

# **Tracing the formation of the Orissa Telemedicine Network Using Actor-Network Theory**

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**Abstract:-** This paper presents the Telemedicine programme being run by Orissa State in India. The study sought to understand eHealth implementation in low resource settings through the lens of actor-network theory. Part of this theory is made up of the sociology of translations, which was employed as a crucial framework for exploring the Orissa State Telemedicine Network Set-up. Data was collected between April – June 2012. Data collection has been through triangulation of qualitative methods: interviews, participant observation, and document analysis. A total of 28 human and non-human actors' were identified and semi-structured interviews conducted with the human actors using Face to Face (15) and Video Conference (13). Findings included the use of physician leaders to spearhead such project, much awareness should be created among the various actors and all the actors should be identified and brought on board the project. It can be deduced from the above that, the network has successfully undergone all the moments of translation. The key factors that ensured this success include state government's involvement, availability of a project champion in the person of the nodal officer. Further research should be carried into unresolved issues in implementing and integrating eHealth solutions which include issues of diagnostic/therapeutic efficacy, privacy and security of information transmission, clinical standards and guidelines for practice, technical interoperability of systems and Human resource planning.

**Keywords:-** Actor network Theory, eHealth, Telemedicine, Orissa State, India

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## **I. INTRODUCTION**

Orissa is a small state along the eastern coast of India with approximately 37 million people. The state has rich natural resources and has achieved substantial progress in many areas during the past 50 years. However, natural calamities hitting the state every year constitute major hurdles in the path of progress. Super cyclone of 1999 was followed by severe drought in 2000 and unprecedented flood in 2001. Again in 2003-2004 the state was ravaged by severe floods. Hence there has been a constant need for infusion of resources from outside sources to improve the financial health of the state and to provide people the basic needs of food, safe drinking water and health services at affordable cost.

EHealth is the term more commonly used in relation to ICT deployments in health care. There have been several attempts to define eHealth (Alvarez RC (2002), Commission of the European Communities (2004), Silber D (2003)); there is still no universal agreement on the precise meaning of this term.

Oh et al (2005) are of the view that eHealth is widely used by many individuals, academic institutions, professional bodies and funding organisations. It has become an accepted neologism despite the lack of an agreed-upon clear or precise definition. Communication among the many individuals and organisations that use the term could be improved by comprehensive data about the range of meanings encompassed by the term. 51 unique definitions that we retrieved showed a wide range of themes, but no clear consensus about the meaning of the term eHealth. In addition, two universal themes (health and technology) and six less general (commerce, activities, stakeholders, outcomes, place, and perspectives) were identified. The widespread use of the term eHealth suggests that it is an important concept, and that there is a tacit understanding of its meaning.

Catwell et al (2009) however, thinks that any definition of eHealth should encompass the full spectrum of ICTs whilst appreciating the context of use and the value they bring to society. One definition which they identified as taking into consideration the various facets is the one proposed by Pagliari et al (2005), who defined eHealth as:

“...An emerging field of medical informatics, referring to the organisation and delivery of health services and information using the internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking, to improve healthcare locally, regionally and worldwide by using information and communications technology.”

Ouma et al (2008) identified the solutions which are provided through eHealth initiatives within hospitals as Hospital Information Systems (HIS), telemedicine services, Electronic health records and Internet services.

## **II. RESEARCH METHODOLOGY**

For conducting the research, the researcher adopted two methodologies, namely qualitative case study and in-depth interview employing the Actor-Network Theory for analysis. The rationale for choosing qualitative approach is based on the fact that the purpose and the research questions require that the study be conducted in its natural setting and the Actor-Network Theory will be employed as a guide. In line with interpretive approach, there was no clear cut separation between data collection and analyses; the two occurred simultaneously. This is because follow-up interviews and interaction with field participants continued at the analyses stage.

