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Interactions in ICT4D Projects: A Sociotechnical Perspective

Completed Research Paper

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Abstract

Stakeholder interactions play a vital role in achieving project outcomes. The role of stakeholders in Information and Communication technology for Development (ICT4D) is often overlooked or ineffective. This hinders ICT4D projects or in some scenarios may adversely affect the project. The current paper proposes to use Actor Network Theory (ANT) to unpack these interactions not only among stakeholders but extend it further to include technology, thereby creating a holistic understanding of the phenomenon. An ICT4D initiative in India was analyzed using ANT logic to explain stakeholder interactions and behaviors. The findings from this research enable better understanding of interactions and also explain the effect of these interactions on ICT4D project activities, other stakeholders and networks. It also enables a better insight into the behavior of stakeholders and contribution of interactions between them in attaining the mutual desired outcomes in ICT4D projects.

Keywords: Stakeholder Interactions, Actor Network Theory, ICT4D.

Introduction

Stakeholder interactions influence the way project management teams do stakeholder management and how practices emerge as stakeholders respond to actions by other stakeholders (Eskerod and Vaargaasar 2014; Pedrini and Ferri 2019). Thus highlighting that management response strategies are not formed in dyadic interactions but evolve from sequences of interactions among multiple stakeholders (Van Offenbeek and Vos 2016). Many researchers have emphasized the importance of stakeholder management (Gerwel Proches and Bodhanya 2015; Hansen et al. 2011; Pedrini and Ferri 2019; Uribe et al. 2018; Zidane et al. 2015), the role of engaging the stakeholder (Andriof and Waddock 2017; Smith et al. 2011) and nurturing key stakeholder relationships and interactions (Andriof and Waddock 2017; Ntshinga 2013; Pade-Khene et al. 2013; Singh and Flyverbom 2016) for success of projects. Effective interactions between stakeholders are deemed to be of utmost importance in Information and Communication Technology for Development (ICT4D) projects (Dodson et al. 2012). Lack of stakeholder engagement in effective decisions making may lead to the project being irrelevant in development activities or negatively affect the targeted community and users in the worst case scenario (Pade-Khene et al. 2013). An example of this is the Bhoomi project (a land digitization project) in India which was a successful project according to the project sponsor World Bank (Chawla and Bhatnagar (2013)).
ICT4D projects: Socio Technical Perspective

2004) but has been criticized for not interacting with all the relevant stakeholders (Glendenning and Ficarelli 2012) and hence negative consequences: increasing dispossession of land from marginal farmers (Thomas 2009; Tongia and Subrahmanian 2006). In the ICT4D domain the interactions between stakeholders is often ineffective or often overlooked. This creates a barrier in terms of fulfilment of the project goals and also adversely affects the project success (Gerwel Proches and Bodhanya 2015). Though research identifies the importance of managing interactions, it is still limited in defining what these interactions are and how these interactions are managed. This research not only addresses the above-mentioned limitations but extends it to examine the range of actors involved in an ICT4D project. An ICT4D project set in India is used as a case study for this purpose. Aligned with the recommendations of Luoma-aho and Paloviita (2010), the use of term “actors” is preferred over “stakeholders” as the term actors includes both human and non-human stakeholders. This paper addresses three research questions: 1) How can actors be identified in an ICT4D project? 2) What are the key characteristics of interactions among the actors of an ICT4D project? 3) How do actor interactions contribute to project outcomes? The overarching aim of the research is to identify the characteristics of interactions among the actors of an ICT4D project and to understand their contribution towards the project’s outcome. The understanding of complex interactions between diverse actors will provide rich insights into the challenges faced by ICT4D projects and how they evolve in response to these interactions.

This paper is structured as follows. First, the current issues in ICT4D projects are discussed followed by a discussion on Actor Network Theory (ANT) as a lens for holistic understanding of the interactions between the actors in an ICT4D project ecosystem. The paper then discusses the theoretical background, research design along with the analysis and findings. Lastly, the paper concludes with discussion of anticipated contributions and future research direction and opportunities.

