Telemedicine Services in Oncology

A dissertation submitted in partial fulfillment of the requirements for the award of

Post Graduate Diploma in Health and Hospital Management

by

Dr. Nitasha Goel

International Institute of Health Management Research

New Delhi

May, 2011

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May, 2013

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To Whomsoever It May Concern

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Project Details:

Project Name: How to set up Telemedicine in India
Duration: 12 Weeks
Location: Bangalore
Guide Name: Avishikta Sarkar
Sponsor Name: Vivek Vig

She has successfully completed His/her project and his/her performance during the tenure of the internship has been found to be satisfactory.

Her findings in course of the project has been found to be practical and relevant and some the recommendations will be incorporated on the floor on approval from the business.

We wish her good luck for her future assignments.

Thanking You,

Regards,

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Certificate of Internship Completion

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Dr. Nitasha Goel** has successfully completed her 3 months internship in our organization from January 14, 2013 to April 14, 2013. During this tenure, the intern has worked on **"Telemedicine services in Oncology"** under the guidance of me and my team at Dell International Services Whitefield, Bangalore.

We wish her good luck for her future assignments.

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Certificate of Approval

The following dissertation titled **"Telemedicine services in Oncology"** is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **Post- Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation

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Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Nitasha Goel,** a graduate student of the **Post- Graduate Diploma in Health and Hospital Management**, has worked under our guidance and supervision. She is submitting this dissertation titled **"Telemedicine services in Oncology"** in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management**.

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

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Thank you

Dr. Nitasha Goel
PGDHHM

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ABBREVIATIONS

HCP	Health Care Professional
NCRP	National Cancer Registry Program
DIT	Department of Information Technology
MCIT	Ministry of Communications and Information Technology
IT	Information Technology
TSC	Telemedicine Speciality Centre
PTC	Primary Telemedicine Centre
STC	Secondary Telemedicine Centre
TTC	Tertiary Telemedicine Centre
GHz	Gega Hertz
RAM	Random Access Memory
HDD	Hard disk drive
MB	Mega Bytes
OS	Operating System
ROM	Read Only Memory
DMP	Dot Matrix Printer
CD	Compact Disk
KBPS	Kilobits per second
PSTN	Public Switched Telephone Network
ISDN	Integrated Switching Data Network
IP	Internet Protocol
VSAT	Very Small Aperture Terminal
UPS	Un-interrupted Power supply
ECG	Electrocardiogram
MRI	Magnetic Resonance Imaging
HR	Heart Rate
CAT	Computed Axial Tomography
TMT	Treadmill test

CDA	Clinical Document Architecture
DICOM	Digital Communication in Medicine
ADT	Admission Discharge Transfer
HL-7	Health Level-7
MPEG	Moving Picture Expert Group
WAV	Waveform Audio File Format
BMP	Bitmap Image File
JPEG	Joint Photographic Experts Group
ASCII	American Standard Code for Information Interchange
HTML	Hypertext Mark Language
SQL	Structured Query Language
PC	Personal Computer
LCD	Liquid Crystal Display
PDA	Personal Digital Assistant
ISRO	Indian Space Research Organization
INSAT	Indian Space
PPP	Public Private Partnership
RCC	Regional Cancer Centre
PAL	Phase Alternating Line
NTSC	National Television Standard Committee
FPS	Feet Per Second
TFT	Thin-film-transistor
USB	Universal Serial Bus
KVA	Kilo Volt Ampere
EMR	Electronic Medical Record
MBPS	Megabits per second
CCD	Charged Couple Device
A/D	Anolog to Digital Converter
SCSI	Small Computer System Interface

LAN	Local Area Network
BP	Blood Pressure
POTS	Plain Old Telephone Service
CDMA	Code Division Multiple Access
GSM	Global System for Mobile Communications
BSNL	Bharat Sanchar Nigam Limited
BPD	Biparietal Diameter
MHz	Mega Hertz
DPI	Dots per inch
kHz	Kilo Hertz
VGA	Video Graphics Array
SVGA	Super Video Graphics Array

Part I

Internship Report

1.1 Organization Profile

Dell International Services is the support and services division of Dell Inc., the large American computer hardware company, with operations in India (Bangalore, Hyderabad, Chandigarh), Europe (Bratislava, Dalian), Latin America (Panama City, Brazil, San Salvador), Africa (Morocco), Canada (Edmonton) and the Philippines, (Quezon City).

1.2 Area of Engagement

- **Dell Global Analytics** - Dell Global Analytics (DGA) is a captive analytics division supporting multiple functions such as Pricing, Web Analytics, Supply Chain, Marketing, Quality, Services, Financial Services and Contact Center Analytics. It is a single, centralized entity with a global view of Dell's business activities spanning Dell's business units of Consumer, Large Enterprise, Public and Small & Medium Business. DGA supports all the three geographies: Americas, EMEA (Europe, Middle East, Africa) and APJ (Asia Pacific), supporting over 500 internal customers.
- **Customer Care**
- **Hardware Warranty Support** for Consumers (USA, UK and Ireland), XPS (UK, Ireland and South Africa), SMB, ANZ, Enterprise Server and client desktops and portables support for UK and Ireland
- **Dell Financial Services**
- **Small and Medium Business Chat Support**
- **Email Support**
- **Spanish-speaking Support'**
- **Dell on Call'** *(Now Known as Solution Station)*
- **Solution Station (Now known as Dell Tech Concierge - DTC)**

1.3 Managerial Tasks

Management is required for every small, big, developing organization who wants to be successful. Even the smallest tasks require a managerial skill to handle it otherwise all the pain may go to vain if not managed properly.

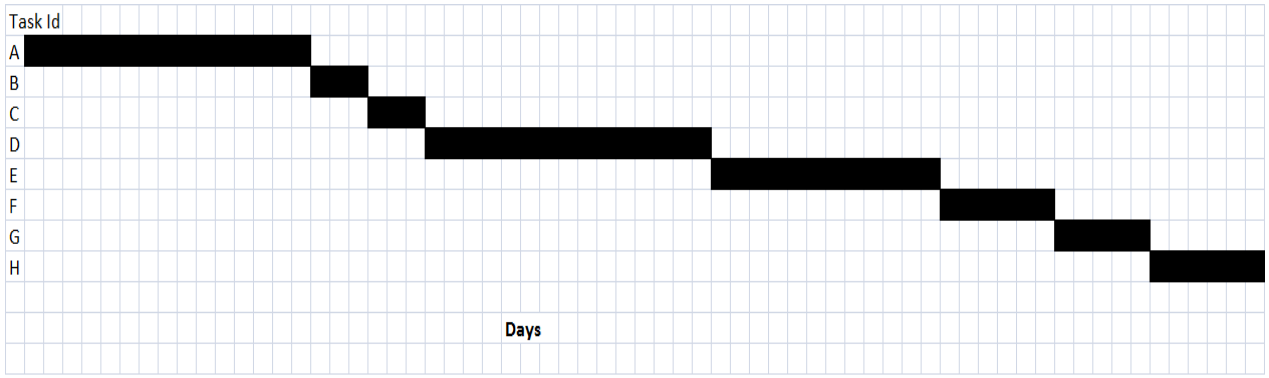
Some of the tasks that were performed are as follows:

- Management for work allocation
- Work related to Cerner
- Validating scripts of various modules of Cerner
- Delivering and Attending various Presentation
- Doing Cross Training for various activities of Cerner
- Regularly updating various tools like Utilization Tracker

1.4 Reflective Learning

As an Intern at Dell International Services I have gained valuable knowledge in terms of functionality of application its management and analysis in real practical world. It helped me to develop the skills and knowledge which is must for everyone who wants to build his/her career as successful professional.

Gantt chart



Total 65 Days

Task Description
A- Training on Cerner & Meditech -15 Days
B-Level 1 Presentation-3
C-Project Layout Design-3
D- Data Collection-15
E-Documentation-12
F- Approval -6 Days
G-Making Presentation-5 Days
H-Final Presentation -6 Days

Figure: 1.4 Gantt chart

Task Id	Task Description	Duration
A	Training on Cerner & Meditech	15 Days
B	Level -1 Training	3 Days
C	Project Layout Design	3 Days
D	Data Collection	15 Days
E	Documentation	12 Days
F	Approval	6 Days

G	Making Presentation	5 Days
H	Final Presentation	6 Days

Table: 1.4 Task Description & Duration

Part II

Dissertation Report

on

Telemedicine Services in Oncology

1.0 Introduction

With the liberalization of health care and telecommunications policies spreading across every continent, we are witnessing an explosion of health information systems worldwide with concomitant benefits to health and human prosperity. Some believe that "high technology" has less importance amidst overwhelming poverty and barriers to implementation in the lesser developed countries. Yet, innovative, and in some circumstances relatively inexpensive, implementations of intelligent networks are lengthening life, lowering the burden of illness, and improving quality of life and functional life capacity in the developing countries.[3]

Telemedicine holds the promise to bridge the gap for access to timely, quality and specialty medical care. This technology enables communication in terms of medical information, images and health information data between patient and Healthcare provider with convenience and fidelity from one place to another. It can do simple tasks like two health professionals discussing medical problems of a patient and seeking advice over a telephone, as well as complex tasks like real time transmission of clinical information across distance. [1]

Need for Telemedicine

Telemedicine is emerging as a critical component of the healthcare crisis solution. It has the potential to significantly impact some of the most challenging problems of our current healthcare system: access to care, cost effective delivery, distribution of limited providers

and high waiting time. It can change the current paradigm of care and allow for improved access and health outcomes in cost effective ways. [2]

Telemedicine in Oncology

Cancer is a substantial public health issue for all population groups. Certain subgroups, however, including individuals living in rural communities, have more risk factors for cancer than others, due to poor health hygiene. Early screening and detection of the disease is an important aspect of Cancer preventive measures. But in rural areas, the unavailability of

specialist care providers leads to increase in undiagnosed cases of cancer. Therefore, the ability to readily access specialty healthcare can significantly impact treatment outcomes of people living with cancer. **Tele-oncology** employs such technologies to connect patients with cancer at a distant site with an oncologist at a Specialist site. The use of telemedicine technology to care for oncology patients eliminates the need for patients to leave their communities to receive much-needed specialty healthcare in a timely manner. It also helps in preventing the spread of the disease by timely screening and patient education. [4]

Advanced technologies enable the remote provision of health care services at locations most convenient for the patient and minimize travel for patients and family members.
Telemedicine can lead to improvements quality and efficiency of continuity of care. The drivers for Telemedicine are:

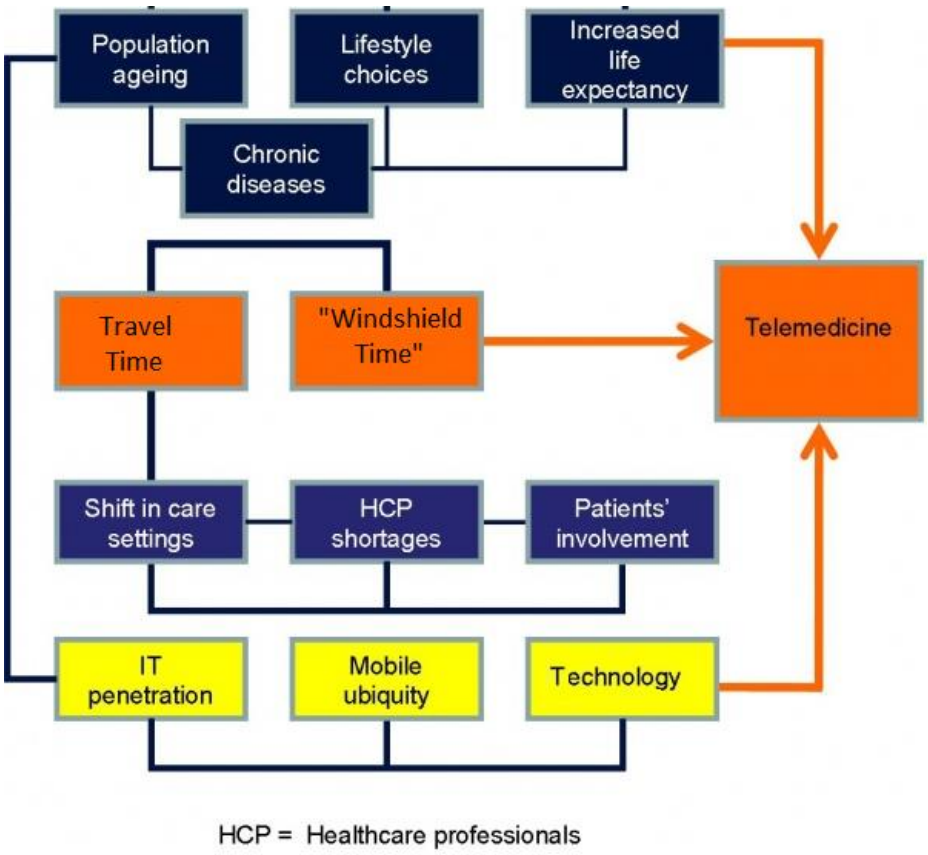


Figure 1.0: Drivers of Telemedicine

2.0 Project Scope

Deploying Telemedicine technology has the potential to improve the efficiency of healthcare delivery- enabling improved access to healthcare across all distance. In this study the factor and the components for setting up Telemedicine will be discussed.