## **III. CASE STUDY**

This study follows qualitative rather than quantitative methods. The rationale for choosing qualitative approach is based on the fact that the purpose and the research questions require that the study be conducted in its natural setting. Within IS research area, four qualitative research methods seem to dominate: Action Research, Case study research, ethnography and grounded theory (Myers, 1997a). Other qualitative methods include phenomenological research and narrative research. Considering the purpose and proposed research questions for this study, qualitative case study research method will be adopted. Case study research is the most common qualitative method used in information systems (Orlikowski and Baroudi, 1991; Alavi and Carlson, 1992). Although there are numerous definitions, Yin (2002) defines the scope of a case study as follows: "A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin 2002).

Clearly, the case study research method is particularly well-suited to IS research, since the object of our discipline is the study of information systems in organizations, and "interest has shifted to organizational rather than technical issues" (Benbasat et al. 1987).

Case study research will involve more than one way of deriving data about the case or organization/unit under study. This may include collecting and analyzing documents, talking to people, survey data, participant observation, consumer research and any other data collection techniques which offer qualitative information about the case. In the view of Stake (1995), case studies involve the researcher exploring in depth a program, an event, an activity, a process, or one or more individuals. The researcher adopted the Orissa Telemedicine Network as a case study and conducted in-depth interviews to have better understanding of the Network.

## **IV. THEORETICAL FRAMEWORK**

Actor-Network Theory (ANT) will be employed as a guiding framework. ANT has been adopted because in Science and Technology Studies (STS), which is concerned with sociotechnical innovations (e.g. Williams, 1997; Latour, 1996b), and mainstream IS research (e.g. Waltham, 1997; Orlikowski, 1992; 2005; 2010), the interaction between technology and organisation has been described as inextricably interwoven. Therefore, many researchers have called for the need to view the two entities as entangled rather than in a dualist cause-effect relationship. In line with this, this study views eHealth technology and organisation as entangled rather than dichotomised.

Moreover, within the mainstream IS research, actor-network theory (ANT), which is a branch of STS, has been found useful for studying complex sociotechnical phenomena (Waltham and Sashay, 1999; Radon et al., 2008). The ANT, based on its principles of agnosticism, generalised symmetry and free association, avoids all forms of dualism (Callon, 1986b) such as human and non-human, technology and organisation and so on. In contrast to reductionist approaches such as factor analyses and stage models, ANT views elements in innovation development as in seamless interaction rather than in dualist relationships. Thus far, the use of ANT appears limited in eHealth research. Therefore, beyond the current saturated area of adoption and diffusion, this research seeks to extend the use of ANT to the early phases of eHealth innovation.

## **V. ABOUT THE ORISSA TELEMEDICINE NETWORK**

Telemedicine activities were initiated in Orissa in the year 2001 with support from Department of Information Technology, Govt. of India and Sanjay Gandhi PostGraduate Institute of Medical Sciences, Lucknow. Subsequently in the same year ISRO/Dept. of space, Govt. of India came forward with an offer to establish a Telemedicine Network in the state of Orissa. Government of Orissa accepted the offer of ISRO and provided necessary infrastructural and manpower support. Establishment of the Orissa Telemedicine network was decided to be completed in a phased manner.

Phase I Orissa Telemedicine Network was established in 2003 that connected all the three Govt. Medical colleges of Orissa to Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGIMS), Lucknow through Satellite-based VSAT connectivity.

The hardware and software were provided by ISRO along with free bandwidth. The network was formally inaugurated by Hon'ble Chief Minister of Orissa Shri Naveen Pattnaik on 13th October 2003 at Cuttack. Department of Information and Technology, Min. of Communication & IT, Govt. of India in the year 2004 on suggestions of SGPGIMS, Lucknow agreed to include SCB Medical College, Cuttack in another Telemedicine Project that linked all the three premier medical institutes i.e; AIIMS, New Delhi; PGIMER, Chandigarh and SGPGIMS, Lucknow. SCB Medical College under this project received a set of very good quality Telemedicine equipments in 2005. The network worked on ISDN connectivity with Sanjeevani and Mercury telemedicine softwares developed and installed by C-DAC (Center for Development of Advanced Computing) Mohali and Pune respectively.