Stakeholder interaction is ICT4D projects

Information and Communication Technologies for Development (Abbreviated to ICT4D), is a diversified field of Information Systems (IS) research that investigates the relationship between ICTs and development (usually in developing countries) (Muranga Njihia and Merali 2013). The research in field of ICT4D is concerned with understanding whether, to what extent, and under what circumstances, the use of information and communication Technologies (ICTs) can be productive of development. Particularly, ICT4D deals with implementation of development projects that aim to improve the social and material conditions of the marginalized and poor groups through ICT applications, mostly in developing countries (Singh and Flyverbom 2016). To support international development, ICT4D promotes technology adoption (Ferguson et al. 2013). The key assumption of ICT4D is that ICTs can empower people in developing countries by providing a platform for their voices and by their participation in decision making (Ferguson, Huysman & Soekijad 2010; Hickey & Mohan 2004; Walsham, Robey & Sahay 2007; Zuckerman 2010 as cited in Ferguson et al. 2013).

ICT4D projects also consist of partnerships and with recent emphasis on working together towards the Millennium Development Goals and the Sustainable Development Goals placing a strong emphasis on partnership (e.g. Goal 17: Partnerships for the Goals) (ITU 2016) the interest and use of partnerships in ICT4D has grown (Ismail et al. 2018). Which gets complicated in the context of developing countries due to interweaving of actors, agencies, political, public and private institutions and foreign and global players (Muranga Njihia and Merali 2013).

With this growth in practice of ICT4D partnerships, there has been rise in problems faced by the multi-stakeholder ICT4D projects. According to Mizrachi & Ben-Attar (2011) (cited in Ismail et al. 2018), there are both problems with outcome and processes. Outcome problems include ICT4D stakeholders viewing success differently and having different goals and success outcomes. Processes problems include tensions and conflicts, misunderstandings, misalignment and disagreements among stakeholders (Ismail et al. 2018). The varying stakeholders may have different objectives, incentives, metrics for success and initial conditions (Tongia and Subrahmanian 2006), from different innovators and service providers to multiple stakeholders and different contexts and frameworks for development. Aaltonen and Kujala (2016) emphasizes the need for understanding stakeholder landscapes for better
stakeholder management. Their work identifies stakeholder interactions as one of the complexities in multi stakeholder projects, linking the effect of these interactions to stakeholder relationships, engagement, management and decision making (Aaltonen and Kujala 2016). They highlighted the importance of managing interactions but were limited by not defining what these interactions are and how these interactions are managed. Instead, the authors urge for future research to explore the stakeholder interaction patterns (Aaltonen and Kujala 2016). This study not only meets this call but extends it further than stakeholders to examine all actors. In some scenarios the inclusion of social context could direct the shaping of technological innovations particularly in vulnerable groups (Ramadani et al. 2018). This approach is also favorable as it considers multiple actors and their concerns in ICT4D project. To be successful, stakeholder interactions need to be considered in an holistic manner (Okon 2015; Tongia and Subrahmanian 2006). Until then, the full potential of ICT4D development cannot be achieved according to Tongia and Subrahmanian (2006).

Several approaches have been developed to study the interactions of humans (Cresswell et al. 2010). One common theory is Socio- Technical (STS) Perspective. STS perspective pays close attention to the technical and social dimensions. A sociotechnical system may be defined as a system (e.g. an ICT4D project) where social dimensions (stakeholder interactions and networks) and technical dimension (ICT tools) are interrelated. Actor Network theory (ANT) draws on this perspective (Kaghan and Bowker 2001). Other candidate theories are Institutional theory and structuration theory. As the key point in the current research is the need to focus on the phenomenon of interaction in the domain of ICT4D projects, therefore current paper proposes ANT as a lens for holistic understanding of the interactions between the actors in an ICT4D project ecosystem. In the current paper, we reflect on the potential contributions of ANT and its applicability to ICT4D project interactions.

**Socio-Technical perspective: Actor Network Theory**

Actor network theory (ANT), also known as sociology of translation, was developed by Science and Technology Studies scholars Michel Callon (1992), Bruno Latour (1996) and sociologist John Law (1992). In ANT, actors are defined as “source of an action regardless of its status as a human or non-human” (Cresswell et al. 2010). Both humans and non-humans (technology artefacts) are considered as actors (Thapa 2011). However, an actor can only perform in combination with other actors. This concept was derived from Tarde (1893) who suggested that division between nature and society is irrelevant for understanding the world of human interactions (cited in Latour and Joyce 2002).

