PROBLEMS AND POSSIBILITIES OF TELEMEDICINE IN INDIA

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Abstract

"Telemedicine: One small step for IT, a giant leap for Healthcare".

_Neil Armstrong

Information and communication technologies (ICTs) are having a great capability to face some challenges in both developed as well as developing countries which includes providing access, cost-effective and high-quality health care services. Telemedicine uses ICT to overcome geographical barriers, and increase access to health care services. This is particularly beneficial for rural and underserved communities in India. This paper focuses on the rising profile of e-health on the international policy agenda and related developments in the National Health Service. Few developments in public health today create energy and opportunity present in the word "e-health". As a developing country, India is implementing the technology to deliver health information and services regarding health widely across the country. These solution though promising also present new challenges particularly in acceptable standards, choice of technologies, overcoming traditional jurisdictional boundaries, investment, privacy and confidentiality.

In this study, examine current state of telemedicine in a developing country, India. Telemedicine has brought several benefits to the people of India, especially those living in rural and remote areas. Discussed the Indian telemedicine implementation case of Apollo Hospital and Chakrajmal village, consolidate lessons learned from cases, and culminate with potential researchable critical success factors that account for the growth and modest successes of telemedicine in India. This research will discuss how e-health provides the opportunity for patients to maintain longer independence and for the providers to monitor a condition more closely. It also describes barriers and challenges for current status of e-health. Also, an attempt is made for presenting future e-health status in Indian scenario. Further, some recommendations are provided for improvement.
Acknowledgement

I would like to make a good use of this page to thanks all people those helped me to complete this final Thesis. First of all in the name of Almighty God, who enabled me to complete this thesis. Before I start to thank people who helped me during the Thesis study, I would like to acknowledge about the great environment and study provided by University West during my study period. I can’t finish my Thesis work without help of my Supervisor, Professors, Co-students and my family.

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Finally special thanks to all my friends and people who directly and indirectly helped me during this Thesis study. And at last but not least, I would like to thank my parents and siblings for everything they have done during these last 28 years.

Trollhättan, Sweden
June 14th, 2012
Naga Pradeep Movva
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1. Introduction

The field of Healthcare looks ambiguous when seen from a technical point of view as there is a lot of requirement for technology in surgical, diagnostic and monitoring instruments while on the other side healthcare focuses on delivering healthcare to entities which are under the bureaucratic control of governments. At an institutional level, the applications of Information technology usually focuses on administrative tools in a more conservative and conventional manner. Adoption of really innovative technologies is generally confined to a small professional group and there is no much attention towards the real information exchange among the providers of healthcare to the patient. Information and Communication Technology (ICT) have become very common in the era of globalization but its implementation in the healthcare domain has been comparatively slower. In terms of ICT applications in the health sector the term e-health is used which deals with the adoption and implementation of e-commerce technologies for improving the quality and availability of healthcare. (Craig, J, 2005)

The WHO (World Health Organization) (2009) defines e-health as application of digital data which is transmitted, maintained and retrieved electronically for supporting health care segment, both through direct interaction and remote access. WHO states that e-health encompasses a range of technological applications which facilitate medications, tests, formulating clinical decisions, result reporting, communicating important information on health issues and storing of pictures, text and images in a digital format. (Ganapathy, K, 2005)

E-Health covers a range of applications like mobile devices, information gathering software, e-learning methodologies and electronic health records which are a result of high innovation. Employing these tools can bridge the gap in healthcare while improving the quality in a substantial manner. For instance, a nurse residing in remote corner of the country can access information through her mobile or laptop regarding the latest treatments available in the world and emulate them for her patients. (Eysenbach, G, 2001)

Research Focus

Main focus of this research is to discuss about the “Problems and Possibilities of Telemedicine in India”, to analyze the present status of telemedicine in India and also to explore hurdles of telemedicine’s which are faced by Indians. In this research, importance of telemedicine for Indian habitants is discussed by quantitative analysis i.e. Case study model here “A case study of Apollo Hospitals” and “Case Study - Chakrimal village” is considered.
2. Background

India is the seventh largest country in the world with estimated total population of 1.17 billion; it has nearly 17 percent of world’s population, second only to China. The literacy rate was 68.5% with age group 15 or above (75.3% for males and 53.7% percent for females). Even though it is having diverse healthcare system it is facing lot of problems regarding the health care across the country. According to World health Organisation (WHO) each year around 900,000 people are dying in the country. As an average about 60 physicians per 100,000 people in India. Almost 70% of the people live in rural areas. (Division, 2004.) (BBC, 2007.)

The health care model in the country is a three-tier one supported by the Government which is primarily responsible for the health of its citizens. There is no uniform health insurance policy in the country as a result of which there is a difference in the health care services in rural and urban India. India has launched several initiatives in the domain of E-Health and medicine, which are actively supported by the Department of IT and Indian Space Research Organization in collaboration with state governments. Few major hospital chains have started their telemedicine networks like for instance Apollo Telemedicine Networking Foundation, started in the year 2000 and currently operate nearly five-hundred centers spread across the country. (Division, 2004.) (BBC, 2007.)

2.2 Healthcare system in India

Initially before examining healthcare position in India, it is significant to judge how healthcare functions in the country entirely. The Indian authorities take assurance of worldwide healthcare to its populae, but conduct that accountability to the nation. In Part IV Article 47 of the Indian Constitution, it is declared that it is a “duty of the State to raise the level of nutrition and the standard of living and to improve public health.” The major location all the way through which legislation is grounded on is the National Health Policy (NHP), formed in 1983 and simplified in 2002. (Rodriguez, 2003)

In addition, there have been several five-year plans that deal with concerns such as defensive medicine, infectious diseases and health in countryside regions. There are three main powers in health industry. There are authorities, faith and private associations. The authorities have integrated its hospital arrangement along with tiered grounds, with main health hubs (PHCs) in countryside regions, bigger hospitals in town like Taluka stage and the widest authorities’ hospitals in the cities. Trust hospitals, formed all the way through charitable donations and private-public relationships, provide facilities at a much discounted cost as matches up to private hospitals, but do not work by the authorities. As a final point, private trade makes up most of India’s healthcare ability, as most probable place of user expenditure. Presently, expenditure on healthcare in our country is about $80 billion and is
anticipated to develop to $339 billion in 2023 (Mehta et al. 2008). This consumption is about 6% of India’s CDP, with a growth rate of above 16%. Of total health consumptions, public division brings 26.2% with the balance upcoming from private sources. (Sood.SP, 2005)