The network is being effectively used since then and in the meantime has benefited 1167 patients suffering from major illnesses through Tele-Consultation and Tele-Follow Up services offered by SGPGIMS Lucknow and AIIMS, New Delhi. The application of the new medical technology in teaching medical institutions of Orissa has played a significant role in improving the quality of Post Graduate Medical Education through tele-teaching in newer fields of medicine viz. Rheumatology, Genetics, Nuclear Medicine and Endocrine Surgery. However almost all departments Anatomy, Physiology, Biochemistry, Pharmacology, F.M&T, Pathology, Microbiology, Community Medicine, Ophthalmology, ENT, Paediatrics, Obstetrics and Gynaecology, Medicine, Neurology, Endocrinology, Pulmonary Medicine, Dermatology, Radiation Oncology, Clinical Immunology, Cardiology, Medical Gastroenterology, Nephrology, Surgery, Neurosurgery, Surgical Gastroenterology, Experimental Surgery, Plastic and Reconstructive Surgery, Genito-Urinary Surgery, Anaesthesiology, Clinical Haematology, Hepatology, Radiology, Medical Oncology, Paediatric Surgery, CTV&S and Orthopaedics have participated in telemedicine activities. During the period from August 2001 to December 2007 five batches of postgraduate trainees have benefited in the three Govt. medical colleges of Orissa through discussion on 933 topics. More than that, the facility has proved extremely useful in updating the knowledge of Medical Professionals and Medical College Teachers and in skill promotion of Nurses.

Recently with continued support from ISRO, the network has expanded further to include district Headquarters hospitals of Koraput, Bhawanipatna, Baripada, Rayagada, Sundergarh, and Capital Hospital, Bhubaneswar as phase II implementation of Orissa Telemedicine Network. This will enable extension of specialty and super specialty medical care to these districts from SCB Medical College & Hospital, Cuttack. Currently, the entire district headquarters Hospitals will be provided the telemedicine facility.

Government of Orissa has been providing an amount of approximately Rupees one crore every year from 2005-06 onwards for establishment/expansion of Telemedicine Network in the State. A central Telemedicine Node is coming-up within the premises of SCB Medical College & Hospital, Cuttack to monitor the activities of the state-wide network and to design, develop & implement new telemedicine projects in the state.

## **VI. DATA COLLECTION**

A qualitative study was used through the application of a case study to investigate the facility. Unstructured interviews, open ended questionnaires, document analysis and observations were used as methods to collect data from the various facilities.

The interviews were conducted following a snowball sampling procedure (Patton 2002). At the site, in depth interview was conducted with key personalities— including physicians, nurses and administrators— who are the major stakeholders in their respective project. The first respondent was the Nodal Officer or eHealth project manager. Each interviewee was asked to suggest other respondents who could provide critical information about the implementation and/or were identified as favourable or antagonistic to the system. To ensure an unbiased account of events, we met all actors identified personally to obtain an interview. The data collection was terminated when no new actor was identified and no new information was revealed during interviews (point of redundancy). Each interview lasted approximately one hour and elicited narratives from the respondents of the eHealth implementation from eHealth solution selection to project completion or abandonment. Project documentation and observation notes were also be used as a means of triangulation.

Appointments were scheduled with all the identified respondents in the project sites. The researcher conducted an In-depth interview with each respondent. Participants were informed prior to the interview that the session shall be audio tape recorded and copies of their transcribed interviews given to them later to modify or edit, as necessary. The researcher informed participants that their individual responses would remain confidential but would be aggregated for future qualitative data analysis and that quotes would not be attributed to individuals unless explicit written consent was obtained prior to doing so. A total of 28 human and non-

human actors' were identified and semi-structured interviews conducted with the human actors using Face to Face (15) and Video Conference (13).

## **VII. ACTOR NETWORK TRANSLATION**

Callon (1987 p.97) stated that "the actor-network theory describes the dynamics of society in terms totally different from those usually used by sociologists."