ANT consists of networks formed up of both people and technologies (Callon 1999). The focus of ANT is on what people and things become as a result of their involvement in the network and not on the characteristics of the people and things (Law 1992). Actor network is a heterogeneous network of interests, including people, organizations and standards (Walsham 1997). ANT is not an empty claim that objects do things instead of human actors (Latour 1996). Instead it says that question of who and what participants needs to be thoroughly explored even if this may include non-human participants (Latour 1996; Latour and Joyce 2002).

Social in ANT is formed from associations and the goal is to unearth the networks that are formed, referring to alliances, flows and mediations. The concept of network is understood as nodes that are established according to connections, associations and articulations with other nodes in a relational perspective not individual or one-way. Such networks are made up of interconnected heterogeneous elements. These interconnected heterogeneous elements are conceptualized by ANT Actors (human or non-human). The term is used to break away from the ideas of purely human person or social actors and hence re-discusses the separation between subject and object made by sociology (Cavalcante et al. 2017). This concept of ANT enables identification of different heterogeneous components of the ICT4D project.

The methodological approach of the ANT is to follow actors to see how they attempt to impose worlds upon one another, and to understand the dynamics and internal structures of actor worlds. It tries to trace and explain the processes whereby stable networks of aligned interests are created and maintained. ANT literally instructs researchers “to map out the set of elements (the network) that influence, shape, or determine an action. But each of these elements is in turn part of another actor-network and so forth” (Ciborra et al. 2000, p. 76).
The translation process of ANT answers the evolvement of the network in ICT4D case study in this research. In order for actors to achieve their goals, more effort is required to ensure successful network alignment and stability. The main actors become indispensable and recognized by other actors. Next the allies are strengthened, this is achieved by defining the roles. This translation process is not always smooth and many obstacles are overcome. The network is considered scalable in that one actor of an actor-network may be expanded into a new complete actor-network, or where a whole actor-network may be collapsed into a single actor. As there is no priori distinction between the micro, meso, and macro level, ANT offers a uniform framework, regardless of the unit of analysis (Latour 1990b; O'Connell et al. 2014).

As ANT focuses on actor level, which interact directly with technology, from this perspective ANT can unearth the details of interactions among actors. In ANT, ICT4D interactions can be seen as translation processes in which the interests of various actors are expressed in terms of specific needs. During the translation process, the specific needs, scenarios for how the technology will be used, and the roles to be played by actors are inscribed in the artefact. The ultimate success of ICT4D context projects rests critically on the initiating actors’ ability to manage the diverse interests of other actors in the network, and to mobilize broader support to ensure that the other actors will comply and fulfil their respective roles (Callon et al. 1986; Latour 1996; Law and Hassard 1999).

Table 1. Four moments of Translation based on Callon (1984)

<table>
<thead>
<tr>
<th>Problematization</th>
<th>Identify the problem that needs to be addressed, Identify relevant actors, Focal actor establishes delegates to represent actors, Form an Obligatory Passage Point (OPP). An OPP is a scenario that eventually occurs among all actors for them to achieve their goals and interests as defined by the focal actor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inteserement</td>
<td>Focal actor negotiates the roles and terms of involvement with actors&lt;br&gt;The focal actor helps create a favorable balance of power by constructing system of alliances between the different actors.</td>
</tr>
<tr>
<td>Enrolment</td>
<td>Actors put the roles and relationships they established in interessement into action. The negotiation and consolidation among actors in interessement phase determine successful enrolment.</td>
</tr>
<tr>
<td>Mobilisation</td>
<td>Focal actor ensures that all unions have their delegates or spokesperson selected and accepted by their groups. Establishes Focal actor as main voice of the network. Thus, attaining the properties of irreversibility also known as immutable mobile</td>
</tr>
<tr>
<td>Irreversibility</td>
<td>The degree to which it is subsequently impossible to go back to point where alternative possibilities exists</td>
</tr>
</tbody>
</table>

The concept of these translations will be used to understand the interactions in the network of the ICT4D project in the case study. ANT can be best understood as a tool kit that helps in describing a phenomenon as accurately as possible where the text is not limited to this as the initial understanding of the network formation and stability will help further analysis of the interactions. Interactions between both human and non-human actors is to designate a continuous flow of translations. As the network follows through the phases of translations, the study will just not focus on micro process of interactions. Instead, ANT eradicates the distinction between micro and macro or local and global as the network incorporates the moments of translations and all actions flow in symmetry.