Certainly, India is declared to be least health expenditure of the Asian countries and one of the least public health expenditures in a globe. After observing contribution of authorities, which is very least part among healthcare providers, there is no shock that customer visit private hospitals for their medical requirements. For average Indian, the recognized per capita expenditure for healthcare is about Rs 320 per annum. Out of this number, 75% gets from person input, 15.2% from state authorities, 5.2% from the central authorities, 3.3% from third-party insurance groups, and 1.3% from municipal governments and overseas contributors (World health Organization 2005). Although healthcare is worldwide, Indians give for it themselves. (Sood.SP, 2005)

2.2 Modern health systems in India

“E-Health is the combined use of electronic communication and information technology in the health sector”. (World Health Organization [WHO]) (WHO, 2012)

“E-health is defined as the application of Internet and other related technologies in the healthcare industry to improve the access, efficiency, effectiveness, and quality of clinical and business processes utilized by healthcare organizations, practitioners, patients, and consumers in an effort to improve the health status of patients”. (Broderick, 2005)

E-Health (also written as: E-Health, E-Health, e-Health. Etc) is widely discussed on the internet and it was emerged in the year 2000. It refers the various information and services that is either shared or modified through technology. It includes virtually all of the aspects associated with medical informatics but also focus around sending clinical data. (Broderick, 2005)

As per the WHO report the medium and high income countries are provided with some services like Citizen centred health systems, online health services, smart cards, electronic health records, ICT for distance learning and education, home based care supporting self-management of chronic diseases and public health information and communication systems. And for the low income countries the issues are more with Ensuring reliable, robust communications between health centres, laboratories, clinics and district medical offices, more widespread telecommunications infrastructure (including wireless and satellite), more reliable and user-friendly success devices. Some enhancements should be made with Integration of ICT and information management skills into the training of health workers, content that reflects local languages and culture, surveillance systems for health risks and emergencies. Telemedicine, EMR (ElectronicMedicalRecords), Health Informatics,
M-Health, Evidence Based Medicine are some of the studies done under e-health. A program called ITIH (Information Technology Infrastructure for Health) is being initiated by our government some objectives

a. Simplification of administrative procedures.
b. Promote information exchange among various set ups.
c. Ensure more access to affordable health care.

There is a very uneven record of statistics regarding health care facilities and financial resources among the rural and urban areas i.e., 80% in urban and 60% in rural areas. The PHC’s that are available in rural areas will be managed by a single medical practitioner and most of the population depends on him and there will be no perfect equipments to have better medication. TCCI (Tata Council for Community Initiative) and the District Administration of Pune was the first to start Telemedicine in India. The main idea to introduce this is to reduce the gap between doctor and patient to have a better communication with the available infrastructure. In AP the health awareness I promoted through internet. The high quality standards and professionalism in INDIA it made the world impressed and attracted the international business. (Broderick, 2005)

3. Research Methodology

Research methodology is a collective term for the structured process of conducting research. There are many different methodologies used in various types of research and the term is usually considered to include research design, data gathering and data analysis. Research methodologies are generally used in academic research to test hypothesis or theories. Having a clear methodology produces well results. Clearly outlined directions and procedures increase consistency, and to create work which can be repeated elsewhere, which is an important characteristic of innovative scientific research. This is why the methodology used in scientific research is always described, so that others can replicate the research themselves or identify errors in the methods used which may have created skewed results. (Järvenr, 2004)

Method Used

There are two main types of research methodologies used; quantitative and qualitative. Both of the research methodologies are often depending on each other, even they are different from each other. A quantitative research is subjective while qualitative is objective in nature; qualitative is descriptive while quantitative is experimental. Qualitative is inductive and the quantitative is deductive, quantitative approach generates numerical data
while qualitative generates non-numerical data. But in some cases both methodologies uses same time to answer the questions. (Beverley Hancock, 2002) (Järvinen, 2004)

Qualitative research methodology of inquiry is employed in much different academic discipline mostly in the field of social sciences. This research aims to gather an in depth knowledge of human behavior and the processes of such behavior. Qualitative research is concerned with the development of social phenomena. (Beverley Hancock, 2002)

According to Beverley Hancock, it consist questions like why people behave the way they do? How opinions and attitudes are formed? How and why cultures are developed in the way they have? And the differences between the social groups? Etc. It means that the qualitative research is concerned with the opinions, experiences and feelings of individuals producing subjective data. (Shank, 2002) Defined qualitative research as a form of systematic empirical inquiry into meaning means the planned and public.

My research is to provide appropriate information about telemedicine networks in India. This particular research discusses about the technological up-gradations in telemedicine which are used presently. The qualitative approach is used to complete this final thesis in which case studies are the methods of research. Through this research, importance of ICT in field of medicine is broadly defined with suitable case study. Main questions during the research are: why is it necessary for India to adopt telemedicine technology? What are the challenges to its implementation and how are they being addressed? What are the influencing factors for the sustainability of telemedicine program in India? And how a telemedicine program can be made sustainable in the context of India?

**Data Collection**

Qualitative research requires high quality judgment skills from the researcher as the research is often designed at the same time it is being done. Qualitative research is towards seeking explanation of social aspects of the world (Hancock, 2002). So in this research an extensive literature review is conductive and the two of the case studies are discussed to answer the research questions. Literature review of telemedicine in India is considered to know the importance of e-health in India, the literature about Indian telemedicine is collected over internet through different keywords on Google Scholar. Other sources for literature used were Diva a national database for Swedish universities and ACM etc. This is done by going through a literature review case studies of Apollo Hospitals and Chakrajmal Village, relative recommendations are suggested. In order to gain deeper results on importance of eHealth for Indians a lot of literature on eHealth is available; particularly what has been published during 2003 to 2010 was studied in detail.
The literature study and the case studies were discussed together to generate the results. The knowledge collected from these sources was analyzed deeply under the light of discussed literature review. From the analysis of data collected, provided barriers and problems for eHealth in India and finally some of the suggestions to overcome these barriers is given.