A socio-philosophical approach of the actor-network theory "...rejects any sundering of human and nonhuman, social and technical elements." (Hassard, Law and Lee 1999 p.338). The actor-network theory accepts the differences between human and nonhuman actors, but denies treating them separately. It supposes that everything is an actor in the network, where elements of any kind hold together such as humans, technological artefacts, organisations, institutions and it do not differentiate between or delegate priorities of any kind of elements.

The basic idea of ANT is that, in order to achieve a goal, a network of faithful alliances needs to be created to carry the network builders' intentions and materialise their goals. As the theory holds a distinctive view of society as a network of humans and non-humans that interact and cooperate to pursue a certain goal, it maintains that any network building would involve the recruitment of human and non-humans. Network building takes place through translations. Translation is the mechanism by which the network builder recruits actors and ensures their faithful alliance. It was first coined and used by Michel Serres (Callon and Latour 1981; Seres 1974) and published by Callon (1986).

Callon (1986) described that the sociology of translation is composed of four moments, namely problematization, interessement, enrolment and mobilisation.

Problematization is the first moment of translation, which relates to the process of a focal actor striving to become indispensable to the other actors by defining the problem and motivating them into the network, and suggesting that the problem would be resolved if the actors negotiated the "obligatory passage point (OPP)". Problematization describes a product of alliances, or associations between actors by identifying what they want (Callon 1986). OPP refers to a process in which a focal actor convinces all other actors to accept the proposal of a network. OPP also refers to a process in which a focal actor shows an interest in all the actors who accept the proposed network (Callon 1986).

Interessement is the second moment of translation, which relates to a series of processes where a focal actor attempts to lock other actors into a position that has been offered to them in the network. Interessement also means the group of actions by which the focal actor aims to impose and stabilise the other actors' identity. These actions are defined through the problematization process. Different devices for different actors are used in these actions.

For example, in the scallop case, some devices of the interessement process had a favourable balance of power: the fishermen's device was the towlines in St. Brieuç Bay and their scientific colleagues used devices such as texts and conversation, which attracted the actors concerned to follow the project (Callon 1986). If the interessement succeeded, then enrolment could take place.

Enrolment is the third moment of translation, which refers to a set of strategies in which a focal actor attempts to define and inter-relate the various roles that allow other actors to enrol. The process of enrolment involves "group multilateral negotiations, trials of strength and tricks that accompany the interessements and enable them to succeed" (Callon 1986 p.211). When the negotiation between actors has been achieved, the inscription appears. The inscription is a process of artefact creation that ensures the protection of some interests (Sarker, Sarker and Sidorova 2006). In brief, an enrolment relates to the other actors' acceptance of the interests defined by a focal actor through the process of bargaining and making concessions (Madon, Sahay and Sahay 2004; Sarker, Sarker and Sidorova 2006).

Mobilisation is the final moment of translation, which relates to a set of manners utilised by a focal actor to ensure that all actors have legitimate speakers to represent them in groups, and avoid betrayal in various collectives from the latter (Callon 1986; Madon, Sahay and Sahay 2004). Speakers or representatives are actors who speak or deputise for other actors (Walsham 1997).

## **VIII. IN-DEPTH INTERVIEW AND ANALYSIS**

The telemedicine network was initiated by the Government of Orissa with support from Indian Space and Research Organization (ISRO)/Department of Space, Government of India (GOI), Ministry of Information and Communication, Government of India; super speciality services and technical support by SGPGIMS. Other Institutions providing expert medical services include AIIMS, New Delhi, PGIMER, Chandigar, and RCC, Thiruvanthapuram. The uses to which Telemedicine are put include teleconsultation (Obtaining 2nd opinion), teleeducation (Distance Medical Education), tele follow-up (Remote, follow up for patients), tele-CME (tele medical Video Conferencing), skill promotion courses for Nurses and other paramedics, and enhancing computer friendly attitude.