In conclusion, the concept of the four moments of translation is employed as a core analytical framework and guideline in investigating the complexity faced during interactions. In exploring the case more profoundly, some other interesting concepts are used with the core framework.

Details of the analytical framework are constructed in three sequential stages in accordance with the research questions as follows.

Stage1: Drawing the scenario of the actor network

In order to draw the fundamental picture of the actor network and to explore the role of interactions, the
Figure 1: ANT concepts and Moments of Translation [adapted from (Callon 1984; Latour 1990a; Law and Hassard 1999)]

concept of punctualisation is used. Using this concept, the punctualised actors can emerge, interact and be observed. Each punctualised actor tells its own story such as its association with actors inside the actor network, the obstacle within itself, the output expected from it, etc. Consequently, the integration of all punctualised actors can be observed. This moment displays the way that all punctualised actors convert themselves into a single black-boxed unit or one punctualised actor of ICT4D project.

By this process, the best hypothetical scenario of a successful actor-network can be drawn. This helps in understanding what the mechanisms of the actor-network should look like, e.g. if the ICT4D project is being implemented successfully. In brief, this stage provides fundamental information about the combination and association of the actor-network, which can help to support the interaction analysis comprehensively in the second stage. Furthermore, the results of this stage can expose the detachment and betray of punctualised actors, which may lead to the actor-network breaking down in stage three.

Stage 2: Analysing the interactions in the actor-network

The four moments of translation are used as a core concept to investigate the interactions and complexities in the ICT4D project. However, some supplementary concepts also are integrated into the core concept to explain the interactions in the actor-network. The analysis procedure is presented moment by moment. Firstly, problematization is the moment in this study that describes initiation of the focal actor to create the ICT4D project, and how that actor identifies the other actors involved from its point of view. This research later explores how the focal actor suggests that problems would be resolved if all actors negotiate the obligatory passage point (OPP). Furthermore, the OPP explains the process in which the focal actor shows its interest and convinces all actors to accept the proposal of the network. This illustrates how the other actors overcome obstacles in order to pass through the OPP. These are the main issues or events in this study that aim to find the possible causes of interaction failure in this moment. Secondly, interessement is studied to see how the focal actor convinces the other actors to accept the interests of the project, and how it creates incentives for the actors to overcome obstacles by way of passing through the OPP. In doing this, many devices are necessary to lock the actors into their positions. The use of such devices by the focal actor is crucial in investigation because it could cause interaction complexities.

Thirdly, this research studies the enrolment process to investigate the set of strategies and negotiations in the actor-network in order to define the various roles played by the actors in creating ICT4D project outcomes. This moment consists of numerous activities in the actor network. In the final moment, mobilization is studied to understand the collective methods that the focal actor uses to ensure qualified speakers speak on behalf of all actors and thus avoid varied types of betrayal. This moment occurs when the actor-network has been punctualised or is working as a single unit, which refers to when an actor-network achieves its goal as planned.
Stage 3: Exposing interaction barriers in the actor-network

This stage is the consequence of the interaction analysis from stage two. Normally, barriers in interactions are noticeable when an actor betrays the actor-network. Betrayal may lead to actor leaving the actor network or in worse scenarios making the actor network unstable.

ICT4D project networks consist of technologies, public, private organizations, communities, institutes, skills and resources. With the Lens of ANT, it can be assumed that these components are dynamic and the connections between these components may change, making a different context when interactions occur between people, technologies, organizations, communities etc.

Research Design

This study will explore how actors interact and what complexities are faced during these interactions in ICT4D projects especially in a developing country. ANT offers a perspective to understand the interactions and their role in actor networks of ICT4D project. In answering the research questions, the researcher will need access to in-depth knowledge of the technology artefacts used, the views of the actors (human) and their interactions with other actors is required in natural setting. Empirical studies that collect such data can be broadly classified as interpretive (Walsham and Sahay 1999). Interpretive methods of research view knowledge of reality as a social construction by human actors (Walsham 1995).

This study uses an interpretive approach as this type of approach can better explain the complex socio-technical interaction process using ethnographic interviews, document analysis, and empirical observation and the setting up and carrying out of fieldwork is the fundamental basis of any interpretive study. In this ethnographic research, the researcher has spent time in the field in order to gain trust and collect data. Both primary and secondary data were collected during 2 visits to the research sites in 2017 and 2018. The researcher stayed at the research site among the rural tribal community and collected data during the period of stay (approx. 10 days each visit). 17 in-depth face to face interviews were conducted with relevant actors. These were the program directors, head of community institutions and community leaders. The interview protocol, suggested by Yin (2015), was followed. Interviews were conducted both in English and Hindi (where preferable). The researcher’s fluency in Hindi and exposure to Indian background helped in establishing a dialogue.