This project will address topics related to how telemedicine system is established and operated, and what are the factors and the components for setting up Telemedicine. The scope is to provide information regarding:

- Care Model
- Connectivity Model
- Determinants to set up Telemedicine
- Telemedicine System functioning

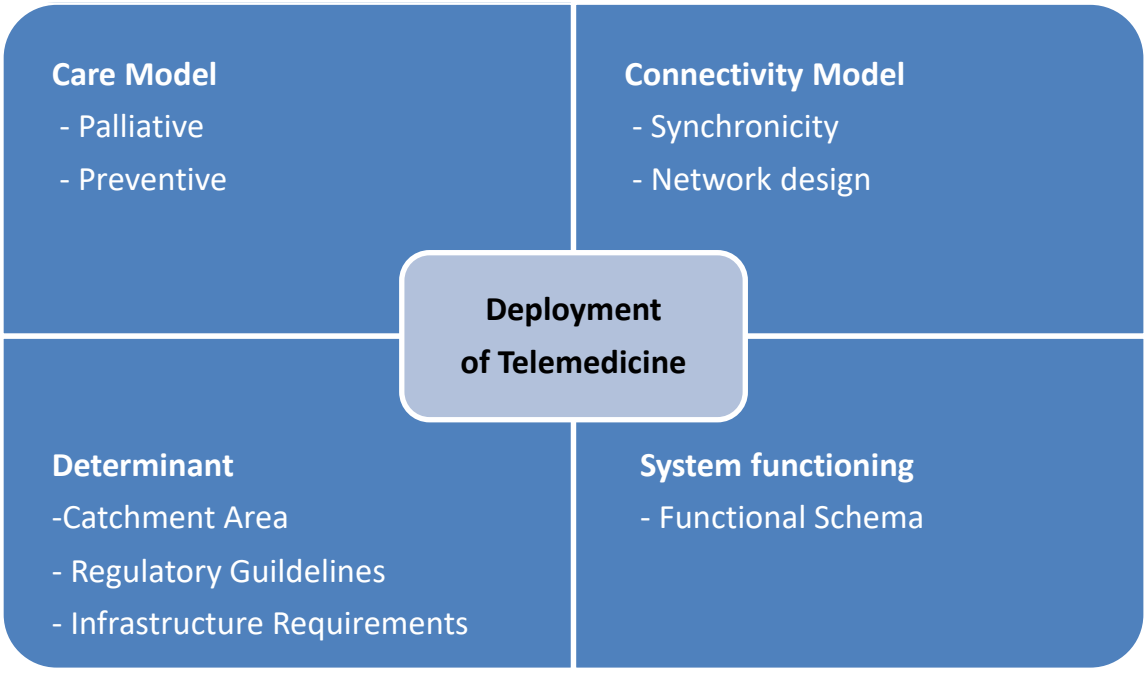


Figure: 2.0 Deployment of Telemedicine

2.1 Care Model

2.1.1 Palliative Care

2.1.1.1 Tele- Consultation: - provides care to patients or advice to other medical providers in a particular medical subspecialty or healthcare specialization.

Tele-Consult will include:

- Screening for disease prevention
- Diagnosis and Treatment Plan
- Second opinion

2.1.1.2 Tele- Radiology: - Radiographic images transmitted electronically to remote sites for evidence based diagnosis.

2.1.1.3 Tele- Pathology: - Tele-pathology will help in electronic transmission of pathological images using information and communication technology.

- Microscope with cameras are used to captures images and transmitted to pathologist for interpretation.
- Tele-pathology caters to various aspects of pathology such as biopsies, surgical specimens, intra-operative frozen section, and cytology.

2.1.1.4 Tele-radiation - The field of radiation oncology is a discipline of cancer care that relies heavily on image review and the use of advanced technology for the development and implementation of appropriate treatment plans. It incorporates aspects of both oncology and radiology. Telemedicine is utilized the three main purposes: teleconferencing, quality assurance, and remote treatment planning [5]

2.1.2 Preventive Care

2.1.2.1 Tele- Education:- Tele-Education will be used for the process of distance education (regulated or unregulated), based on the use of information and telecommunication technologies, that make interactive, flexible and accessible learning possible for any potential recipient related to oncology.[5]

2.2 Connectivity Model

2.2.1 Synchronicity

It is used here to incorporate both timing and technology. With regard to timing, telemedicine may be either

2.2.1.1 Synchronous :-(i.e., in real time), referring to the concurrent presence of interacting participants located at different places.[5]

2.2.1.2 Asynchronous: - (store-and-forward), in which the participants do not interact in real time.[5]

2.2.2 Network Design

2.2.2.1 Point to Point: - These types of connections are to be transmitting solely to the station at the opposite end. Because there is only one device at either end of the connection, no addresses are necessary. [5]

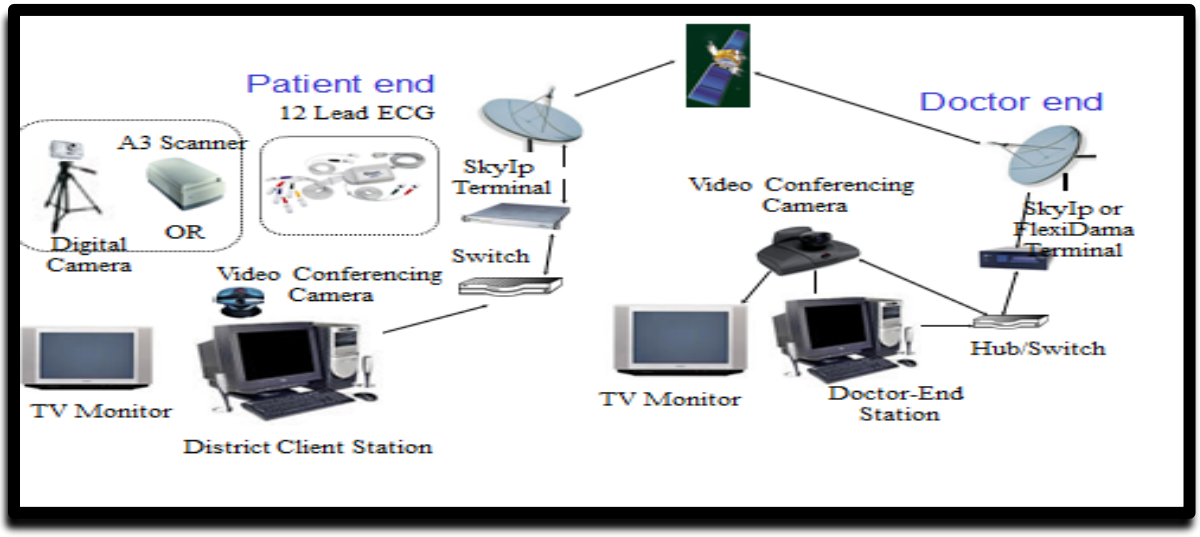


Figure 2.2.1: Point to Point

2.2.2.2 Point to Multipoint: - It connects one station to several other stations. In non-broadcast systems, only specific selected stations hear the communication and in broadcast multipoint protocols are characterized by a physical medium that connects to all machines and where all communication is heard by all stations. [5]

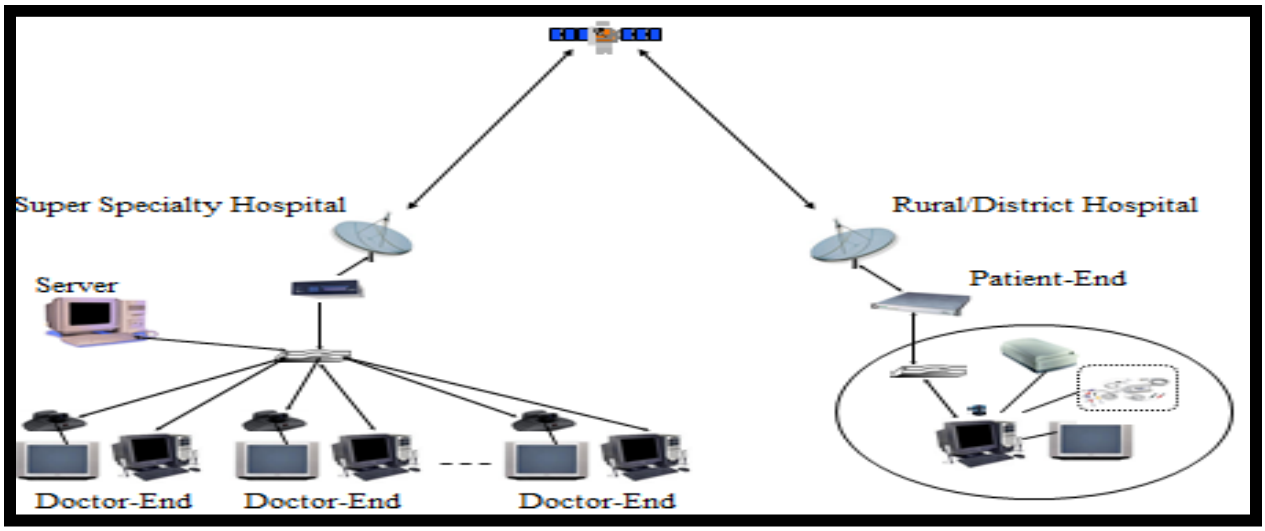


Figure 2.2.2: Point to Multipoint Connectivity

2.2.1Feasibility Study for Telemedicine in India

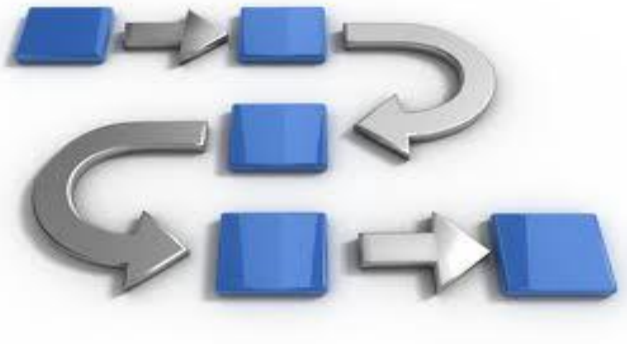
Current Telemedicine market is at nascent stage in India. But it has tremendous potential to increase in coming years. More over due to many government initiatives in this field it is considered to increase many folds in coming years. Currently Public Private Partnership (PPP) i.e. government and private players coming together is considered best business model for Telemedicine. In which GOI providing infrastructure requirements and Healthcare human resource can be provided by private sector.

SWOT ANALYSIS FOR TELEMEDICINE IN INDIA	
STRENGTH • Favourable Demographics • Government participation & funding • Lack of Skilled Physicians and Specialists in rural & remote areas • Lack of Infrastructure in terms of Hospitals and roads in rural and remote areas • Reducing the expenses of travel costs (for both patients and specialists), time and effort	**WEAKNESS** • Lack of Technology Awareness • Lack of skilled and Trained Manpower in Health-IT. • Connectivity Challenges especially in rural and remote areas • Acceptance by Physicians and by general people • High cost of telemedicine solutions including equipment, transportation, maintenance and training • Lack of adopting international standards for interoperability • No insurance coverage for Telemedicine services in India
OPPORTUNITIES • Coming up of 4G spectrum • Providing opportunities for professional development via eLearning • New carrier opportunities in Telemedicine • Use of social networks like (Facebook, twitter) for social awareness programs • Using Cloud technology to launch Telemedicine applications as services • Most of Indian population living in rural & remote areas	**THREATS** • Lack of confidence

Table: 2.2.1 SWOT Analysis

2.2.2 Methodology

Data used in this Report is basically secondary in nature and collected from different journals and web links related to Telemedicine and recommended guidelines for Telemedicine given by government of India, Department of Information Technology.



2.3 Determinants for Telemedicine Set up

2.3.1 Catchment Area

To start any service the target population and area has to be defined. The purpose of defining catchment area is to reach out to the community for providing Oncology services.

2.3.1.1 Parameters: The parameters to define Catchment Area are:

- Demographics of the population living in that area their
- Age
- Socio-economic status
- Employment or vocational status and educational qualification
- High Prevalence of Cancer
- Availability of Care providers

2.3.1.2 Research Methodology: -. Research Methodology to determine the catchment area for Oncology Telemedicine can be primary or secondary.

- **Primary Methodology**
  - Hospital Morbidity & Mortality Records
  - Population based Surveys

- **Secondary Research Methodology**
  - Cancer Registry Programs.
  - E.g. National Cancer Registry Program (NCRP)
  - Hospital and Clinical Journals
  - Epidemiological Reports
  - Review of literature

2.3.2 Government Regulations and Standards for Telemedicine in India

To ensure "Health for All" standardization is needed in Telemedicine and there are certain guidelines and standards laid down. **Department of Information Technology (DIT)**, **Ministry of Communications and Information Technology (MCIT),** had taken initiative on the evolution and adaptation of standards of telemedicine under the aegis of the "**Committee for Standardization of digital information to facilitate implementation of telemedicine systems using information technology (IT) enabled services**". In order to set up a Telemedicine centre these guidelines and standards are mandatory.[6]

2.3.2.1 Telecommunication process guidelines :

The Department of Information technology (DIT) has illustrated guidelines for standardized practice of Telemedicine. These guidelines are categorized based on certain criteria. [6]

Patient Criteria: This indicative guidelines define the rights of a patient during remote consultation

- Ensuring quality of Consultation
- Confidentiality of Records

- **Telemedicine Nodal Center:** The indicative guidelines are defined to correctly use the technology, troubleshoot any technical and operational problem and Document problems and troubleshooting methodology.