4. Literature Review

By using the resources from health sector and telemedicine services telecommunication is widely used by various age groups in most of the developed countries. Mostly old people utilize these health services where persistently ill and handicapped people are expected to be a part of this. Telemedicine or e-health service is the main profitable area for the country which is a combination of several health care services that helps the patient for better care. This is possible because in this environment the doctors or health employees are not replaced. The main advantage of telemedicine is that it reduces the distance of travel, patient expenses, time, and physical pressure because of remote care. A health professional can communicate with specialists from any place at any time that makes a assured relationship between the patient and doctor. Addition to this it is used to increase the health awareness in rural areas and also encourage the medical practitioners to improve their skills professionally. All the medical practitioners around the world can communicate with each other that overcome the environmental barriers and leads to the expansion of health care services as well as educational resources. (Archna, 2007) (S. Tachakra, 2003) (Craig, J, 2005).

4.1 Need of Telemedicine in India

There are many reasons for the increasing popularity of telemedicine in India. The country is having number of remote towns and villages which are not having proper facilities for healthcare. Almost 80% of healthcare facilities are in urban areas where as only 30% of the people stay there. The scenario is clearly revealed by this data that only 20% of the health care facilities are provided to the rest 70% of the people living in the rural and remote areas. (Kaur J Mishra SK, 2007)

The rural population is much prone than the urban population mainly due to three reasons, the time taken to communicate with health care centres, late diagnosis of the condition and lack of skills in the health care providers in the rural areas. Telemedicine is potential which is capable of dealing with these issues in an effective manner, provides cost effective treatments and results in cost savings by avoiding travel and other expenses. Indian healthcare system has benefited a lot from telemedicine and telemedicine continues to contribute
to the growth of Indian health-care system in terms of care and disease healing. (Mishra.SK, 2005)

Telecommunication by various expertise organizations like Tata Consultancy Services, Wipro, Pentafour Software, and Tata Unisys are famous in India. India is said to be, it is in an exclusive situation for constructing its telemedicine substructure. Through its trained medical practitioners and rising technical trade, nation has a chance to establish huge number of goods and facilities to supply to developing region. Due to its knowledge on ICT, India appears balanced to integrate telemedicine ahead of its present basic projects to major programs that can function as an example for itself and rising global. (Kannan, – 2008)

4.2 Current Status of Telemedicine in India

As per analysts, any hospital with 100 beds capacity is an IT- buyer. According to a survey there are more than 1000 hospitals in India which belong to this category. National Association of Software manufacturers are a service Companies (NASSCOM) predicts that healthcare systems in India will spend more than INR 100 million on IT in present year. (Dr. S.K.Mishra, 2006)

Initiatives of e-health by government are:

- Hospital management systems and networking hardware which are needed for telemedicine process. Even though e-health has small scale of operations it adapts vital changes which are implemented across the world which supports initiatives of telemedicine and health care industry entirely.
- To support this infrastructure, some steps are taken by government to protect the privacy and confidentiality of health information. Some necessary steps are also taken to train several stakeholders of healthcare industry to fulfil health information standards. (Dr. S.K.Mishra, 2006)

The above initiatives are having the information standards and a strong legal support. The telemedicine reduces the gap between the urban and rural areas regarding the health care services. In India there are more than 150 telemedicine proposals which are supported by Indian Space Research Organization and IT Ministry. On an average daily 6 consultations are happening in each telemedicine centre. As there is a decrease in price of the technology the telemedicine is now very much affordable.

In some emergency situations which are very common in India telemedicine has proved to be very useful. It reduces the time of journey as well as is coming with less cost and with more secured and best treatment. The people in rural areas are much prone to diseases but the availability of the best practitioners is less. Using telemedicine people in rural areas can
access the doctors virtually with in no time. This practice of telemedicine is very supportive in terms of financial status and the time to get access to the best doctors. 70% of the skilled professionals are offering their services in the urban areas and 23% in semi urban and only 2% in rural areas which makes it highly possible for the people in rural areas to get the best treatment. This is very much in contrast as 70% of the people live in rural areas where as 30% people live in urban and semi urban areas. This means only 30% people are getting access to the proper hospitality and treatment. (Dr. S.K. Mishra, 2006)

Telemedicine is capable of decreasing the gap between the health care services in the rural and urban areas. Now a day's telemedicine has developed with the increase in technology in multimedia, computers and data system, telecommunications. Telemedicine allow people of remote area to get the services in super speciality hospitals. Regular diagnosis and suggestions from renowned doctors helps the patients in saving their lives, wealth and time. (S.K. Mishra, B.S. Bedi, L.S. Satyamurthy, K. Singh., 2006)

In India small hospitals lack the sufficient facilities and they don't use the latest technology in diagnosing the illness. Thus telemedicine is most beneficial and reasonable to the people who cannot access the health care services to the fullest.

In 1999, C-DAC started growth program of telemedicine technology in India, with an objective of representing and measuring its feasibility in India. (Dr. S.K. Mishra, 2006)

4.3 Specific Activities of E-Health (Telemedicine) in India

Indian healthcare system mainly consists of three levels. The first one has being the primary health care in a group of villages. The second one is the secondary level health centre which is located at district level and the third one is the tertiary level located in the cities and medical college hospitals. Presently, 75% of the qualified doctors are in urban, 23% in towns and only 2% in rural areas where as the vast majority of the people live in the rural areas. Hospital beds per 1000 people in rural areas is only 0.10 when compared to 2.2 in urban areas. ISRO's Telemedicine has been broadly divided in to the following areas: (Dr. S.K. Mishra, 2006) (WHO, 2012)

a. Providing Telemedicine technology and connectivity between rural and remote hospitals and super speciality hospital for Tele-consultation, treatment and training of doctors.

b. Providing technology and connectivity for education between medical colleges and postgraduate college/hospitals.

c. Providing technology and connectivity for Mobile telemedicine units in rural health camps.

Telemedicine software system has been developed at Mercury by Centre for Developing of
Advanced Computing, C-DAC. This supports Tele-cardiology, tele-Radiology and Tele-Pathology etc. At present under the ISROs project Telemedicine Network consists of 75 Hospitals, 61 are Remote/Rural/District Hospital/Health centres connected to 14 Super Specialty Hospital located in the major cities and more than 12,500 patients have been provided with Tele consultation & treatment. (Dr. S.K.Mishra, 2006) (WHO, 2012)

In last few years, there are various telemedicine projects in India. Besides this dealing with ailments, telemedicine projects also allow for health instruction and defensive health care to individuals in distant areas where lack of knowledge about the project is a main cause behind ailments.