Overview of the case

The research utilized the IT for Social Impact Project-India site, delivered by an Australian University (here after referred to as International University (IU)) as an undergraduate subject in collaboration with a Not for Profit (NFP) organization in Australia and an Indian NGO partner (Satpuda Vikas Mandal (SVM)). This project is globally recognized for its work in the remote tribal region of Maharashtra state. Pal, a village situated in Satpuda Ranges on the bank of the Suki River in Jalgaon district of Maharashtra state of India is the host location site. The project also extends into surrounding villages of Jamnya, Mohamandali and Mongruel and these locations also form part of the extended field research site. Though India has achieved remarkable economic growth and rapid progress in the ICT4D area (Glendenning and Ficarelli 2012; Thomas 2009), but still the vast majority of Indian citizens grapple with poverty, limited communication facilities and high levels of illiteracy, particularly within villages and rural communities. The research sites selected for this research are among the rural and least developed parts of India. The travel times indicated in Table 2 are for appreciation of the remote nature of these rural communities. The presence of multiple actors and the project being delivered in a developing country makes this research site suitable for said research. Access to the case study was a major determinant too. The IT for social impact-India project has been in full-fledged operation since 2012 and has been working closely with rural tribal citizens to adapt technologies to local context. This multi-year project had its 7th visit to the case site in 2019. Over the last 6 years, this project has worked closely with the community at the case site to deliver IT enabled education in schools, community development and farm science projects. Some of the technology used includes drones, virtual reality and robotics. In 2017, a mobile digital classroom in a box was deployed between remote village schools where there is no internet and a ‘computer driver’s license’ (program to instill basic computer literacy
in female students) accreditation process has begun to address the digital literacy gap. In addition to these projects further work has been done on a sustainable housing project for the resident teachers, a digital land data governance project and E-waste management projects are also being run.

Table 2. Particulars about case sites (Census 2011)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Pal</th>
<th>Jamnya</th>
<th>Mohamandali</th>
<th>Mongruel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>7041</td>
<td>966</td>
<td>779</td>
<td>1045</td>
</tr>
<tr>
<td>Distance from HQ (Jalgaon)</td>
<td>73.5kms</td>
<td>98.1kms</td>
<td>50.9kms</td>
<td>88.5kms</td>
</tr>
<tr>
<td>Literacy rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>72.27%</td>
<td>50.89%</td>
<td>46.50%</td>
<td>48.10%</td>
</tr>
<tr>
<td>Male</td>
<td>79.77%</td>
<td>64.04%</td>
<td>53.16%</td>
<td>53.99%</td>
</tr>
<tr>
<td>Female</td>
<td>64.03%</td>
<td>38.34%</td>
<td>40.64%</td>
<td>41.22%</td>
</tr>
<tr>
<td>Tribal Population percentage</td>
<td>50.46%</td>
<td>99.90%</td>
<td>99.61%</td>
<td>84.40%</td>
</tr>
</tbody>
</table>

Data Analysis and Findings

The objective of the data analysis is to understand the different interactions of actors and the complexities experienced in effective interactions of actors with the program. The data collected through interviews, note taking, and observations in the field was analysed using qualitative techniques. All the interviews were transcribed, summarized and categorized and actor network theory served as the guideline for collecting and analysing data (Walsham 1995). This aligns with Walsham’s (2006) view that theory provides a way to analyse the data. Using ANT as the theoretical lens, the researcher followed the actors and their networks to understand the issues such as inscription, translation, and other processes associated with ANT. Thereby creating data theory link. NVivo was used to transcribe, re-identify and manage all data. Over 217 codes were identified. Some of the codes decayed during the process. The codes were then classified based on the phrases and words. After classification they were connected into categories, the 3 Cs of qualitative data (coding, classification and categorization). Document analysis was used to understand the policies, procedures, context and demographic information. The essence of the analysis throughout the research involved the comparison of data in a certain theme constantly being judged to belong to that particular theme. This allowed to identify commonality among themes. Data was coded into sub-themes and combined into themes. In order to select the data analysis strategy, the three factors played a vital role: the role of theory in the current interpretive research (Klein and Myers 1999; Walsham 1995), intriguing interest in research and not to be constrained by *a priori* assumptions about the area of interest.