- **Telemedicine Specialty Centre (TSC):** the Indicative guidelines are defined to ensure quality of Consultation. The documentation of the consultation has to be done by the specialist. Certain parameters need to be considered at Specialty Centre. These are:
  - The methods for documentation of patient record,
  - Monitoring for closure of each case and
  - Retrieving of old records

- **Informed Consent:** This guideline states that the medical practitioner must inform the patient regarding his rights to withdrawal of treatment, potential risks, consequences and benefits of telemedicine and confidentiality measures. Patient Consent is to be obtained on the letter head of the Telemedicine center.[6]

All the guidelines mentioned above are illustrated in details in the Annexure

2.3.2.2 Standards for Telemedicine:

The standards specification related to infrastructure, Medical devices, data exchange and connectivity are mentioned in the Table: 2.3.1

Specifications	Primary Telemedicine (PTC)	Secondary Telemedicine (STC)	Tertiary Telemedicine (TTC)
Hardware	1 GHz processor, 128 MB RAM, 40 Gb HDD, CD ROM, Multimedia DMP 132 column, CD writer as a recommended back up	Same as PTC with Ink jet printer in lieu of DMP 132 printer	Same as STC L1 and preferably Laser printer

Operating Systems	Any standard Operating system (OS)	Any standard Operating system (OS)	Any standard Operating system (OS)
Video Conferencing	Web camera based	Web camera based Zoom H.32x based 128 kbps	Web camera based Zoom H.32x based 384 kbps or better
Connectivity	PSTN	PSTN/ ISDN / VSAT	PSTN/ ISDN / VSAT/IP
Power Source	UPS 1Hr Backup	UPS 1Hr Backup	UPS 1Hr Backup
Medical Devices	Digital Camera, Document scanner A4 size for ECG paper strips	PTC L3 +200 MA X-Ray machine in lieu of portable, glucometer, Fetal HR Monitor.	PTC L3 +200 MA X-Ray machine in lieu of portable, glucometer, Fetal HR Monitor. CAT scan, TMT, Echo cardiography. MRI
Data Exchange Format	Applicable clauses of CDA and ADT of HL7, desirable for interoperability DICOM	Applicable clauses of CDA and ADT of HL7, desirable DICOM compliant with ability to accept non-DICOM images.	Applicable clauses of CDA and ADT of HL7, desirable DICOM compliant with ability to accept non-DICOM images
Audio Storage Format	MPEG/WAV (minimum requirement)	MPEG/WAV (minimum requirement)	MPEG/WAV (minimum requirement)
Still Image Storage Format	DICOM, JPEG2, bmp	DICOM, JPEG2, bmp	DICOM, JPEG2, bmp
Moving Image Format	DICOM	DICOM	DICOM

Text Storage Format	ASCI, HTML	HTML	HTML
Backend Database	ORACLE Microsoft SQL Server	ORACLE, Microsoft SQL Server	ORACLE Microsoft SQL Server

Table 2.3.1: Standards for Telemedicine

All standards in the above table is mentioned in detail in Annexure

2.3.2.3 Components of Telemedicine

The Telemedicine system comprises of the Hardware and software at the patient end and consultant end are connected with each other either through landline or satellite or internet. For smooth data transfer and patient care management it is important to have an appropriate infrastructure and space.[6]

Infrastructure can be broadly classified into –

- Hardware,
- Software
- Video Conferencing,
- Connectivity
- Storage,
- Power Backup,
- Mobile unit

2.3.2.3.1 Hardware

The hardware platform in telemedicine systems consists of **Personal Computers** and **Peripherals.** To determine the type of hardware to be used the following parameters must be considered:

- **Flexibility –** The hardware should be flexible in terms of up-gradation, memory expansion and addition of new peripherals.

- **Interfaces –** The number of interfaces supported in terms of adding new clinical device interface and communication interface
- **Portability** – The ease of transporting and handling of the device

2.3.2.3.2 Types of Computer:

- **Desktop** – The Desktop gives most flexibility in terms of adding new clinical device interface, communication interface, up-gradation in terms of memory expansion, addition of new peripherals. The configuration requirement for Desktop is mentioned in Table 2.1.[6]
- **Laptop** - Specifications of a laptop PC will be similar to the desktop PC. The number of interfaces available is similar as in a desktop.[6]
- **Palmtop**: This option is suitable for a portable telemedicine system (telemedicine system in a suitcase). This is a scaled down version of a laptop, with smaller LCD screen and keyboard. Here the types of interfaces available are comparatively limited.[6]
- **PDA** - It is a further scaled down version of hand held computer, and may be used for similar application, but with much less power and interfaces as compared with hand held computer[6]

Hardware	Interfaces	Portability
Desktop	More Interfaces	Less Portable
Laptop	Less Interfaces than Desktop	Portable
Palmtop	Less Interfaces than Laptop	Portable
PDA	Less interfaces than Palmtop	Portable

Table2.3.2 Comparison of Computers

2.3.2.3.3 Types of Peripherals:

The peripherals will include output device:

Peripheral Device	Factors to be considered
Printer and Scanner	• Printing quality and multi-functionality. • Less refills of Cartridge • Popular printers used are Inkjet and Laser
Microphone with Speakers	• Good sound quality and no disruption in voice output.
Web Camera	• Resolution of video • Clarity of video output
TFT Monitors	• Clarity of display • Less reflection

Table: 2.3.3 Factors for selecting Peripherals

2.3.2.3.4 Storage Devices

The data storage can be in form of

- Physical Storage
- Cloud Storage

Storage	Functionality	Factors
Physical Storage		
Servers/Data Centres	Servers or Data Centres can be used to store and retrieve textual data and images	• Capacity of data Storage
Cloud Storage	Storing Data off- site i.e. maintained by third party helps in storing and retrieving textual and digital data	• Flexibility • Convenience

Types of Storage Table: 2.3.4

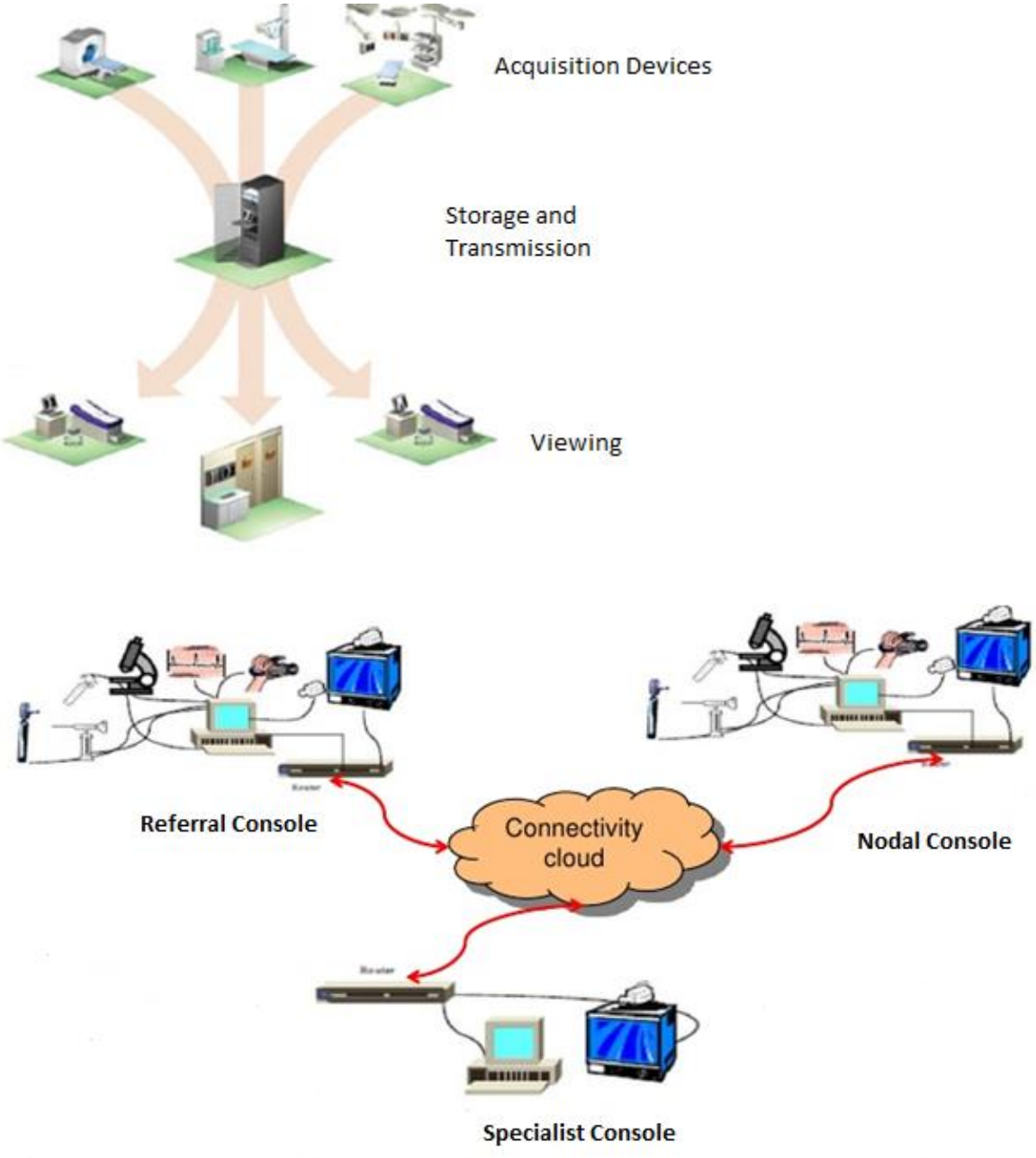


Figure: 2.3.4.1 Types of Storage

USB (Universal Serial Bus) are also very commonly used for storage purposes. With off-site storage solutions like virtualization, cloud are gaining acceptance, encryption of data will gain acceptance for storage security. Here, instead of accepting vendor encryption, it is better to locally encrypt data prior to transfer to the cloud, and then use the provider's encryption, if possible, as a second level of security.

2.3.2.3.5 Power Back up Devices

Power Back Up should be planned for uninterrupted service. Any room designed for telemedicine must have emergency backup power for services involving videoconferencing. The Power Back up Devices can be:

- UPS (Uninterrupted Power Supply) 1KVA.
- Generator [6]

2.3.2.3.6 Software

The telemedicine software should be capable of performing the following functions:

- Acquisition of Patient related information
- Storage of the patient information
- Display of patient information
- Transmission of the Patient information over a communication link
- Scheduling of doctor appointments [6]

Following additional functionalities, though not mandatory, are highly recommended in the software (to support multiple formats and facilitate interfacing capability). The specifics of these would be determined by the application under consideration and the equipment to be interfaced.[6]

- Capturing of images/document from a scanner
- Capturing of video/ other data from the output of the medical equipment and conversion to DICOM

- Conversion from DICOM to non-DICOM formats
- Recommended to be HL 7 compatible[6]

There are Customized Telemedicine Software with EMR interoperability as defined by DIT, Govt. of India and integration of Medical Diagnostic Systems like Tele-pathology, radiology, ECG etc. should be able to interface with all communicable media – PSTN, ISDN, IP etc.

Software Vendors:

The popular Tele-medicine software which is available in market is:

- Mercury Integrated Telemedicine Solution,
- Sanjeevani Integrated Telemedicine solution

2.3.2.3.7 Video conferencing units

Video conferencing is an essential component of Telemedicine and probably only real time mode which is used at all locations. The factors influencing the selection of Video Conferencing unit is:

- Quality of video output

- Audio and Video Inputs

- Data transfer Rate

Video conferencing units are offered in four distinct configurations with the telemedicine systems [6]

Type of Video Conferencing Unit	Key Feature
Video conferencing-	• Stand-alone box with network interface with camera,

Stand-alone	microphone and display (usually a video monitor or TV), • High-end quality with a higher cost. • Data transmission rate work up to 2 Mbps • Additional video & audio inputs and outputs for external camera and additional video monitor
Video conferencing - PC add-on card type	• PC add-on card, with codec • External CCD camera and a microphone are connected to the card • Data transmission rate work up to 768 kbps • No extra video & audio inputs • Less Expensive than stand-alone
Video conferencing - Camera with built-in encoder type	• Has a small camera with built-in encoder, and accompanying software for decoding connected via USB port • Data transmission rate work up to 512 kbps • No external video & audio inputs and outputs • Less cost than stand-alone but quality compromised
Video conferencing – Software based web Camer0061	• Economical option • Data transmission rate work up less than 64 kbps.

Table 2.3.5: Types of Video Conferencing Unit

Stand –Alone Video Conferencing unit is a comprehensive system, which is one-stop-shop for Videoconferencing. Such equipment is made by various companies few of the market players are Polycom, Sony, Aethra has various grades cameras which are linked with each other. Sony and Polycom are the famous and widely used. [6]

Figure 2.3.6: Stand-Alone Telemedicine Unit

Transmission of Moving and Still Images

Transmitting site should be equipped with teleconferencing CODEC, A/D converter, MPEG-1 board, SCSI, and LAN card, but only teleconferencing CODEC and LAN card are required at receiving terminal. [6]

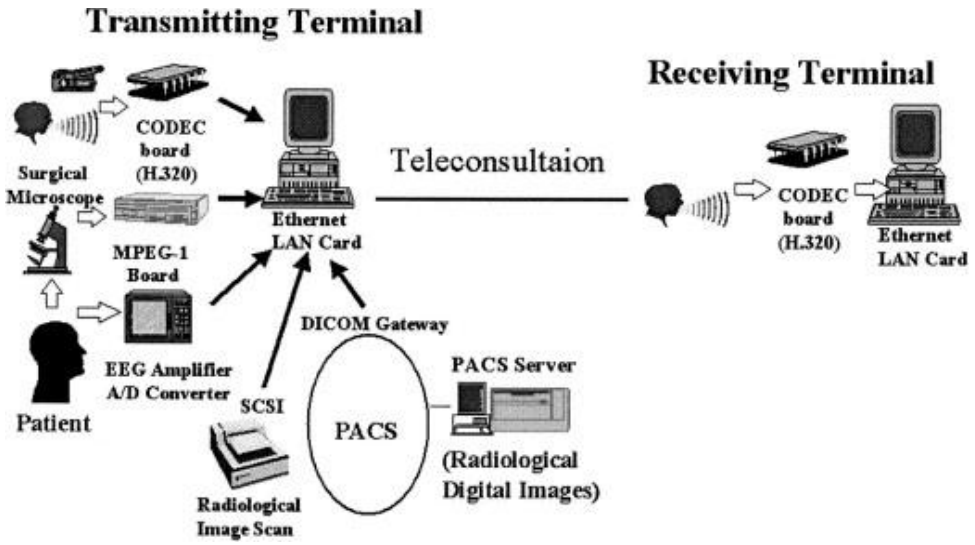


Figure: 2.3.7 Transmission of Moving and Still Images

2.3.2.3.8 Medical Devices

The Medical Devices which will be used for Telemedicine Oncology Service are mentioned in the table with the application. [6]

Services	Medical Devices
Tele- consultation	• Stethoscope
	• BP Monitor
	• Digital ECG machine
	• Glucometer
Tele- Pathology	• Tele-Pathology Microscope including Camera
Tele- Radiology	• X-Ray Digitizer, ,Portable X-ray machine
	• Ultrasound (Sonography machine)