Prior to the government initiative informant 2 told me that “In the month of August, with due permission from Funding Agency, Telemedicine infrastructure was created at S.C.B. Medical College Hospital, Cuttack, Orissa by shifting some of the equipments used in the Kumbh mela project. Since 15th August 2001 tele-continuing medical education for postgraduate students of SCB Medical College, located 1500 km away from Lucknow, has been started through ISDN telecommunication link. Various departments were taking part in this tele-teaching programme; those are departments of Surgery, Surgical Gastroenterology, Urology, Pathology, Radiology, Paediatric Nephrology, Rheumatology, Endocrine Surgery The response from students is prompting us to continue on a long term basis. Such distance education programme for postgraduate medical students offered by a tertiary care medical center was first to happen then”

### **IX. RATIONALE FOR INITIATING THE TELEMEDICINE NETWORK**

According to Informant 1, the rationale for initiating the Telemedicine Network in the state is “to promote quality of medical care and medical education in Orissa since most people live in remote hilly regions and do not have access to specialist medical care due to transport and communication constraints”

Another informant 4 told me that “There has been a constant demand to make available qualified medical professionals in rural Orissa and in particular KBK Districts where all posts of medical professionals in Government Hospitals are never filled up. So, the Government of Orissa (GO) has come up with plans and projects to establish Telemedicine network in the state so as to take specialist medical care to people living in the villages”.

Thus having identified the problems of the state and realizing that Telemedicine is the way out, the GO supported the initiative by providing funds for infrastructure, manpower support and all other recurring expenses. Rs 1 Crore was provided by the government each year.

GO then embarked upon identifying the relevant actors to help him establish the TM network. In the words of my informant 1 “the government sought help from several funding agencies, viz. ISRO/DoIT, GOI; National Informatics Center, New Delhi to have a viable Telemedicine Network that can survive on a reasonable maintenance cost”.

Thus, the GO has defined the OPP i.e. to establish a viable TM network that can survive on a reasonable maintenance cost. Thus all the actors involved would ensure they play their role for the OPP to be achieved.

### **X. INTERSEGMENT**

The GOI then began a process to convince other actors to accept and recognize his role. GOI ensured that they got the actors interested and negotiate the roles and terms of their involvement (Callon, 1986). The researcher learnt that “some agencies have promptly reciprocated by providing financial assistance and equipment support. Super specialty hospitals like Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow also agrees to offer expert medical service to the people of Orissa to improve the quality of medical care and medical education in the state.”

On how they were able to bring the medical and paramedical staff on board, the researcher was told that “On 18th January, 2007, we organized a sensitization workshop for all medical and paramedical personnel of all the Districts of Orissa. They participated and asked questions and got appropriate answers. At the end of the workshop, all their doubts were cleared and they embraced the project.”

According to one Informant (7) who participated in the workshop “I embraced the project because realize the government was committed to alleviating the plight of the people hence my desire to contribute my quota”.

Another means used by the government to get others on board was when they advertised the “call for bids” for the telemedicine project in the dailies (Fig. 1). They received a number of quotations and at the end of the day one were selected. However, the unsuccessful ones were still in touch in case of any developments.

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**OFFICE OF THE ENGINEER-IN-CHIEF (CIVIL), ODISHA  
NIRMAN SOUDHA, UNIT-V, BHUBANESWAR**

**INVITATIONS FOR BIDS (IFB)**

**Tender Call Notice No. CE-(B) - 15 / 2011-12**

File No. B-IV-H-23/05 2480 / Bhubaneswar, the 24<sup>th</sup> Jan. 2012.

1. The Chief Engineer (Buildings) Odisha, Bhubaneswar on behalf of Governor of Odisha invites percentage rate bids in double cover system in **ONLINE MODE** only for construction of the following works as detailed in the table below.