"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 disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities” (WHO, 2012)

Telecommunication is the combination of communication, information technology, biomedical engineering and medical science. A customized hardware and software will be installed at both the ends of patient and doctor with diagnostic equipments. A network hub is used to connect them through a small device called VSAT(Very Small Aperture Terminal). By communicating through this the information can be sent to specialists through digital transfer system and can have a better diagnosis and treatment. The most useful thing of this telecommunication is to have a better follow-up of the patient in case of post-operation by having a video conference. This reduces the time and travel expenses of the patient. This technology can be used widely in three ways. The first one is point-to-point which is between a single patient and a specialist doctor. Next one is one point to multi point system which facilitates a patient to communicate with various specialist doctors. The last one is Multi point-to-Multi point system. In this various patients will communicate with different doctors at various geographical locations.

**National Task Force on Telemedicine**

In the later part of the year 2005 Ministry of Health, Govt. of India has constituted a National Task Force on Telemedicine. The group has met once in the month of October and formed various working groups to work out various issues related to telemedicine in the national context. (Dr. S.K.Mishra, 2006)

**Tele-health Industry operating in India**

In technical aspect India is now capable of providing the necessary hardware, software,
connectivity and services for the implementation and growth of Telemedicine. Industries providing hardware and software supports are Apollo Telemedicine Network Foundation, Hyderabad; Online Telemedicine Research Institute, Ahmadabad; Televital India, Bangalore; Vepro India, Chennai and Centre for Development of Advanced Computing. At present there is a lot of increase in the usage of telemedicine. But it takes quiet some time to fully implement the telemedicine. Most of the implementation is still in the product stage. Even the broadband connectivity has been prevailed to the remote areas and the cost has been decreased credibly. (Dr. S.K.Mishra, 2006)

As a result of ISRO’s Telemedicine Endeavour, remote areas like Kargil and Leh in the North, offshore islands of Andaman and Nicobar and Lakshadweep, as well as some of the interior parts of Orissa, Karnataka, Kerala, Chhattisgarh, J&K, North-easteren states of India and some tribal districts in certain other states have access to specialty healthcare from some of the major specialty hospitals in the country today.

<table>
<thead>
<tr>
<th>Major Areas</th>
<th>Telemedicine Technology Adopted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tele-Consultation</td>
<td>The Patient with the local doctor consults the specialist, obtains the line of treatment</td>
</tr>
<tr>
<td>Tele-Diagnosis</td>
<td></td>
</tr>
<tr>
<td>Tele-Treatment</td>
<td></td>
</tr>
<tr>
<td>Tele-education</td>
<td>For continuing Medical Education, Training for doctors and paramedics from a higher level Hospital/Institution</td>
</tr>
<tr>
<td>Tele-Training</td>
<td></td>
</tr>
<tr>
<td>Tele-Monitoring</td>
<td>Regular monitoring for intensive care &amp; emergency care</td>
</tr>
<tr>
<td>Tele-Support</td>
<td>Support during disaster management</td>
</tr>
</tbody>
</table>

Table (I) - Major areas of Telemedicine Technology Adopted (WHO, 2012)

4.4 ISRO’s Telemedicine Network

Some important factors in various countries

<table>
<thead>
<tr>
<th>Factors</th>
<th>India</th>
<th>USA</th>
<th>UK</th>
<th>Germany</th>
<th>Australia</th>
<th>Asia-Pacific</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Growth rate</td>
<td>1.55%</td>
<td>0.9%</td>
<td>0.23%</td>
<td>0.27%</td>
<td>0.99%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Birth rate (per 1000)</td>
<td>24.28</td>
<td>14.2</td>
<td>11.54</td>
<td>9.16</td>
<td>12.86</td>
<td>22.16</td>
</tr>
<tr>
<td>Infant Mortality Rate</td>
<td>63.19</td>
<td>6.76</td>
<td>5.14</td>
<td>4.19</td>
<td>4.97</td>
<td>40.19</td>
</tr>
</tbody>
</table>

Naga Pradeep Movva
Currently ISRO's Telemedicine Network has 75 Hospitals in which 61 hospitals are in Remote areas, rural areas, District Hospital, and Health Centres which are connected to 14 Super Specialty Hospitals situated in major cities. (Samuel.K.Moore, 2002)

**ISRO'S TELEMEDICINE NETWORK**

![Diagram of ISRO's Telemedicine Network](image)

**Table (ii): Some important factors in various countries (ISRO, 2005)**

<table>
<thead>
<tr>
<th></th>
<th>8.74</th>
<th>8.71</th>
<th>10.35</th>
<th>10.42</th>
<th>7.18</th>
<th>6.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death Rate (per 1000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life Expectancy Rate at birth (in years)</td>
<td>51.2</td>
<td>77.4</td>
<td>69.7</td>
<td>70.7</td>
<td>71.4</td>
<td>69.7</td>
</tr>
<tr>
<td>%GDP on health</td>
<td>4.9</td>
<td>14.0</td>
<td>7.4</td>
<td>10.6</td>
<td>8.3</td>
<td>2.7</td>
</tr>
<tr>
<td>GDP per Capita</td>
<td>2,540</td>
<td>36,300</td>
<td>18,410</td>
<td>25,580</td>
<td>17,980</td>
<td>818</td>
</tr>
</tbody>
</table>
4.5 E-Governance on E-health (Telemedicine) in India

The public health service which is run by the government is facing lot of problems and is detoriotating day by day. The large geographical size, increase in population, lack of transport, lack of accessibility, illiteracy, poverty, lack of enough nutrition, differences in food habits and life style are the different factors responsible for this situation. Government priorities like providing food, water and education are yet to be fulfilled. At this stage low budget for health and lack of funds have brought down the health services. As there is a lot of development in information technology there is a need to connect all the sectors using this Information Communication Technology(ICT). This will help the doctors to provide there valuable services to those people who couldn't get the maximum benefits from the health care services. All the IT giants started experimenting the ICT in both private and govt hospitals from 2006.