Table: 2.3.8 Medical Devices

2.3.2.3.9 Connectivity

Connectivity is required to enable the transmission/exchange of diagnostic data/images between telemedicine systems. The communication or connectivity method can be decided based on:

- Speed of data transfer and retrieval

- No Data loss

- Bandwidth

To provide connectivity, communication hardware is used. The communication hardware can be divided into two categories:

- Terrestrial links[6]
- Wireless/satellite links [6]

2.3.2.3.9.1 Terrestrial Links:

The hardware for terrestrial links can be further divided into following categories:

  - PSTN/POTS
  - ISDN
  - LAN

PSTN/IDSN Line is the most commonly used connectivity among various Telemedicine projects

Mobile Phone is another commonly used for connectivity purposes in Telemedicine projects

  - CDMA (Through Reliance/Tata/BSNL) - Direct or through Data Card
  - GSM (Through Various service providers) - Direct or through Data Card
  - 3G/4G Technology [6]

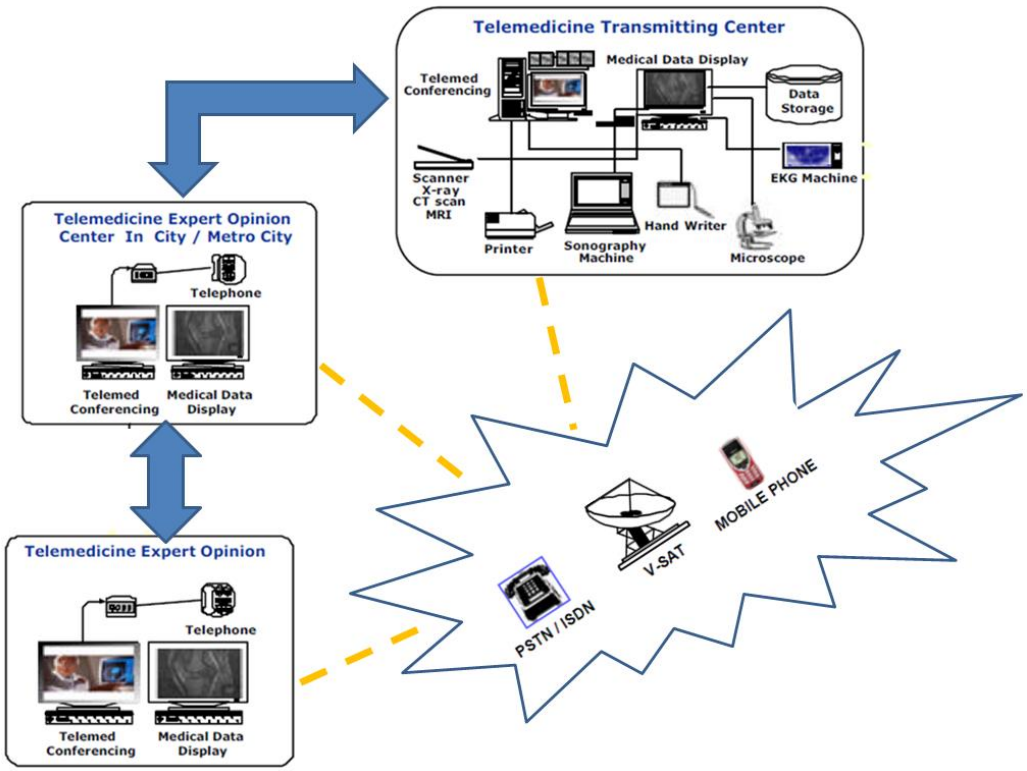


Figure 2.3.9: PSDN/ISDN/Mobile Network Diagram

ISDN (Integrated Switching Data Network) is a low cost option wherein the average per minute cost was 1 local phone call (less than 1 cent (US) per minute for every 64 kbps connectivity. 128 kbps was felt to be adequate for video conferencing [6]

2.3.2.3.9.2 Wireless/satellite links

- **Satellite Links -** Satellite link is the best option to connect a remote site, without any or with an unreliable, communication link, with high/flexible bandwidth pipe in shortest possible time, though currently costly.
  - **VSAT -** The easiest way to provide a satellite link is by using a VSAT (Very Small Aperture Terminal).
    - VSAT hardware normally accepts the data with 10 Base-T LAN/Ethernet interface.

- The specs of 10 Base-T LAN/Ethernet interface on the telemedicine system is provided.

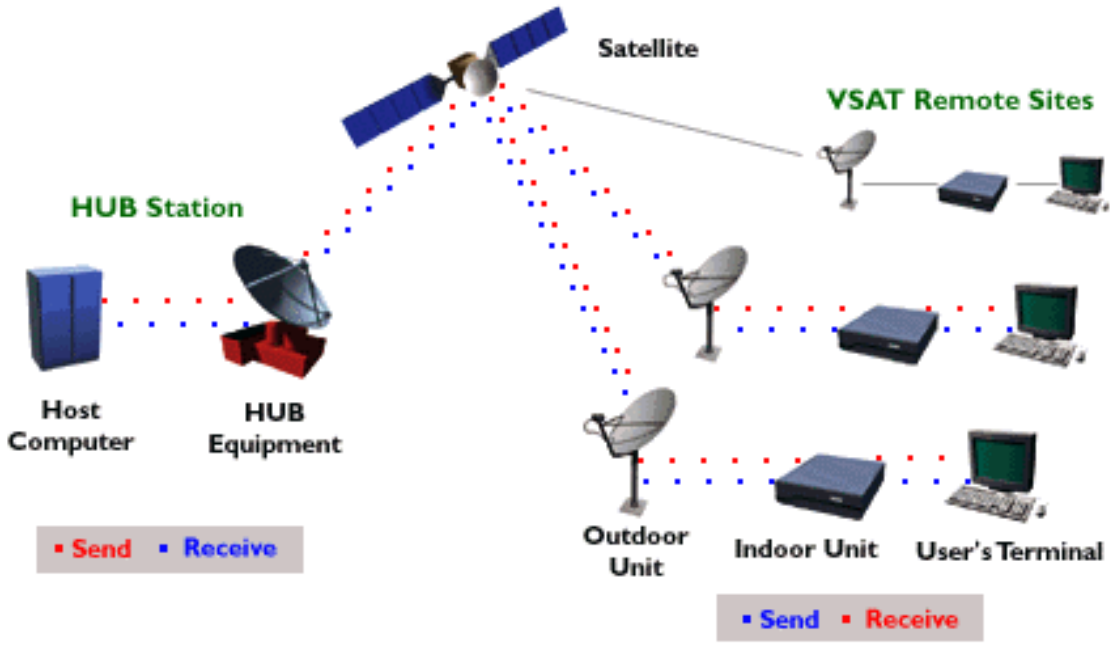


Figure 2.3.9.1: V-Sat Network Diagram

The only local provider of satellite connectivity in India is **ISRO**. A satellite dish is required to transmit and receive the data which costs extra (again free for government or special cases). While free for government or some special cases, the actual quoted cost of satellite connectivity (Rs 60/- or approximately US $1.16 per minute as per 2009 currency rates) is a limiting factor. [7]

- **Wireless LAN -** Wireless LAN connectivity is mostly required to connect and facilitate diagnostic data exchange between various telemedicine systems inside a hospital through Wireless. [6]

2.3.2.3.10 Mobile Clinic

The Mobile Telemedicine Clinic Project utilizes satellite communications to connect medical staff running a mobile clinic [7]

Mobile Telemedicine Unit consisting of portable Medical equipment along with Telemedicine hardware, software and VSAT system mounted in a Bus/Van. [7]

Figure 2.3.10: Mobile Clinic with V-Sat connectivity

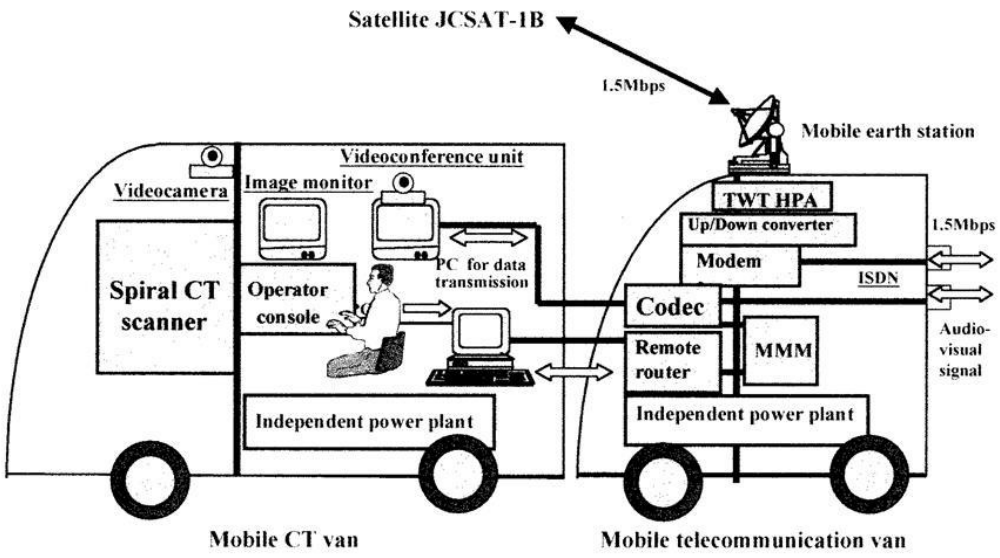


Figure: 2.3.10.1 Interior of a Mobile Clinic with portable devices

2.3.2.3.11 Space Requirements for Telemedicine

To achieve quality service delivery, along with Technology and connectivity certain aesthetic details should be considered.[8]

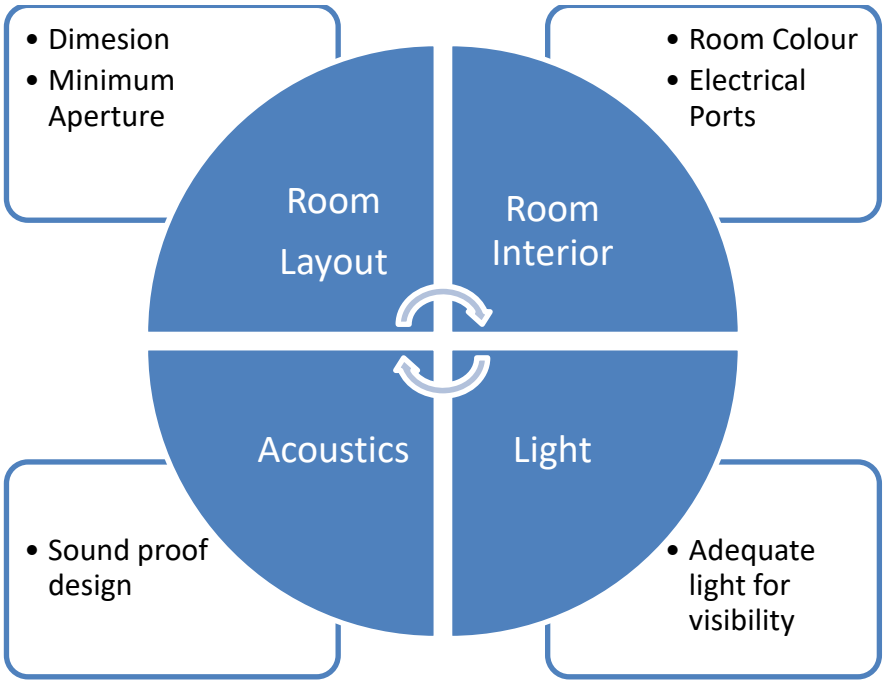
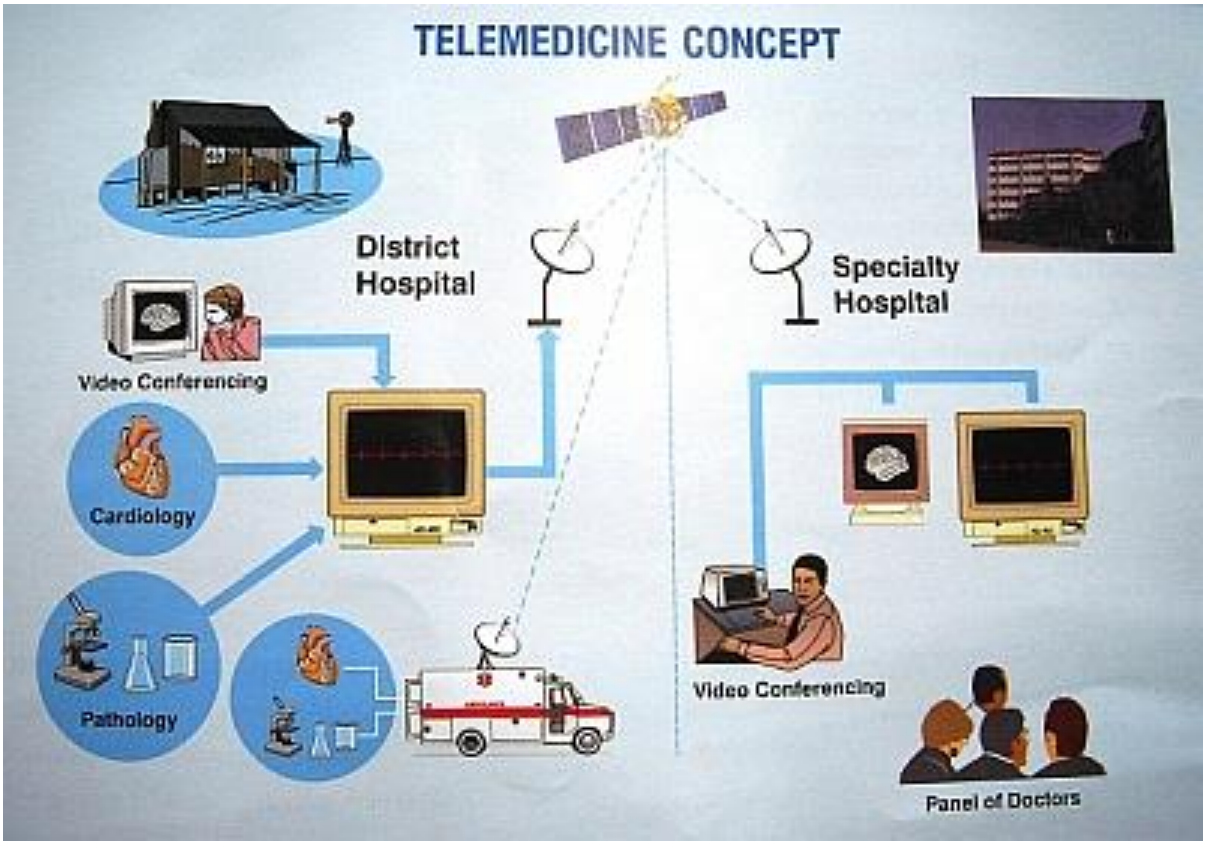