Findings and Discussions

The punctualisation concept of ANT was used to open the black box of actor and establishing the actor network. Punctualisation is a concept of ANT that allows conversion of an entire network into a single point (Law 1992). This will help illustrate the relationship between heterogeneous actors for producing the desired goal. The actors in an ANT-network are themselves made up of networks and this is how simplification works. So, a stable network can be punctualised and is considered as a single actor.

Since the IT4SI project is a complicated project with multiple actors involved, it becomes necessary to collapse the network complexity. The complication in the IT4SI also arises due to lack of basic infrastructure, access to electricity and occurring in a developing nation where some actors work in
culturally unfamiliar environments and scenarios where there is limited or no exposure to technologies. Hence the punctualisation concept of ANT facilitates the analysis of the actor interactions. In order to understand how actors involved in the project establish their associations, Latour (2005, p12) suggests to “follow the actors”. Following the actors or following the flow enables researchers to establish the way associations/relationships are made among actors (Fioravanti and Velho 2010). This research follows the main actors of the IT4SI project, those being SVM, IU and NFP. The reasons for and details of the actor selection are presented by the concept of punctualisation in the following sections.

**Punctualised actor of IT4SI project**

As focal actor of the IT4SI project, SVM has the opportunity to steer the project. Firstly, by encouraging the local community to accept the social development initiatives. SVM functions as the primary support provider for the rural and tribal people in the area of Pal. Secondly, SVM defines the roles and identities of actors in the network by both actions and documents. SVM does this by providing local support and access to the local facilities, they also take care of the actors staying in and commuting between the different tribal locations. Finally, financial support made in the existing project are controlled by the SVM. A senior manager of SVM indicated:

“Access to these remote areas was impossible in past so government officials came to us. We have been acting like a catalyst for government schemes. We bring the government schemes to them and also have a dialog with government officials on their behalf. In many schemes direct funds are transferred to us”. [P8]

Due to lack of infrastructure and poor reach of government schemes in these rural areas, SVM steps in and provides services like education, women empowerment and developmental initiatives to tribal people. Further details on the motivations of the focal actor were suggested:

“Due to the long history and presence in the region... even the founders of the SVM had vision of making this area developed. We have set up Ashram schools and try to get good teachers but because of the remoteness of the area and lack of proper hostel facility not many want to come and teach in these areas”. [P5]

In order to attain its aim of providing education, social awareness and developing the community, SVM needed support and cooperation of other relevant actors. In short, the focal actor had to associate with other actors, to motivate or influence relevant actors to enrol in the actor network of the IT4SI project. In the eyes of focal actor (SVM), CERES Global was seen as a potential actor in social development project (IT4SI) and was therefore enrolled in the actor network. However, since CERES Global could not deploy the project by itself and needed IT experts to design and deliver the project, a new actor had to be enrolled into the actor network to carry out the task.

“IT school skills is necessary if tribal kids were going to get jobs in cities they really had to have IT schools but the IT provisions in those remote areas was so poor that they never touched a computer so building up the IT skills gave tribal kids a lot more opportunities for getting jobs in the future. Now we provide the environment education focus but for IT education and teacher training the SUT expertise was needed”. [P6]

Consequently, an IT expert (IU) was enrolled into the actor network of CERES global as a new actor. The association of these two actors was crucial in creating the IT4SI project. The punctualised actor network of the IT4SI is depicted in figure 2. From the Figure 2, the association between the punctualised actors can be described as follows.

1. Initially, the main focal actor (SVM) needed to associate with other actors (NFP and IU) by being a actor that aimed to communicate, negotiate and motivate other actors in the actor network. When other actors are enrolled into the actor network, initiation of the IT4SI project would start.
2. In making the project realistic, SVM needed to combine with the NFP as the punctualised actor, focusing on delivery of sustainable environmental initiatives in the tribal area. The lack of IT expert limited the project initiation at this stage.

3. In the part played by NFP its cooperation with other universities and global exchange program helped enrol IU as the IT expert. IU’s expertise and technical knowledge made it an indispensable actor of the actor network.

4. Since the enrolment in the IT4SI actor network was based on trust and associations have been cooperative the actor network of IT4SI has grown and interactions between the actors have grown significantly over the past years. In the next section, all details of these interactions and complexities is presented by the four moments of translation.

