

As per NHRC rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in objective(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol.

If the researcher requires transfer of the bio samples to other countries, the investigator should apply to the NHRC for the permission.

Further, the researchers are directed to strictly abide by the National Ethical Guidelines published by NHRC during the implementation of their research proposal and submit progress report and full or summary report upon completion.

As per your research proposal, total research amount is NRs. 50,000.00 and NHRC processing fee is NRs. 8,810 .00.

If you have any questions, please contact the research section of NHRC.

Thanking you.

Sincerely Yours,

Dr. Shanker Pratap Singh
Member Secretary

Letter from Department of Health Service (DoHS):

नेपाल सरकार
स्वास्थ्य तथा जनसंख्या मन्त्रालय
स्वास्थ्य सेवा विभाग
(कर्मचारी प्रशासन शाखा)

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फ्याक्स नं– ५२६२२३८
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पाटनढोका, टेकु, काठमाडौं, नेपाल

पत्र संख्या– ०६९/७०
चलानी नं– १६४०

मिति: २०६९।०९।१२

विषय: आवश्यक सहयोग सम्बन्धमा ।

श्री जिल्ला जन/स्वास्थ्य कार्यालय,
ललितपुर/सिन्धुपाल्चोक/धादिङ ।

प्रस्तुत विषयमा University of Tromso, Norway का विद्यार्थी श्री रमेश भट्टलाई Master Degree in Telemedicine and e-Health मा Thesis लेखनको लागि त्यहाँबाट आवश्यक जानकारी तथा सहयोग गरिदिनु हुन यस मिति २०६९।०९।११ को निर्णयानुसार अनुरोध छ ।

(रेवती रमण शर्मा)
शाखा अधिकृत

"जनमुखी प्रशासनः अनुशासन र सुशासन"