Figure 2.3.11: Space Factors influencing Telemedicine Services

Figure 2.3.11.1: Telemedicine Consultation room layout

2.4 Telemedicine System Functioning



Telemedicine Concept Figure: 2.4.1

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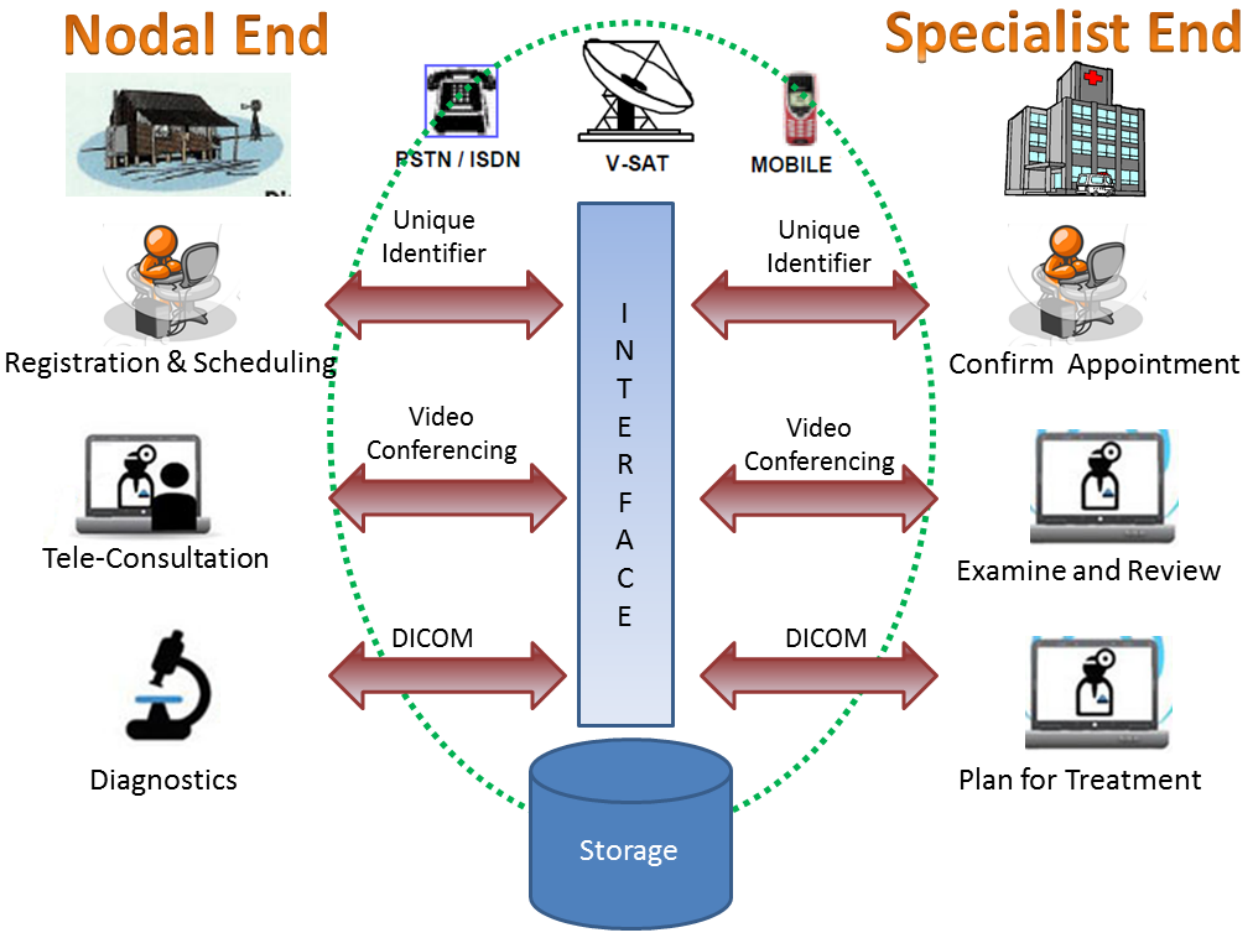


Figure: 2.4.2 Functional Flow

2.4.0 Conventional model of telemedicine

The model followed by many of the existing telemedicine solutions is given below:

- Tele-medicine infrastructure is set up at a big hospital and connectivity is established with different parts of the country using VSAT or other means.
- A nodal centre is a hospital/Clinic in remote area where doctors and patients can directly interact with specialists at the specialty Center.
- The Clinical Information from the Nodal Center is transmitted to the specialty center
- The Specialty would diagnose and plan treatment based on the clinical information and reports.
- The Clinical data and images are stored in form of physical servers and virtually.[9]

2.4.1 Maintenance of Telemedicine Center

The Telemedicine system should be maintained to avoid loss of information, money and efforts.

The technical components such as Hardware, storage, videoconferencing etc. must be protected against weather condition, damage and should be periodically serviced.

Maintenance of Medical Records is an essential part of any activity both from administrative as well as legal purposes. [1]

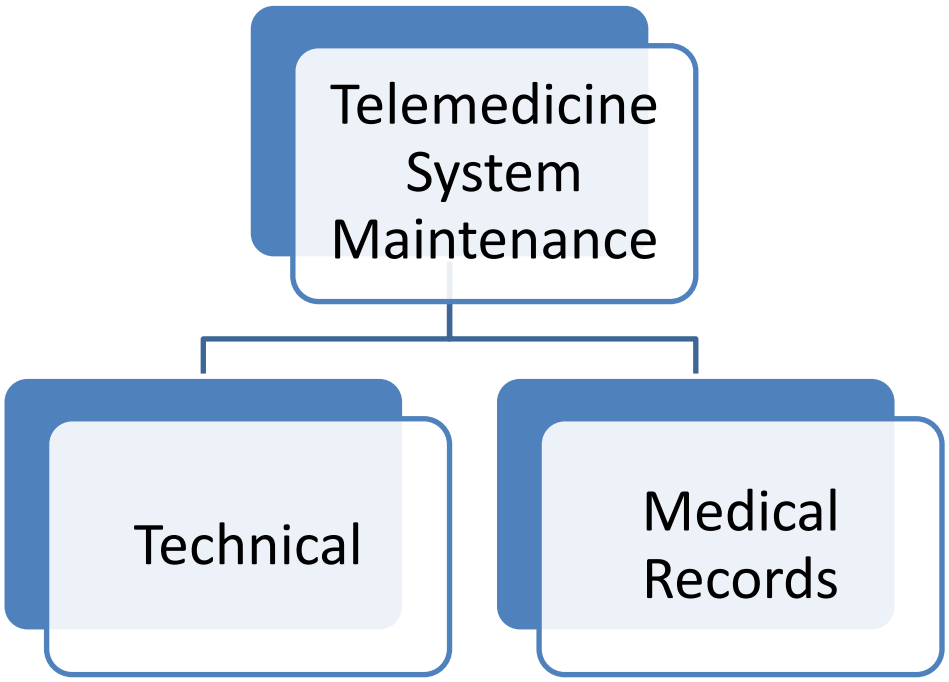


Figure: 2.4.1.1 Maintenance of Telemedicine Center

3.0 Successful Telemedicine Projects

In recent years, India has some successful ongoing telemedicine projects. Below are descriptions of some large initiatives in oncology.

3.1 ISRO

ISRO has committed to provide free bandwidth for telemedicine and for Tele-education

- Satellite based telemedicine nodes have been deployed with state government
- Around 250 nodes have been deployed across the country
- The INSAT satellite system established in 1983 created one of the world's largest domestic communication systems [10]
- Seven satellites and 130 C-band transponders linking many hundred earth stations in remote areas along with thousands on very small aperture terminals (VSAT)
- This infrastructure enables the country to reach over 65% of the Indian landmass and 80% of its population [10]
- With the help of ISRO in Kerala and Karnataka oncology related Telemedicine services are provided in various districts.

3.2 ONCONET- Cancer Care for Rural Masses (ONCONET -Kerala)

- Onconet is a Public Private Partnership (PPP) Model. [11]
- Kerala was the first state in India to formulate a Cancer Control Program in 1988[11]

- Kerala Regional Cancer Centre Thiruvananthapuram (RCC-T) where the Telemedicine program is initiated

- Telemedicine project with reduced operational cost, is developed and implemented by Centre for Development of Advanced Computing, Thiruvananthapuram (C-DAC (T)) and launched at RCC-T, Kerala. [11]

ONCONET-Kerala, is a comprehensive telemedicine solution, tightly integrated with web based Hospital Information System.

- The nodal centers are at Kannur, Kochi, Palakkad, Kozhencherry and Kollam in various districts of Kerala.[11]

Figure: 3.2.1 VSAT connectivity for RCC and its five nodal centers by using INSAT 3C

3.3 Karnataka State (India) Telemedicine Project

- The Indian Space Research Organization (ISRO) has implemented the Karnataka Telemedicine Project to bring healthcare for rural people.[12]
- This network would also serve as a model for the utilization of "Healthsat" proposed for launch in the future.

In this phase "Server/Browser-based, Multi-point-to-Multi-point" type of Telemedicine System/Network (provided by (TeleVital) is put into operation.

- This Multi-Specialty Network has specialty hospitals for Oncology, Gynecology, Nephrology, etc. providing telemedicine service to various district hospitals across Karnataka. [12]

Around 30 hospitals in district, taluk and remote areas will be linked via satellite for Tele-consultations with five multi-specialty hospitals.

- ISRO is installing Rupees 3-crore equipment and providing the bandwidth free of charge.[12]

As the other promoter, the Karnataka government provides the infrastructure, doctors, paramedics and the subsequent running cost. [12]

The bandwidth will also be strengthened as C band is used. [12]

- Major hospitals which will offer Tele consultancies are:
  - Jayadeva Institute of Cardiology
  - Narayana Hrudayalaya
  - NIMHANS, St Johns
  - Samatvam Institute of Diabetics of Bangalore

- JSS Institute of Medical Sciences, Mysore

3.4 Apollo Telemedicine Project

- Major Hospital providing Telemedicine service
- Apollo provides link to villagers via satellite to specialist services [13]

The first rural project is Aragonda which is linked to Chennai Apollo Hospital bringing tertiary care to doorsteps of patients.[13]

Organization	Apollo Hospitals
Program Name and Inception	Apollo Telemedicine Enterprises Limited;1999
Location (States)	South India (Tamil Nadu, Andhra Pradesh), North India (Delhi), and East India (Orissa, Assam, Nagaland, West Bengal)
Health Network	Hospitals (Private and Public), Outpatient clinics, Military bases
Application orientation	Cardiology, Dermatology, Emergency, Radiology, Rheumatology, Nephrology, General Consultation
Non Clinical Activities	Health Education, Web Development, Research and Administration
Number of Sites	45
Content Delivery	Telephone, Interactive with still and video images, Store and forward
Equipment	PC and Standalone video conferencing, Tele-Radiology system, Home-care units
Peripherals	BP Monitor, Spirometer, Ultrasound, Tele- ECG, Digital Camera, Stethoscope, Glucometer, Document Camera
Connectivity	POTS/Wireless/VSAT/ISDN
Sponsors	Indian Government, ISRO, GE, Wipro

Table: 3.4.1 Apollo Telemedicine Project

4.0 Conclusion & Recommendation

Telemedicine offers several advantages in the practice of oncology. Early screening can prevent the spread of the disease. The number of emergency visits to the hospital can be reduced. Unnecessary admissions can be avoided. Routine follow-up visits by the patient can be limited to the peripheral clinic. Physician visits from the tertiary hospital to the rural/peripheral centers can be cut down. Thus, by the use of Telemedicine not only doctors but also other professionals, researchers, decision makers can work to reduce the miseries of cancer patients. We can give challenge to a disease like Cancer by implementing Telemedicine. This Telemedicine system can be used by developing countries to improve health status for cancer patients.

I would like to suggest that Dell has the required infrastructure and finances to start Support services in Telemedicine. They have the skilled and trained staff in support services which can handle telemedicine services as well. They have their cloud services as well where information can be easily stored, archived and retrieved at any time.

5.0 Case Study

Exploring the possibility of using IT to Manage Global Diverse Workforce

5.1 Abstract

Diversity is a reality in the modern workplace across the globe. The importance of culturally diverse workforce is being recognized worldwide. If managed well it can yield many advantages, such as developing employee and organization potential, improving customer service and business growth, and also enhancing creativity and problem solving. Managing diversity of a global workforce environment is more challenging for managers who are driven to do more with less. Information Technology (IT) and Globalization are among the most important factors that shape today's business. The advancement in IT has made business communities to maximize their global presence. Moreover, IT can play a critical role in the strategy of global competition. This study explores the value of IT in managing diversified workforce in global businesses. Using appropriate technologies is shown to break down cultural barriers and promote understanding and knowledge sharing between employees of different language backgrounds and hence lead to successful collaboration.

5.2 Introduction

There are inevitable changes which are taking place in workforce. Diversification of workforce is happening in various organizations. Diversity refers to a mixture of people with different group identities operating within the same social system (Cox & Nkomo, 1996). The factor that contributes to the diversity is the personality traits of employees. The personality traits are shaped by genetic, experience, culture, and religion among others. Management's acknowledgment of the personality traits such as psychological needs, cognitive ability, and inter-personal styles, among others will help manager to create a diverse but a cohesive group of employees. Diversification of workforce is mainly occurring

due to two factors firstly the changing composition of national populations and secondly globalization.