*Interactions in Setting up the Obligatory Passage Point (OPP)*

The Obligatory Passage Point (OPP) refers to the process of motivating actors into accepting the project goals and this is achieved by the focal actor showing interest in the actors and explaining to them how the project can help them achieve their interests.

In the actor network of the IT4SI project, all actors had their own interests and obstacles (see Figure 3). Due to effective strategies and interactions, the actors were able to overcome the obstacles. Therefore, the mission of the actor network was achievable as they were routed through the OPP.

Firstly, the above Figure shows that the actor network consists of 3 main punctualised actors as also discussed in the earlier section. These punctualised actors are SVM, IU and NFP.

Secondly in the view of the focal actor (SVM), the goal of actor network was development and education of tribal areas.

Thirdly in achieving this goal, all the actors would attain some personal benefits. The IU would be able to engage in group projects where they would be able to demonstrate and consolidate their IT skills for positive social impact. NFP would be able to work towards its goal of environmental education, gender equity and sustainable development.

Finally, if all actors would overcome their obstacles, they would be able to obtain benefits and the mission of the actor network will be completed.

In this project of IT4SI, the OPP held all actors together in the process of translation and helped them solve their problems. Hence the mission of the actor network was successful. To analyse the setting of the OPP and its role, looking back to the start of the IT4SI project was necessary. SVM had gained extensive experience and knowledge to develop the tribal areas over more than 6 decades of existence and work towards uplifting local tribal community. Due to SVM’s experience in dealing with
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Figure 3: Association in actor network of IT4SI India project (adapted from Callon 1986).

developmental collaborative efforts within the tribal community they fostered an environment of interaction. The openness of the network in sharing of new ideas and conflict resolution was primarily achieved by a mediator. A member of the host organization mentioned that having a clearly defined mediator helps them to share the knowledge and resources within the network.

“Whenever I face any issues, I reach out to the P4 (mediator). I trust him so it becomes easy to share my ideas and concerns”. [P13]

The dependency on mediator for conflict resolution and also for the knowledge co-production suggests that the mediator is an indispensable actor in the network thus identifying him as the Obligatory Passage Point (OPP). While P6, who is a respondent with the longest association with the project and host organization pointed that…

“Well if it's to do with I.T. things then I would go to P7. If it's to do with organization, with schools and the general organization with the stakeholder groups in India then I'd to go to P4”. [P6]

Rendering P7 as another OPP for the technological aspects. Identification of multiple OPP’s suggests existence of different networks for both knowledge sharing and technology.

SVM also introduced the project team to community which established a dialogue between the team and community members. SVM delegates acted as boundary spanners that enabled building trust, improving coordination in decision making and implementation of the project network. Boundary spanners also known as bridges or brokers are those actors that facilitate transactions and flow of information between people and groups, which have no access to each other or have no basis on which to trust one another (Long et al. 2013).

SVM (focal Actor and OPP) provided various group interaction opportunities that facilitated the exchange of knowledge. This also enabled all the actors to be on same page and have clearer understanding of the goals. The idea that actors are shaped by their interaction with other actors is highlighted here. One on one interactions shape the actor’s network about roles and allocations. Latour (2005) emphasizes that interaction among actors helps in aligning focus of the actors over time. Availability of many venues for both formal and informal interactions provide multiple occasions for interest alignment and actor enrolment. Thus, contributing towards a stable network.

Also the focal actor had helped the other actors in their actor network by getting them through obstacles, by acting as boundary spanners and introducing them to the local tribal network, also facilitating knowledge exchange through regular meetings and channeling the actors in same direction.

In conclusion, the details described earlier indicated that OPP helped in holding all actors together. Each main actor had support from the focal actor, and consequently, ways were opened for them to achieve
their set benefits. These supports from the OPP resulted in success of achieving the mission of actor network. The following point summarizes the main reflections from this section.