The e-Governance initiative by the Govt. of India examines the practical implications of IT related issues in the Government with the aim of improving services to the citizens. The application of e-governance in health care can monitor and improve the quality of health care services, make the system efficient, transparent and cost effective as it will bring healthcare providers, policy makers, professionals and the public on a common platform. The government of India has launched Village Resource Centres (VRCs) using communication and remote sensing satellite provided by Indian Space Research Organisation (ISRO) to give essential and intelligent services to 600,000 villages. The villagers will get information on agriculture, health, education, natural resources through VRCs. Initially, the VRC will be set up on the Andaman and Nicobar Islands, Wayanad and Palakkad areas of Kerala and in some parts of the northeast.

4.6 Empirical case Study on Modern health (Telemedicine) in India

Telemedicine projects in India are actively supported by

- Department of Information Technology (DIT)
- Indian space Research Organization
- NEC Telemedicine program for North-Eastern states
- Apollo Hospitals
- Asia Heart Foundation
- State Governments.
- Telemedicine technology also supported by some other private organizations.

Case Study - Apollo Hospitals Ltd

Being one of Asia's biggest private health-care groups and the seventh biggest in the world Apollo Hospitals Ltd since 1987, has extended its services by offering unparalleled health-
care through tele-medicine projects. Aragonda project was the first tele-medicine station set up by Apollo to cure diseases like malaria and others which are prevalent to Aragonda and neighbouring villages. The Apollo Hospitals also facilitate Army Hospitals India passing through an association centre to its telemedicine services to develop the capability to remotely serve soldiers in war time and during disaster relief. In the last decade Apollo team, had made several attempts to increase the awareness about telemedicine activities which are aimed at providing healthcare services to remote areas and also for promotion of education across the country. The telemedicine concept which is currently used is developed by a team of stucnet who is pursuing Hospital Administration. The company formally launched Apollo Telemedicine Enterprises Limited as a non-profit wing in Sep’1999. The project sole intention is to provide tertiary care and to cut costs and save precious time in providing healthcare for people residing in remote areas. After executing the project successfully in Bangladesh and few other locations, now the group is looking forward to implement the project all over the country by connecting all its hospitals to three specialty centres located in Hyderabad, Delhi and Chennai.

Project is brought into effect with the help of tele-medicine project software which gets to work in 3phases. In primary phase data transformation from consultation centre takes place and, in second phase patient record is accepted and tele-consultation is fixed and finally consultation details are viewed. Patient’s details record known as electronic medical records (EMR) is transferred from consultancy centre to specialty centre with help of software known as Emescpe, which is freely available in the market and user friendly software for the doctors. By providing the Unique Health Identification Number (UHID), assigned by the Apollo Hospital as a one-time registration number to the patients, the Emescpe furnishes the medical history of the patients recorded on the database. For the reference of the patients, their medical history is made available on labvalues.com which are accessible with the help of patients UHID and password. New records of patient and all necessary details like, age, name, symptoms, ailments, diagnosis so on etc are updated by using same UHID number in emedscope.com. In addition to this Radworks software is being used for online transmission of CT scans, X-rays and other related pictures of the patients. In next stage EMR of the patients’ are transferred from Emescpe software to client software. Data can be transferred by anyone of these options such as internet, physically or through remote access service (RAS). Specially centre consist of telemedicine rejected/accepted page and tele-consultation page. Based on availability of doctor, tele-consultation appointment of is accepted, rejected, kept pending or cancelled. Appointment schedule is sent to consultation centre by using reference number. In last stage, clinical receptionist in consultation centre views the appointment details to verify status of patients’ appointment (Ganapathy.K, 2005).

Apollo Telemedicine Enterprises Limited saves patients’ data on centralized database server

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which is situated at Atlanta. As part of its apollolife.com site, Apollo group plans to offer online medical records maintenance to its patient for reasonable cost. Fist telemedicine treatment in Aragonda was given to 11 years old girl having a hole in her heart valve as her condition of ill-health was not identified by the general doctor in the Aragonda hospital and later her eco-cardiogram was sent to specialist in Hyderabad to diagnose the problem. Then Specialist studies the patient’s reports and based on the condition of patient he fixes date for tele-consultation and he also gives some suggestions through telemedicine software. On fixed date specialist interacts with patient and general physician in remote area through video conferencing and then based on condition of patient treatment is started. This is how the project of tele-medicine works (Ganapathy K, 2005).

Execution of Telemedicine in India

In spite of the problems and challenges India has made a great progress in the field of telemedicine, as well as in the implementation across the country. Establishment of e-health now include support of both private and public sectors. The telemedicine projects are now supported by Ministry of IT, Communications etc wherein superhighway was placed among three third stage hospitals like AIIMS at New Delhi; PGIMER, Chandigarh and SGPGI, Lucknow. ISRO (Indian Space Research Organisation) has founded space based telemedicine in 2001. Presently ISRO is supporting satellite based connections to around 200 health care systems across India (ISRO, 2005).

In case of Apollo’s Aragonda (2000) project has been satisfactory to affect then US President Clinton, who applauded Apollo for its efforts to provide healthcare services by using hi-tech medicine, for the population of this Indian small town in Andhra Pradesh. After the success of this project Apollo started its telemedicine services across the country. Now India takes pride of having around 500 clients across the country which is said to be a unique achievement. Currently, India goes through following with regard to telemedicine (ISRO, 2005):

- Growth of original telemedicine equipment
- Test beds for clinical test
- Accessibility of foremost raised areas in technical and check-up for changing and exercising telemedicine
- Placing guiding principle and values for working telemedicine in India
- Settling model for IT substructure for healthcare
- Accessibility for capability for forces
- Worldwide consultations and so on
Technology Used for Telemedicine Project

Today millions of people are using internet to get the information regarding health. This type of tool has a major impact on their life which also improves their health. Cyber doctors gives appointments to the patients and also offer 24 hours service to the patients around the world. They even prescribe medicines through net. Internet is very much responsible for the growth of e-health programs in India. Numerous health care providers are using internet to obtain information of patient to offer health care and medicine. Several staff members report that there has been a rapid increase of patients at offices to know about healthcare websites and also about the health information content on internet (ISRO, 2005).