Sl. No.	Name of Work	Value of work (in ₹)	Concerned E.E. with Head-quarters	Security (in ₹)	Cost of document (in ₹)	Period of completion.	Class of Bidder
1.	Construction of Telemedicine Complex within premises of SCB Medical College and Hospital, Cuttack.	3,31,92,923/-	E.E. Cuttack (R&E) Division, Cuttack.	3,32,000/-	10,000/- + 400/- (VAT)	6 (Six) Calendar Months	Super Class/ Special Class

2. The bidders have to participate in **ONLINE** bidding only. The web -site for "ONLINE BIDDING" is <http://tendersorissa.gov.in>.

3. Bid documents will be available in above Website from **01.02.2012 to 17.00 Hours of 22.02.2012** for "ONLINE BIDDING".

4. Bids received online shall be opened at **11:00 AM on 27.02.2012** in the office of the Engineer-in-Chief (Civil), Nirman Soudha, Unit-V, Bhubaneswar, Odisha.

5. The bidder must possess compatible **Digital Signature Certificate (DSC)** of Class - II or Class - III.

6. Further details can be seen from the website : <http://tendersorissa.gov.in>.

**I&PR-34117/11/0009/1112 Chief Engineer (Buildings), Odisha.**

Fig.1 Call for bids

## XI. ENROLMENT

With the success of the interestment, each of the actors began to accept the interest defined for them by the focal actors. Strategies and activities to support actors' enrolment and start the network were discussed. The government decided to implement the Telemedicine project in the state in three Phases: Linking academic Institutions, Connect Few identified districts to Medical College Hospitals (MCHs), and Connect rest of Districts to MCHs Zone wise.

Under phase 1, all three government medical colleges of the state i.e. SCB Medical College, Cuttack; MKCG Medical College, Berhampur and VSS Medical College) were connected to SGPGIMS, Lucknow through satellite based VSAT connectivity offering 26-384 kbps bandwidth. ISRO/Dept of Space, GOI provided hardware, software along with free bandwidth.

The researcher was told that "in 2008, District Hospitals of Kalahandi, Koraput, Rayagada, Sundergarh, Bhubaneswar were all connected to SCB Medical college Hospital, Cuttack. That was pahse II. Laterthe VSS medical college , Buria was alos conecetd to Roukela, Bolangir, Sonpur, Anugul, Jharsunguguda, Baragada, Deogarh and the MKCG Medical College , Berhampur also connected to Nayagarh, gajaoah, Boudh, Kandhamal, Nuapada, malakangiri, and Naharangpur".

## XII. MOBILIZATION

From discussion with the various actors, they indicated that they have actually mobilized their constituencies and they are all committed to the telemedicine. The researcher learnt that Tele-education and tele-healthcare to the Orissa Telemedicine Network through VSAT (extended C-band) continued:

"This programme, sponsored by Indian Space Research Organisation and Government of Orissa, is continuing since March 2003, to support distant medical education programme. Three medical colleges of Orissa i.e. SCB Medical College, Cuttack, MKCG Medical College, Berhampur and VSS Medical College, Burla were connected to SGPGIMS via VSAT at 384 kbps bandwidth. Regular sessions of various departments held daily in schedule manner. These sessions consist of Tele-education, Tele-consultation and Tele-follow up. This distant education programme has immensely benefited the postgraduate students and doctors of these medical colleges in enhancing their knowledge and keeping them abreast with the recent advances and research in various super-specialties and treatment of their patients. The frequent Tele-follow up clinics of Rheumatology, Endocrine Surgery and Nuclear Medicine are helping the patients from the state of Orissa who had undergone primary treatment at SGPGIMS, to a great extent by saving their time, money and efforts by avoiding a trip to Lucknow for follow-up."

The successful mobilization can be summed up thus: "As a result of our successful mobilization, today we have been able to connect all the three government medical colleges and the thirty district headquarters Hospitals in the state".

The researcher was provided with Fig. 2 below which is the map of Orissa Telemedicine Network showing all the medical colleges and district headquarters hospitals connected and the telemedicine programme for one month (Fig 3)



#### **XIV. ACKNOWLEDGEMENT**

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