National populations are changing because of the cumulative effect of high birth rates of minority ethnic groups and increased immigration, which consequently is mirrored in the workforce (Abbasi and Hollman1991; Cox and Blake 1991; Donnelly et al. 1998).

Globalization has meant that today every company, large and small, faces increased competition at home from foreign companies, at the same time as they confront the need to be competitive in the international market. In order to prevail, companies need to adopt new ways of doing business, with sensitivity toward the needs of different cultural practices. They must compete for the best talents they can find, and search for ways to get the best from the employees they now have (Thomas 1991; Daft 1997). More and more, these employees will be located in different countries as many organizations move to a global way of doing business. Part of this trend is the increasing reliance on virtual teams, made possible by the advance of Information Technology
(IT) (Zakaria, Amelinckx and Wilemon 2004). So managing a culturally diverse workforce in today's organizations is therefore of great importance.

Due to diversification problems have raised i.e failure to handle diversity for a company. The first important problem is financial cost caused by turnover, absenteeism and lawsuits. Companies lose all the money invested in recruiting and training when a dis-satisfied employee leaves. In addition, high turnover means employees are constantly in the learning stage instead of performing at their full potential. Absenteeism results in a significant cost: there is a positive relationship between employees' perceptions of being valued and cared about and their attendance. In addition, lawsuits on racial discrimination can also cause financial cost to the company (Daft 1997; Robinson and Dechant 1997).

Reduced individual and organizational productivity is the second problem. This occurs when people experience prejudice and non-acceptance. People who feel unappreciated are less innovative, and are less aggressive in pressing their ideas or in assuming leadership. They will not voice disagreement, because they want to be accepted, and time will be wasted due to poor communication and misunderstandings (Loden and Rosener 1991; Daft 1997).

Third, a less obvious impact is the tarnished corporate image that develops around employee dissatisfaction. If a corporation becomes known as one that alienates nontraditional employees, it will have a hard time finding qualified workers in periods of limited skilled labor supply (Daft 1997; Elmuti 2001).

To challenge these problems and many more IT can be used as one of the ways to manage global workforce diversity. It helps in

- Sharing data and information among global locations simultaneously helps keeping the employees in a diverse workplace informed which can create a united atmosphere.
- Conducting workshops and training without traveling that will enhance diversified workers to get knowledge.
- IT tools such as the Internet, teleconference, data warehouse, and data mining can facilitate exchanging expertise among diversified workers. As a result, qualified employees will be advanced.
- Standardizations of all business aspects through IT are possible. Moreover IT can help in crafting a cohesive group in a unified environment.

5.3 Objectives

The objective of this study is

1. To explore the possibility of using IT in managing global workforce diversity

2. To explore the possibility of using IT in managing human resource issues in relation to improving organization effectiveness.

5.4 Rationale of the Study

To understand the possibility of using IT in managing issues related to global diversified workforce as diversification and use of IT is increasing globally in organizations.

5.5 Methodology and tools used

Study Type- Questionnaire based Study
Sample size- 25 Employees
Sample included- Organization in Delhi and NCR are
Method Used- Survey and Interviewing individuals
Data Type- Primary
Tool Used for Evaluation of Responses- Microsoft Excel
Sampling technique – Convenient sampling

Requirement gathering for the study to explore the use of IT in managing global diversified workforce involved conducting a survey at organizations in Delhi and NCR area. The survey conducted by ensuring filling of questionnaire. The questionnaire was close ended one.
The study involved a sample of 30 employees in Delhi and NCR area. Out of which 5 employees did not respond in survey, so responses of 25 employees are recorded and analyzed.
The requirement gathering methods which I used were collecting responses through online questionnaire filling and interviewing.

Steps followed in development of questionnaire

1. Decide the information required.
2. Define the target respondents.
3. Choose the method(s) of reaching your target respondents.
4. Decide on question content.
5. Develop the question wording.
6. Put questions into a meaningful order and format.
7. Check the length of the questionnaire.
8. Pre-test the questionnaire.
9. Develop the final survey form

Tools used

1. Microsoft Excel

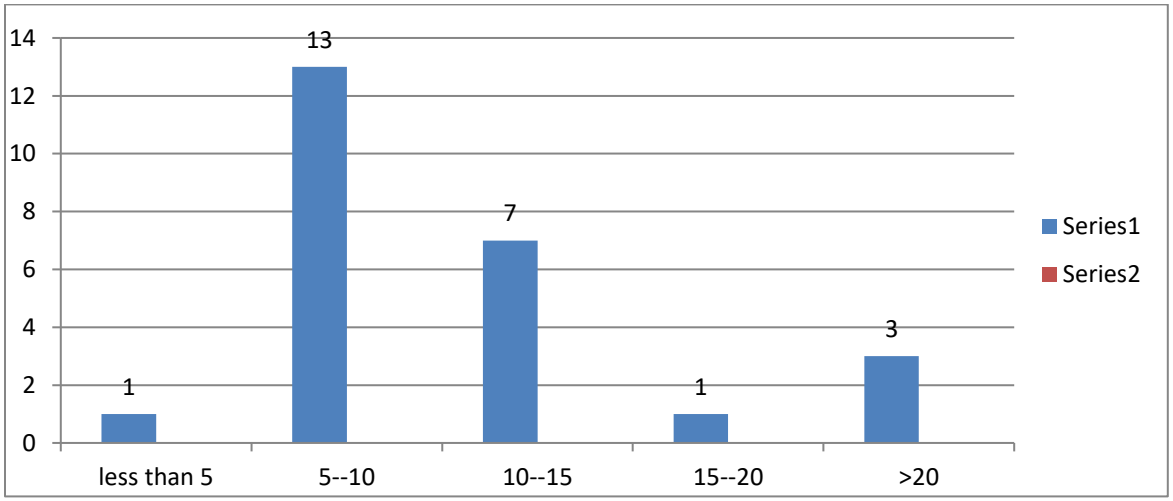
Microsoft excel is a commercial spreadsheet application written and distributed by Microsoft for Microsoft Windows and Mac OS X. It features calculation, graphing tools, pivot tables, and a macro programming language called Visual Basic for Applications. It has been a very widely applied spreadsheet for these platforms, especially since version 5 in 1993, and it has almost completely replaced Lotus 1-2-3 as the industry standard for spreadsheets. Excel forms part of Microsoft Office. The current versions are 2010 for Microsoft Windows and 2011 for Mac OS X

5.6 Findings

A survey was conducted to know the possibility of using IT in managing global diversified workforce in organizations in Delhi and NCR area.

Out of 30 employees responses of 25 employees were recorded and analyzed. As 5 employees does not respond to the online questionnaire.

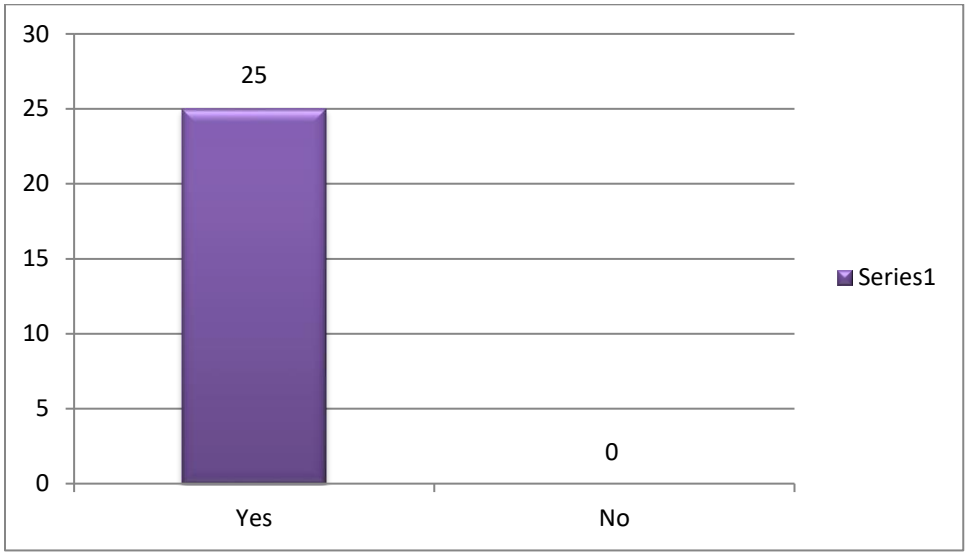
First question asked from employees:-what is the average number of members in their team at the office.



Graph: 1

Findings after response is 13 employees said they have average number of Team members ranging from 5-10 in their office. 7 employees said they have members ranging between10-15. Only one employee said he has team member ranging less than 5. One employee have team member ranging between 15-20.Three employees said they have team member more than 20.

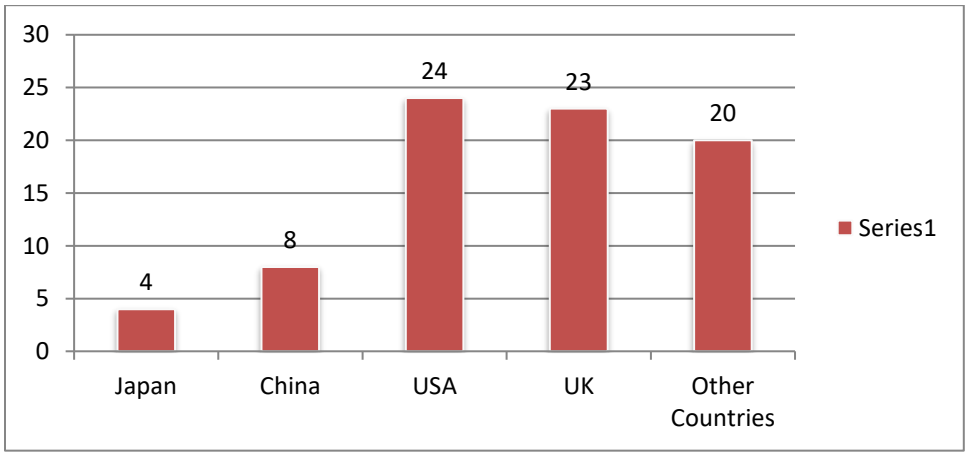
Second question asked from employees: Do they have team in other countries as well?



Graph: 2

Finding after reply from respondents: All 25 employees responded that they have team in other countries as well.

In continuation to second question if respondents say yes which other countries they have team is being asked.

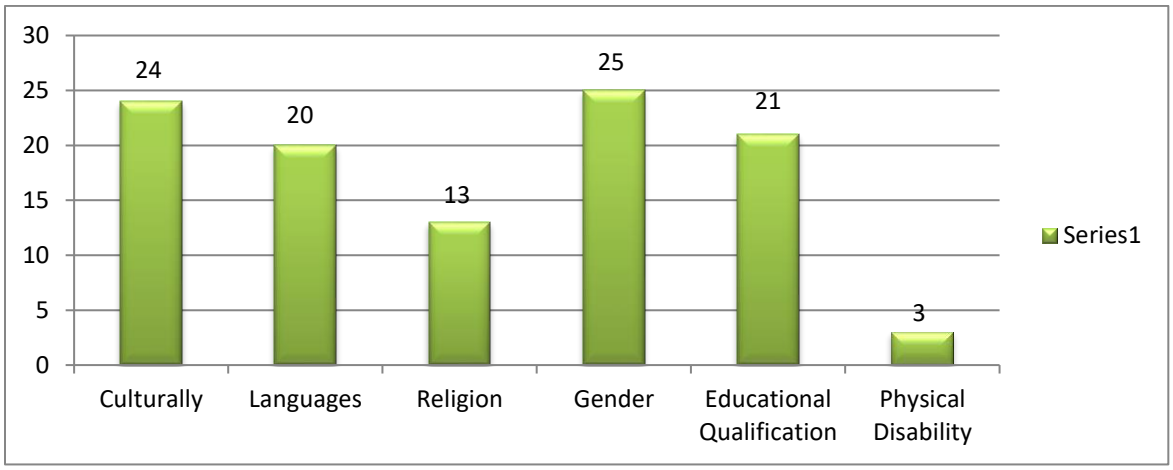


Graph: 3

Finding after reply from respondents: - Around 24 employees responded they had team in United States of America, 23 said in United Kingdom.20 employees said in other countries like Germany, Malaysia and East Africa. 8 replied China and 4 Japan.

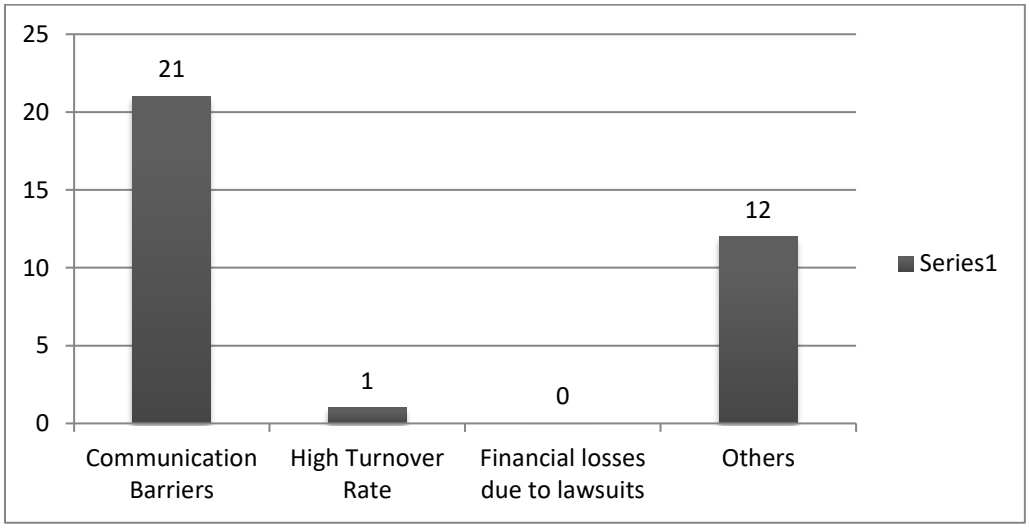
Third question asked is their team diversified and what are the parameters.