Aragonda project had two centers in which one is specialty centre and the second one is consultation centre and these two centers are connected to each other. Specialty centre is a room which consists of advanced equipments like high-resolution video camera (polycam), web camera, document camera, PC, microscope, telephones, microphone, speakers, fax machine, and modem. Technology which is used in specialty centre is Internet, trans-telephonic ECG, digital imagery. Specialty centres are present in Hyderabad and Chennai. Here medical experts from various medical fields are available from Apollo Multi Specialty Hospitals. From specialty centers medical specialist communicates with a RMP in a remote area Consultation centre which is established in 50-bed Aragonda hospital. Technology which is used in specialty centre is used here also. Equipments which are used in specialty and consultation centers are manufactured by GE, Wipro and Citadel. (Iwasaki, 2001)

Consultation centre in Aragonda and specialty centre in Hyderabad are connected with help of Integrated Services Digital Network (ISDN). For this project, Department of Telecommunication (DOT) has provided 128 kbps (Kilobytes per second) line and this was subsidized by Central Government of India. As back up at Hyderabad, the hospital used Very Small Aperture Terminal line (VSAT) of 2 mega bytes per second (mbps). Srinarikota and Aragonda are directly linked to Chennai specialty centre with the help of VSAT of 2 mbps connection with help of ISRO. To lay VSAT line 2 years of time period was taken for establish the Very Small Aperture Terminal line. VSAT connection is costlier connection but it works faster than Integrated Services Digital Network links. But for practical reasons villages can be easily connected with ISDN links. (ISRO, 2005)

Hyderabad is connected to two consultation centers with help of ISDN line which are located in Calcutta and Guwahati. Polycam is a vital device which is used for consultation. It is video conferencing device which also includes voice transmission enabler. Polycam is connected to ISDN line and TV at specialty and consultation centre. From consultation centre CT-scan, X-rays, ultra sound, colour Doppler etc. are transferred to the Integrated Services Digital Network line with help of interface. In specialty centre medical record are obtained on system and these records can also be viewed on TV with help of polycam which

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uses interface. If polycam is not present consultation centre used web cam between Calcutta and Hyderabad. High resolution/luminosity subsystem is used for transmission of echocardiograms and x-rays. To capture positive and negative images high-end scanners are used in specialty centers. To transfer ECG, unique trans-telephonic device is used which is linked to ECG machine on one side and to telephone line on other side. Digital or electronic stethoscope can be used to hear the heart beat. ECG equipment is placed on patient and is connected to telephone line and doctor who is at specialty centre can hear heart beat on system or telephone. If video conferencing treatment is done then voice is transfer by voice-enabling device which is attached to the polycam. For clear transmission of heartbeats voice enabling device has features such as echo-canceller and sound reduction units. (Mishra.SK, 2005)

5. Analysis

A significant number of researches are already performed on how telemedicine is changing the way of e health in India. The Ministry of Health & Family Welfare, Government of India is working hard for the development of policies for telemedicine and e health in India for the benefit off health related institutes like hospitals and medicine producing industries, but this task needs more time to complete (Kaur.J Mishra SK, 2007). ISRO (Indian Space Research Organization) in 2005 wrote a research article in which they writing about the enabling specialty healthcare to the rural and remote population of India (WHO, 2012). Through the telemedicine projects, ISRO has successfully linked hospitals and healthcare centers in remote rural areas with specialty hospitals in cities through INSAT satellites (WHO, 2012). Malina Jordanova (2010) wrote in there document about mobile health system in developing countries, they described a detailed infrastructure of e heath system working in India during 2006-2010. M health systems are very useful in case of tourist during their visit in rural areas; they can get support at the spot anytime anywhere. Long term acute care LTACH developed in 1980 (Jordonova, 2010). Those living in suburban and rural areas may have limited or no access to neurological care. (Ganapathy.K, 2005) Writing about how the practice of neurosciences will change with increasing use of telemedicine and ICT. Clinical effectiveness and cost-effectiveness have been demonstrated by (Craig. J, 2005). (Rita H. Wouhayibi, 2010) Presents a context-management framework for telemedicine that is designed to capture sensor data for transfer to a remote location; they also further described an application developed on top of the framework for emergency medicine. The concept of virtual hospitals for new solutions and mobile/Internet technology has laid the structure upon which one can build a potent, advanced and critically needed platform for health services: The Global Virtual Hospital (GVH). (Palem., 2010), A web based telemedicine system integrated with the hardware for energetic, measurement and with context and rational support can provide an immersive practice of a virtual health clinic.
Deployment of this system can provide, anywhere, anytime healthcare that can complement the existing healthcare system (Savio Monteiro, November 1, 2011)

**Possibilities of Telemedicine in India**

- Transmission of digitized audio, video and still images.
- Improvements in quality of care in rural and undeserved communities
- Overcoming isolation of rural practitioners by linking them to urban medical centers.
- Delivery of information and services in to the home.
- Monitoring the patients at home.
- Keeping patients in the community and maintaining continuity of care.
- Reduction of travel time and expense for physicians and patients.
- Increased mobility as people move from urban to rural areas with continued access to specialists.
- New business and marketing opportunities.

5.1 Traditional healthcare dominance on modern health systems in India

**Case Study - Chakrajmal village**

Chakrajmal Village is in Bijnor district in north Indian state Uttar Pradesh. It got its first doctor in 2008. He doesn't belong to the village. The villagers had access to the doctor via telemedicine project which was launched by World Health Partners (WHP) to provide health care services to 1,000 villages in Uttar Pradesh’s Bijnor, Meerut and Muzaffarnagar districts.

WHP is a US based organisation which works towards the health care of the poor people. The organisation works for drawing the private sector, innovations in labour management and using technologies at low cost to develop a sustainable health care services. Now the WHP network in Uttar Pradesh covers 1,200 local individuals called Sky Care Providers and 120 entrepreneur-run centres branded as Sky Health Centres. The Sky Care Providers are given training and low-cost mobile solutions by WHP to perform diagnostics, symptom based treatments, tele-consultations and, wherever needed, referrals to the Sky Health Centres. These centres use remote diagnostic devices to measure the basic parameters as heart rate, blood pressure, pulse rate etc. The patients are connected through WHP central medical facility to doctors via webcams and computers. Patients who require treatment that is not possible through telemedicine are referred to the nearest WHP clinics. (Knowledge@Wharton, 2012)

The entrepreneurs are of the following opinion regarding the telemedicine “Telemedicine is a good strategy to strengthen the existing human resources available in health care. The scale, however, will come only through effective government intervention.”
Even though the telemedicine scenario is changed there are challenges to be overcome. The biggest challenge is getting the skilled doctors to look in to the problems faced by the people in remote areas and also making the people of remote areas believe in the opinions given by these doctors through telemedicine. According to the analysts there will be more than a billion phone connections and network will not all be a problem. But finding the right linkages is the biggest challenge. People of remote places should be educated and made aware of the rising technology. The cost effectiveness should be clearly made understood by the people in these remote areas. The doctors should cooperate else the people cannot believe in the telemedicine.

People in the remote areas are very much used to the traditional practices of the health care. Most of the people in these regions are illiterate. People should be made aware of the technology, telemedicine and the urgency of the skilled doctors and their suggestions. The first challenge is making the people educated about the technology and its advantages. It is giving large number of sessions regarding the usage and advantages of telemedicine to the people so that they can use this telemedicine for their betterment. The doctors should feel responsible so that the people can believe in them. The traditional healthcare can also be included in telemedicine. Doctors should cooperate with the people. Even the government should take the responsibility in making the telemedicine available to the remote areas. (Knowledge@Wharton, 2012)

5.2 Barriers of E-health in India

Population size: Indian population was about 1028 million as per 2001 census. The population growth is not even for all the states and union territories. As there is a large population implementing telemedicine faces many problems in terms of infrastructure, facility, the manpower and the funds. The population growth is not even for all the states and union territories. There is a wide disparity between different income groups, between rural and urban communities and different states and even districts within states. (Rodriguez, 2003) (Manpreet Kaur, 2011).

Population Distribution: A major portion of Indian population is living in the villages. Around 743 million populations is living in rural areas, that is, 72.2% Indian population is living in the rural areas and 7.3% is living in the urban areas. Spreading these facilities to low density areas or in rural areas and to extend these facilities to the population is a very cumbersome process. But the majority of the healthcare issues are reported from the rural areas where only 2%-3% of doctors and specialists are available. (Rodriguez, 2003). (Manpreet Kaur, 2011)
Illiteracy rate: The literacy rate in the country is 64.84 per cent, 75.26 for males and 53.67 for females. Low literacy rate is a bottleneck in the success of E-Learning, E-Health or E-Business system which in turn affects the Telemedicine usage. (Manpreet Kaur, 2011)

Awareness: The population in the rural areas is not much aware as compared to that of the urban areas; the reasons may be the literacy rate, poverty rate or some other factor. Even the studies show that behaviour of the citizens of about same income group but of two different urban areas or metros vary widely in terms of the awareness towards their needs. There is lot of development in the field of biomedicine and information technology. The doctors should take the responsibility to make the people aware of this in the rural areas. (Manpreet Kaur, 2011)

Connectivity Problems: There are still some areas which are not properly connected by rail or road. Many of the villages have not even telephone lines. The others are facing the issue of electricity. Inadequate medical facilities in rural and inaccessible areas. Many important telemedicine projects have been hampered by the lack of appropriate telecommunications technology. Regular telephone lines do not supply sufficient bandwidth for telemedical applications. Many rural areas still do not have cable wirings or other kind of high bandwidth telecommunications access required for more sophisticated uses. (Manpreet Kaur, 2011)

Language Problem: Different areas have different languages and this is a major problem as eLearning contents which are in English and to convert these into different languages is a major task.

Cultural Issue: Classroom learning is treated as actual learning and any type of eLearning is looked at it as second grade of learning. People prefer to get treatment by presenting themselves before the doctor rather than getting treatment through Telemedicine, Telecare technologies. (Manpreet Kaur, 2011)

Poverty Rate: Approximately 250 million people are below the poverty line. 75% of the population below the poverty line is residing in the rural areas. The main causes of poverty in India are dependency on agriculture, population growth rate, and regional inequalities etc. It becomes difficult to afford any equipment required for these services. The cost of healthcare is very high and lack of sufficient funds to invest in rural areas also stands as a barrier. Even the specialist doctors are not placed in rural areas as they will be isolated which is not even preventable by monetary means. (Manpreet Kaur, 2011)

Knowledge barrier: Deficiency in the information provided is the major problem in tracking IT-changed health care service. Present information measure does not maintain simple shift
of examined papers. Several number of organizations utilized in a nation are not well-matched with highly developed organizations of other nations. The substructure difficulties of a nation mostly concern to inaccessibility of a power which provide without any disturbance, restricted net connectivity, deficiency of an effective public moving organization, deficiency of marketable infinites for place of business, etc. Telecommunications and connectivity effects such as bandwidth, phone call expenses, and Internet admittance and so on require dealing with for expansion and growth of serves sector. Furthermore health care applications utilized nowadays are old-fashioned they are not practical across unusual stages. (Seaton.B, 2004)

Financial Difficulties: The financial division in a nation with value to release of health service and e-business surroundings affecting overseas direct investment funds, assistance of e-commerce, etc. is largely well-disposed. The main concern has been pertaining to dealings with overseas exchange. In olden times breakdown of medical record organizations has dissuade citizens from spending in health care associated trades. Nowadays everything has been changed. There are no economic difficulties these days. In fact, a number of organizations such as Godrej, TVS grouping and Bhilwara group are spending in medical transcription organizations. Price differentials that the Indian organizations were providing are declining. (Seaton.B, 2004).

5.3 Technical & Social factors of Telemedicine

Currently, in spite of accessibility of e-Health schemes and service, they are not still broadly utilized in real-life-time medical or health positions. A main cause why European and national policy objectives have so far not been accomplished with regard to e-health is that very small dependable prove is existing on optimistic like economic and other affects of these originality. The aims of this plan are:

1. To formulate a common appraisal and valuation model and method, together with measure instruments for valued pointer, for e-health goods and facilities concentrating on optimizing economic source allotment.

2. Recognition of products pattern illustrations of e-health applications across Member States which have relevance in the field of this analyze as hospital and territorial nets incorporating practice and instruction educated from these cases into system.