Graph: 4



Findings after reply from respondents:-24 employees responded that they have culturally diverse workforce.20 employees replied they have team which is diverse in terms of language.25 employees replied they have team which is diverse in terms of gender. 21 employees replied they have team which is diverse in terms of educational qualification. 13 said they have team which is diverse in terms of religion and 3 said they have diverse team in terms of physical disability.

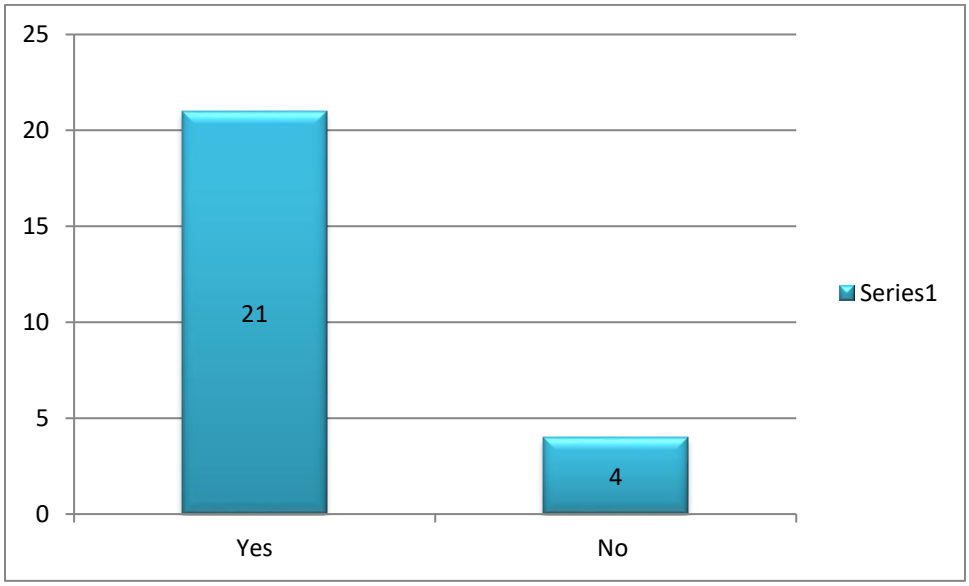
Another question is that do they face problems due to presence of diversified workforce.



Graph: 5

Findings after reply from respondents:-Around 21 employees responded that they face problem of communication due to diverse workgroup. 1 employee said there is turnover due to diverse workgroup. None said that financial losses are there due to diverse workgroup. 12 employees replied there are other problems which they face due to diverse workforce like not getting well along with everyone in their organization due to diversity and etc.

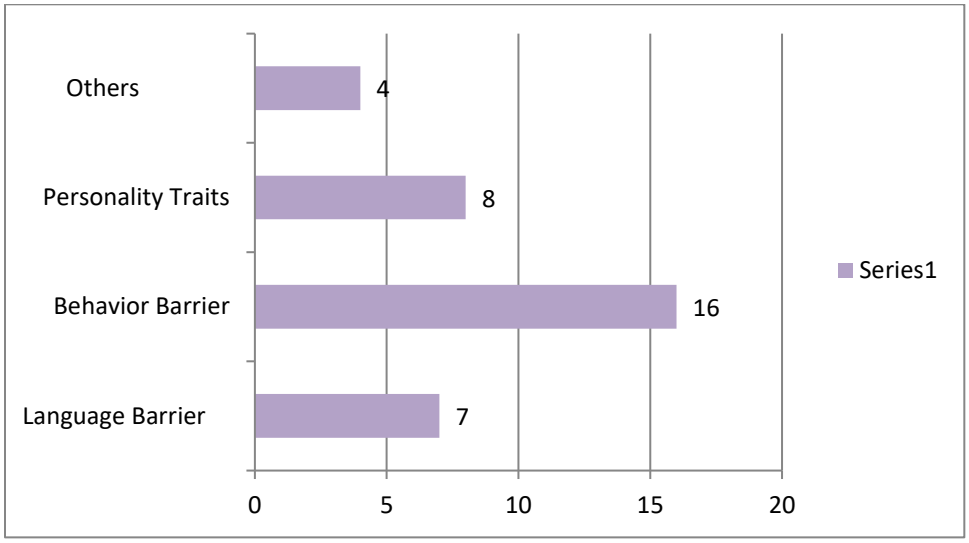
Another question is do they face problem in communicating with diversified team within and across organization.



Graph: 6

Findings after reply by respondents:-21 employees said they face problem in communicating due to presence of diverse work group.4 employees said they don't face problem in communicating with diverse workgroup.

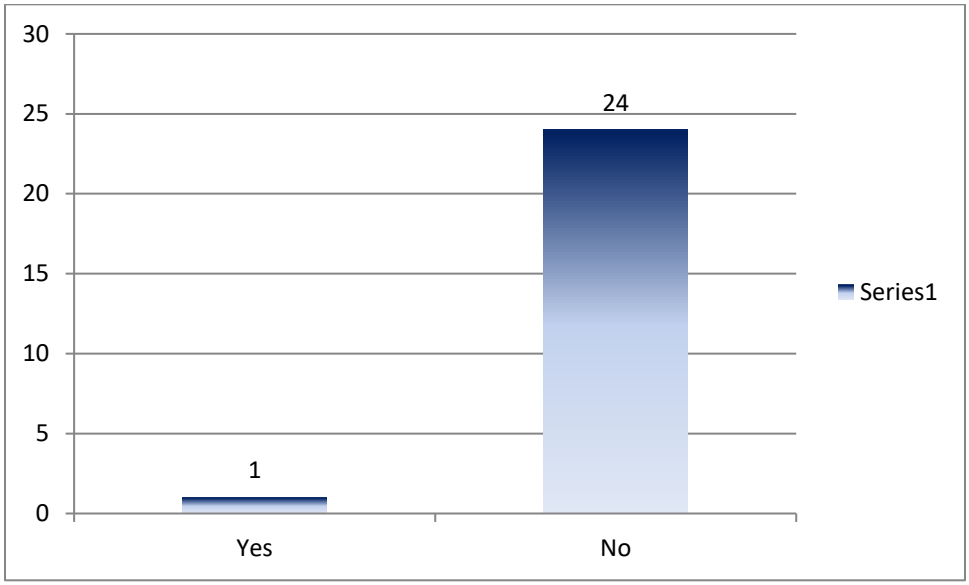
Continuation to above question if the employee says yes, then what are the problems they face in diversified workforce.



Graph: 7

Findings after reply from respondents:-16 employees replied that they face problem in communicating because of Behavior barriers due to diverse work group. 8 said difference in personality traits causes difficulty in communicating with diverse work group. 7 said language is also one of the barriers which hinder communication among their colleagues. 4 replied there are other problems which hinder communication with their fellow workers.

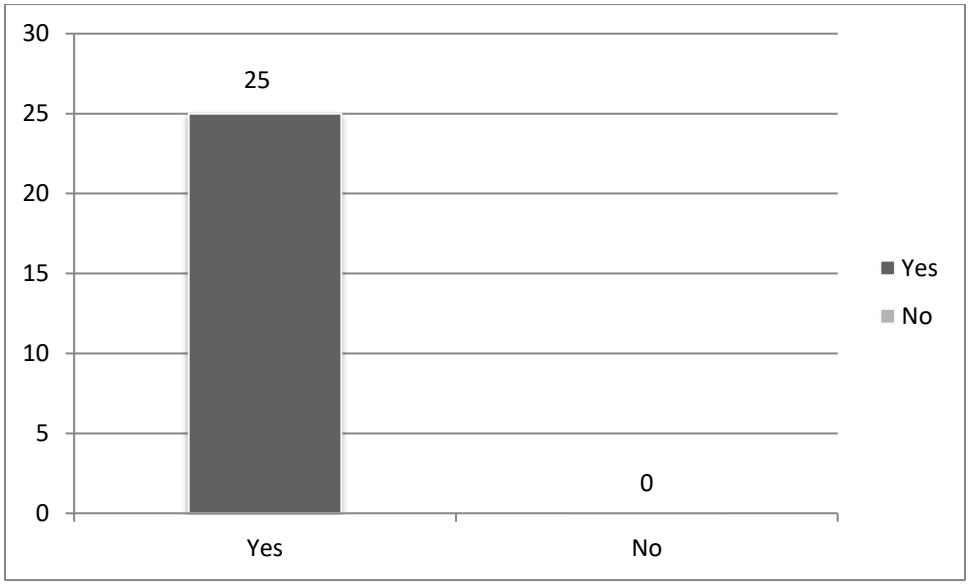
Another question asked is there turnover of employees due to presence of diversified workforce.



Graph: 8

Findings after reply from respondents:-Only 1 employee said yes there is turnover due to presence of diverse work force and that employee did not specify the reason.24 employees said no there is no turnover due to diverse work group.

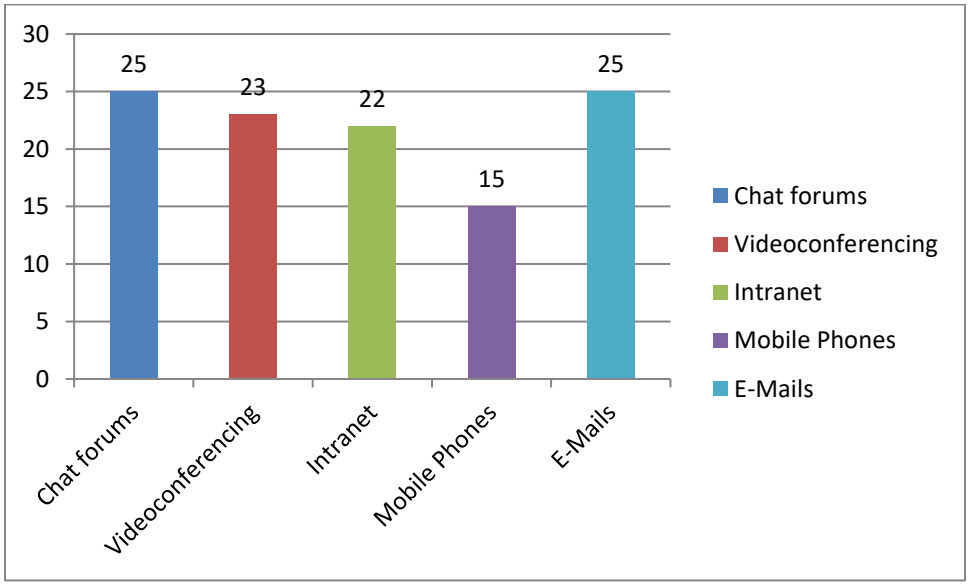
Another question asked is everyone in their organization is treated equally in diverse workforce.



Graph : 9

Finding after reply from respondents:-25 employees replied that they are treated equally in diverse workforce.

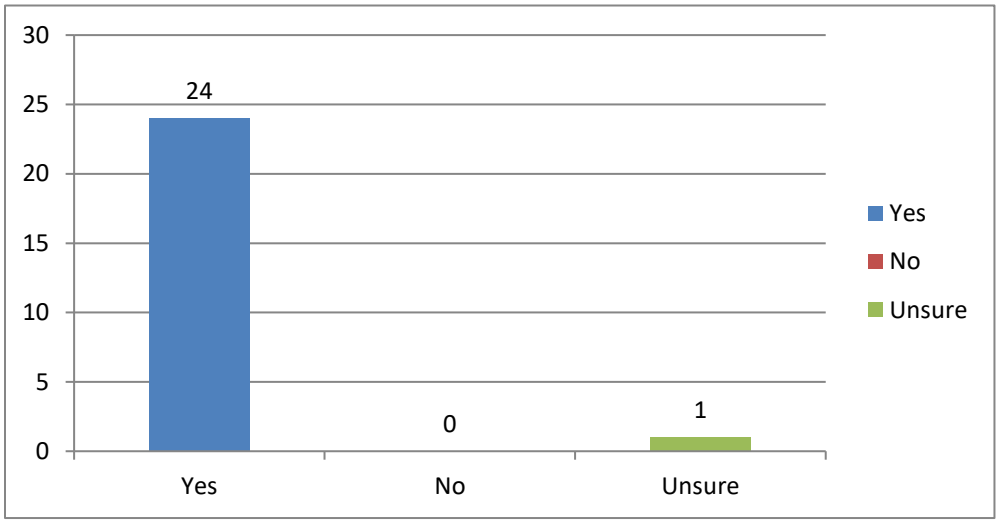
Another question asked is how they communicate with each other within and across organization.



Graph: 10

Findings after reply from respondents:-25 employees said they use chat forums and e-mails to communicate with their fellow workers. 23 and 22 employees said they use videoconferencing and Intranet to communicate with each other and 15 employees said they even use mobile phones to communicate with each other.

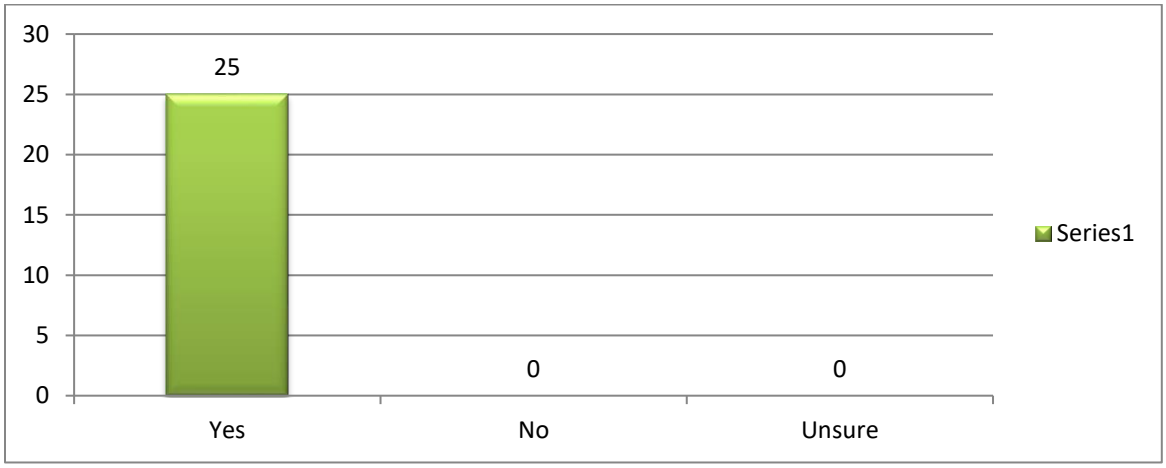
Then they being asked do they think diversified workforce is important for an organization.