3. Enforcing process and measurement instruments formulated to 10 practical application locations reflecting territorial and health arrangement kinds of the Union in domains of hospitals and territorial nets.
5.4 Challenges of E-health in India

India is a vast country with extremes in availability of communication systems including rail, roads and other telecommunication systems. A large section of people cannot make use of these technological developments particularly those living in the rural areas. Around 650 million people are living in villages. Around 27000 villages don’t have minimum communication. Around 51000 villages need to still get the power supply. Where there is a power supply it is most often erratic. Telecom facilities doesn’t exist either. There are approximately 200,000 villages that have yet to get simple analog telephones. Most of these villages are in extremely remote and it will take many more years for them to get connected to the main land of India. Some of these villages are also located near international borders in the north and are of military importance. Although there are highly advanced communication systems available, operating these systems would require some minimum understand and literacy level. Providing access to information and services to the large population of over one billion with over 400 million persons who are illiterate is a challenging task. Maintaining a gender balance in utilization will also pose some difficulty particularly in areas where mobility of women is restricted. The literacy level of rural women is 30%.

Moreover, the telecommunication system will be most utilized in rural areas where 55% of the people cannot read and write. The health care facilities are also falling short of norms. There is a need for additional 21,983 Sub-centres, 4,436 PHCs and 3332 CHCs. Only 25% of those living in villages have access to health care services. Over 40% of Indians borrow or sell assets to meet hospitalization expenses. Imparting skills and knowledge appropriate to suit the diversities including icons would require different skills of the person developing these modules. Then there are certain barriers to gaining knowledge such as shifting from the traditional and with a human interface, distance of these knowledge centres, costs, and technology phobia among both the health care provider as well as the community for whom the services are being provided. Sustainability of such a high level of communication would require continuation of funding for many more years until the system becomes self-reliant. Manpower is another major constraint both in the IT sector as well as in the health sector. Although over 813,000 people are employed in the IT industry, India needs to have at least 2.2 million. Satellite transmission can help but is very expensive.

6. Discussion and Conclusion

Future Possibilities of Ehealth in India

The health care industry has traditionally been seen as conservative and slower industry to adopt technological innovations than industries such as banking, finance and telecommunications. In 2002, IBM produced a report outlining their vision of e-health ten
years hence, in 2012. It also identified a number of key technological enhancements that will drive improvement in health care provision, including:

- Increases in bandwidth.
- Advancements in wireless technologies
- Improvements in storage capacity
- Screen resolution enhancements
- Decision-support system enhancements
- Increased acceptance and use of the Web in everyday life
- Integrated clinical and business application software
- Developments in telemedicine
- Improvements in e-business transactions
- Developments in data warehousing and data mining

**Recommendations & Strengthening E-health Industry in India**

So far the growth of E-Health is dependent on private sector which is aided by certain policies of the government. It didn’t have the expected impact on the health care market. A more efficient health care system can make India a competitive country in the health sector. By improving the quality of the professionals and computer education and by decreasing the price of internet there can be an increase in terms of E-Health both in domestic and international service providers. Higher bandwidth will increase output of Indian service firms and will also enable them to utilize more data/picture intensive and high value-added work. Uninterrupted power supplies should be offered, for the same reason as mentioned for essential services. It should be made mandatory for all health care entities to follow health information standards in a phased manner. This will reduce administrative costs for government, reduces medical errors and will make it easy to exchange health information among different entities in our health care industry. Laws must be framed that will protect privacy and confidentiality of health information. Should implement a licensing mechanism to ensure quality of service for domestic e-health service providers and also improve quality of English at all levels of education system. There is a need to increase the number of medical and paramedical graduates per year. This will not only help the ITES industry but also cater to existing demands for health care in rural areas. Also computer literacy level in health care system should be increased and IT education must be made compulsory for all medical and paramedical graduates. Incentives must be provided to health care organizations for training their employees in basic IT applications. Increase venture funds for capital investment and number of long gestation projects in areas such as biotechnology should be increased.
Conclusion

There are several up-gradations in technology every day and our lives have been influenced by these changes. Growth of information infrastructures, computing technology, telecommunications, and so on, has showed us a new way to see and perceive things. Things have become simpler, easier, faster and cheaper than ever and are changing radically. New findings are taking place quickly and technology is becoming more accurate and precise. Advanced technologies have resulted in development of new health projects which are specific, result oriented and unique. At present telemedicine is only one category of technology, but it may soon be “ears and eyes” of health care organization.

Recently in India E-health services were adopted by healthcare provider organizations. Growth of e-health services has given rise to need of new healthcare professionals, healthcare administrators and healthcare technologists. Till today, many medical, dental, nursing, pharmacology and other healthcare degrees do not have courses related to information technology. Telemedicine continues to benefit Indian health-care system in terms of care and disease treatment. Several technology companies like Tata Consultancy Services, Wipro, Pentafour Software, and Tata Unisys are providing telecommunication support needed for telemedicine, but much remains to be accomplished before telemedicine can reap its benefits for India’s growing population. India is in a unique position for building its telemedicine infrastructure with its educated medical practitioners and emerging technological industry, the country has opportunity to create huge number of products and services.

From the above research it can be concluded that successful implementation of telemedicine depends on connectivity and volume of transactions. In India only 2% of doctors visit rural areas so telemedicine must be introduced in small towns where there is lack of facilities but, cultural acceptance of telemedicine is still limited. In the above research case study of Apollo Hospitals is considered. It is a large organization with substantial number of computer experts and doctors, such a backbone may not be available in other developing countries. India has to develop low cost service delivery options since health care services are moving from public realm to private realm. Hence, the rate of diffusion of telemedicine continues to be low. Given the scope and potential of telemedicine in India, initiatives are taken by the private players such as Apollo for evolution of telemedicine platform.

"Though we have more advantages with telemedicine services we have some disadvantages and risks too. The very first thing is security in which data may be corrupted and stolen by some of the intruders. There may be some errors while transferring data that can lead to false diagnosis. Communication gap may occur because of people from various languages. Network failures may occur while transferring the data through internet. To assist the
mental health care, primary care and long term care, telemedicine is very useful and to face many challenges. Due to the lack of sufficient infrastructure this telemedicine is kept as a secondary option in India. A standard data protection service from Europe is used in the network to avoid data loss and to increase the protection to transfer the confidential information."

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