Graph: 11

Findings after reply of respondents:-Around 24 employees said that diversified workforce is important for organizations as it brings different kind of talent and skill at common place and even it brings different perspectives which could bring best results. Only 1 employee said that he is not sure about the importance of diversity in an organization.

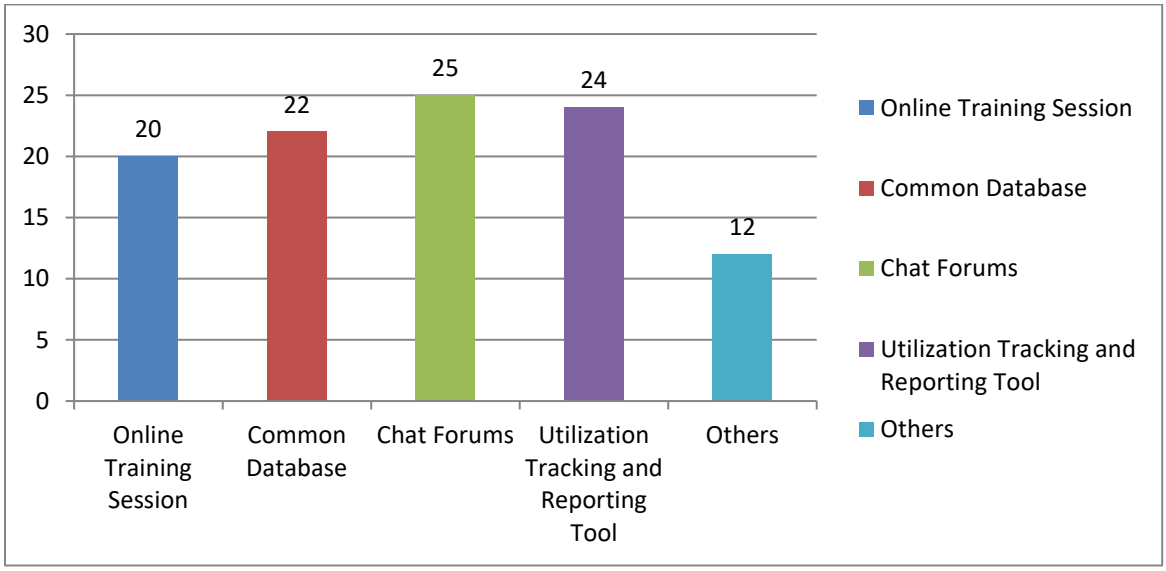
Then question is asked do they think IT helps in better communication and timely information sharing across global workforce.



Graph: 12

Finding after reply from respondents:-All 25 employees said that IT is helpful in better communication and timely information sharing across global workforce.

In Continuation to the above question if the respondent said yes then what are the ways IT helps in managing diverse global workforce.



Graph: 13

Findings after the reply from respondents:-20 employees said IT helps in managing global diversified workforce by providing online training session where unnecessary travel cost can be eliminated.22 employees said IT helps in having common database through which information can be easily stored, archived and retrieved at any time eventually having single point of access. 25 employees said IT helps in better communication through chat forums in global diverse workforce. IT also helps in managing a diversified workforce globally by having common utilization tracking and reporting tool where everyone in organization has to enter their daily work task and activities done with time slots.12 employees said there are other ways by which IT can be used to manage diversified workforce.

5.7 Conclusions and Recommendation

After evaluating the findings I found out that there is possibility of using IT to manage diversified workforce globally. The questions asked in survey shows that IT has the possibility to be used in managing issues related to diversified workforce globally. So, to know more about the role of IT in managing global diverse workforce I suggest for further requirement gathering for development of software which will help to manage and counteract issues related to global diverse workforce.

6.0 References

1. http://www.humaclin.com/humaclin_TM_Module.pdf

2. http://www.who.int/goe/publications/goe_telemedicine_2010.pdf

3. http://www.telehealthresourcecenter.org/

4. http://ehealthkerala.com/MedicalInformatics/oncology.jsp

5. http://www.telemedindia.org/procedures.html

6. http://telemed.esanjeevani.in/Telemedicine/Report.pdf

7. http://www.isro.org/publications/pdf/Telemedicine.pdf

8. http://telemedicina6.unifesp.br/set/curso/2006-10-23-pgsaude/Fundamental_TelemedicineRoomDesign.pdf

9. http://www.cpca.org/cpca/assets/File/Policy-and-Advocacy/Active-Policy-Issues/HIT/Telehealth/2012-02-14-WorkFlow-TM.pdf

10. http://www.isro.org/

11 .www.medetel.lu/download/2005/parallel_sessions/.../**OncoNET**.doc

12. www.thehindubusinessline.com/2004/02/.../2004021101781700.htm

13. citeseerx.ist.psu.edu/viewdoc/download?doi...1... - United States

14. http://www.sbaer.uca.edu/research/swdsi/2002/papers/02swsdi029.pdf

15. http://www.irma-international.org/viewtitle/32666/

16.http://www.irma-international.org/proceeding/managing-modern-organizations-through-information/31508/

17. Information Technology - Its Impact on Global Management

18. Influence of Internet and Information Technology on Work and Human Resource Management

Annexure

7.0 Annexure: Table: 1 Government Regulation & Specification for Personal Computer

Processor Speed	1 Gega-hertz or above
Ports	Serial/Parallel/USB
T LAN/Ethernet interface with Wake-On-LAN (WOL).	10/100 Base
Interfaces for Medical Devices	Interface for ECG and pathology camera
Hard Disk Drive	40 GB (minimum) or more
FDD	1.44 MB
RAM	128 MB Upgradable to 1GB
CD Writer	8X (minimum) re-write speed (recommended)
Graphics	32 MB (minimum) RAM & PAL-B composite (minimum) video output.
Image Resolution	24-bit image capture with resolution 720*576 (minimum) with appropriate

	video interface
High Resolution	1280 x 1024) 17” color monitor
Audio interface with speakers	20W minimum & Microphone
Web Camera	(640~)*(480~), Optical system; CCD; Progressive 330K effective pixels
Frame rate	30fps@VGA (640*480)
Operating System	Standard Windows 101 US Key board
Mouse	Scroll two-button mouse with mouse pad
Other Requirements	Preferred two spare PCI slots, Auto shutdown facility

Table 2: Specification for Camera

Video Standard	CCIR PAL-B
Camera sensor	CCD
Picture resolution	450 TV lines, minimum
Control (local end)	Control (local end)
Display	Minimum 21” or bigger colour TV with video and audio inputs.(recommended is 29” colour TV)
Video Format	Composite color
Video interface	BNC or RCA
Audio interface	RCA

Table 3: Medical Devices Specification for Portable X-Ray

Generator	1 Pulse, Half wave
Output (max)	60mA-70kV-0.4s;40MA-80kV-2.0s; 20mA-100kV-6.0s
Line Resist	Max.0.4ohm
KV	45 to 100 kV, 5 kV per step
Rad. Timer	0.04 s to 6.0 s in multiple steps
X-ray Tube	Focus 2.8 x 2.8 mm : Anode capacity40 KHU or equivalent
Power Supply	Single Phase, AC, and 50 Hz (in addition to general Supply
Suggested Features	• Easy Mobility and steering • Integrated cassette box • Easy transportation, in normal elevator and narrow passages

Table 4: Medical Devices Specification for Tele-Pathology Microscope including Camera

Optics	Delta/infinity corrected with harmonic components
Nose-Piece	3 or more objectives
Objectives	Standard achromatic objectives, oil with phase contrast, Magnification as per application, BF/DF observations
Eye Pieces	10X 22X with harmonic components optics
Illumination	12V, 30 W stabilized

Table 5: Specification for X-Ray Digitizer

Resolution	1200 dpi/lpi (horizontal/vertical)
Color resolution	12-14 bits/channel (gray scale)
Active area	As per the application (commercially available A3 and A4 scanners can also be deployed)
Computer interface	Other than Rs-232
Additional Features	Backlighting optimized for X-ray application
Resolution	1200 dpi/lpi (horizontal/vertical)
Color resolution	12-14 bits/channel (gray scale)
Active area	As per the application (commercially available A3 and A4 scanners can also be deployed)
Computer interface	Other than Rs-232
Additional Features	Backlighting optimized for X-ray application

Table 6: Specification for Ultrasound (Sonography machine)

Scanning Method	Electronic Convex, Micro convex and Linear Array
Imaging Modes	B, B/B, B/M, M
Electronic Array Probes	3.5 MHz, 5.0 MHz, and Linear convex, Trans-Vaginal (for Gynecology/obstetrics applications)
Display Frame Rate	24-30 fps
Depth Selection	4.5, 6, 9 12, 15, 18, 21CM, Scroll Function
Gray Scale	64 shades of Gray, at least
Converter	512x512x6 bits, at least
Measurements	Mouse/Trackball Operations
B-Mode	Distance, Area Ellipse
M-Mode	Heart Rate (optional)
Additional Features	Fetal Parameters: BPD, HC, CRL, AC, FL, HI, GS, LV, And TA as relevant, Image Management: Report: Patient and Measurements Summary Image

	Computer interface: Using Image grabber/video capture card (PAL/NTSC/Composite video) /DICOM format output

Consent Form

Informed Consent for Telemedicine Services
(For Teleconsultation within India only)

PATIENT NAME: _____ LOCATION OF PATIENT: _____	DATE OF BIRTH: _____	MEDICAL RECORD #: _____
PHYSICIAN NAME: _____ LOCATION: _____ CONSULTANT NAME: _____ LOCATION: _____ CONSULTANT NAME: _____ LOCATION: _____		DATE CONSENT DISCUSSED: _____

1.1. Introduction

Telemedicine involves the use of electronic communications to enable doctors at different locations to share individual patient medical information for the purpose of improving patient care. A teleconsultation is based entirely on the information furnished i.e. text data, laboratory values and images. This information is used for diagnosis, therapy, follow-up and/or education. The Teleconsultant cannot countercheck the reliability of the information provided. The electronic systems used will incorporate network and software security protocols to protect the confidentiality of patient identification and imaging data.

1.2. Possible Limitations

Due to unanticipated technical reasons there may be an interruption during the teleconsultation or quality of transmission may be suboptimal resulting in postponement of the teleconsultation. The teleconsultant would give an opinion based on the physical examination findings of the primary doctor. The teleconsultation may be videotaped, digitally recorded, filmed or photographed and used for teaching purposes. The patient's identity will not be revealed. A breach of privacy of personal medical information is theoretically possible. Lack of access to complete medical records may very rarely result in judgment errors.

1.3. Patient Consent To The Use of Telemedicine

I have read and understood the information provided regarding telemedicine. I have discussed it with my doctor, and all of my questions have been answered to my satisfaction. I hereby give my informed consent for the use of telemedicine in my medical care.

I hereby authorize _____ ***(name of primary doctor)*** *to use Telemedicine in the course of my diagnosis and treatment.*

Signature of patient (or person authorized to sign for patient: _____ *Date:* _____

If authorized signer, Relationship to patient: _____

Witness: _____ *Date:* _____

I have been offered a copy of this consent form (patient's initials) _____

DISCLAIMER: The teleconsultants, doctors at the remote centres and all personnel directly or indirectly involved with any part of the Telemedicine set up will not be held responsible, in the unlikely event of an error in diagnosis or management, due to the occurrence of sub optimal technical conditions. While every attempt will be made to ensure ideal conditions, unforeseen situations may occur.

Hello Sir/Madam,

I am a student of IIHMR and conducting a research project on understanding the role of IT in managing diverse workforce in a global organization.

I seek your valuable time and guidance to help me in understanding the same. I request you to help me by filling the questionnaire.

Thank You!!

Questionnaire

Name of the Organization……

Name of Respondent ……..

Designation ……..

Address…….

Contact No……

Email Address……

Languages (Spoken)……

1. What is the average number of member in your team at your office?

   Less than 5 ☐ 5-10 ☐ 10-15 ☐ 15-20 ☐ >20 ☐

2. Do you have team in other countries as well?

   Yes ☐ No ☐

   If yes, which are the countries?

   Japan ☐

   China ☐

   USA ☐

   UK ☐

Any Other Please Mention ☐ ……

3. Your team is diversified on which of the following parameters?

Culturally ☐
Languages ☐
Religion ☐
Gender ☐
Educational Qualification ☐
Physical Disability ☐
None of these ☐

4. What are the problems which arise because of having diversified workforce?

Communication Barriers ☐
High Turnover Rate ☐
Financial Losses due to legal lawsuits against discrimination ☐
Others please specify ☐

……..

5. Do you face problem in communicating with diversified team within and across organization?

Yes ☐ No ☐

If yes what are the problems

Language Barrier ☐
Behavior Barrier ☐
Personality Traits ☐
Any other please Specify ☐ …….

6. Is there turnover of employees due to presence of diversified workforce?

Yes ☐ No ☐

If Yes please specify the reason…….

7. Do you think everyone in your organization is treated equally in diverse workforce?

Yes ☐ No ☐

8. How do you communicate with each other within and across organization?

Chat Forums ☐ Video-conferencing ☐ Intranet ☐ Mobile Phone ☐ E-Mails ☐

9. Do you think diversified workforce is important for an organization?

Yes ☐ No ☐ Unsure ☐

If Yes, Why? …….

10. Do you think IT helps in better communication and timely information sharing across global workforce?

a. Yes ☐ b. No ☐ c. Unsure ☐

If yes what are the ways?

Online Training Session ☐

Common Database ☐

Chat forums ☐

Utilization Tracking and Reporting Tool ☐

Any Other Please Specify ☐…….