Table 3. Reflections from interactions during setting up the OPP

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Reflections</th>
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<tbody>
<tr>
<td>1.</td>
<td>By taking a broad view the support from the OPP when the focal actor (SVM) created a mutual open environment of interaction and negotiation.</td>
</tr>
<tr>
<td>2.</td>
<td>The goals and benefits of each actor were closely tied with the overall aim of the IT4SI actor network.</td>
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<tr>
<td>3.</td>
<td>The experience and knowledge of Focal actor and other actors helped them overcome the obstacles.</td>
</tr>
<tr>
<td>4.</td>
<td>The main actor network was not overly complicated, though each actor had its own actor network the intertwining of actors from external networks was not observed in the main actor network during the project. Consequently, the main actor network could be stabilised. These stable actor networks are of interest because they are the status quo (Callon et al. 1986).</td>
</tr>
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</table>

As the main actor network was complicated and achieved stability, it can be said that the network was successfully mobilized. The existence of enrolled actors is the basis of mobilization. Mobilisation was achieved as a result of focal actor ensuring continued support for the project from enrolled actors. Focal actor achieved this by ensuring an open network for interactions and also providing various formal and informal interaction opportunities.

The device in Actor Network: Interactions with non-human actor

Referring back to actor network of IT4SI India project, many devices such as meetings, proposal, informal communication were used by focal network (SVM) and these devices were powerful enough to lock all actors into their positions.

During the project, other actors also used various devices to either impart their role or to maintain their position in the actor network. IU was responsible for technical aspects and used various devices in form of ICT to bind other actors in the network. Standardization is a necessary device for non-human actor, especially ICT devices like laptops, drones, classroom in a box, Spehro etc. Actor network utilised these devices to impart ICT skills and motivate the tribal community to interact with technology.

The non-human actor of technology plays a crucial role in imparting knowledge and delivering goals of the actor network. In ANT interaction changes actors and in current case study interaction with the non-human actor of technology translated actors. The change in frame of mind is mentioned by P15 (the only female associate of SVM)

“When they bring technology and show it to us, we get excited and motivated to use it. They take special care to involve all students and teachers, especially females. These type of activities boosts confidence and also lets all think how we can use this in future.” [P15]

The technology expert (P7) also mentioned that they aim to impart technical skills in female students through gender equity workshops that they organize especially for tribal female students. He recalled that the number of female students attending these workshops grew from 1 in first visit to more than 20 in recent visits.

Another informant from SVM highlighted that the introduction of technology to the tribal students excites them to utilize and understand new things. It opens the door to better future for them.

“When the Australian group (IU) comes they bring different technologies. They introduced our students to Kano* and it was an interesting talk and the children liked it very much. They broke it all and fixed it later and self-confidence was built amongst them. Now they can also assemble a small CPU, if they get the parts.” [P1]

* Kano is a computer anyone can make. It’s an easy way to learn building a computer, to do simple coding and to create with technology.
Another informant P8 attributed practical demonstration of technology by IU experts as a contributing factor to kids motivation and intelligence. Thus highlighting the importance of exposure to technology among tribal kids. When inquired about the importance of technology exposure to the tribal kids, P8 said:

“Exposure to technology is immensely important as these are the things that we have never seen in life, for example, drone, the recording drone is flying above our village and they are seeing the recording from the front. We can’t even imagine this in our life, so they get to see all these things easily, so there will be a change in their intelligence. Their grasping power or knowledge grows. They are sort of injected with enthusiasm and spirit.” [P8]

The above comments by various informants establish the translation of actors through technology. Interaction with technology through practical demonstration, learning programs and usage has translated the actors (students). The IT4SI actor network translates the idea/plan/goal into the artefact and actor inscribe their interests into the artefacts as well.

In the above section ICT4D project was analysed from the ANT lens. While doing so the focus was on the research goals of understanding the formation of ICT4D project ecosystem and unveiling the actor interactions. This was achieved by applying the punctualisation concept of ANT to the case study in order to establish the actor network of ICT4D project. The four moments of translation were used to understand various interactions among actors and the contribution of these interactions to the ICT4D project outcome.

**Conclusion**

This research intended to expose the interactions among actors in ICT4D project. The theoretical lens of ANT was used to investigate the actor interactions in developing country of India. In explaining the details of interactions, the sociology of translations (four moments of translations) was used.

Through the lens of ANT, it could be said that the focal actor (SVM) dominated the IT4SI project. The focal actor used this dominance to open a room for participation by other actors. this allowed the focal actor to keep aims and goals achievable. The involvement of other actors led to refinement of the goals and also the goals were set within the capacity and skills of the participating actors. This implies that in setting the project goal, the focal actor was concerned about the capacity of the relevant actors joining the project’s actor network.

As an OPP the focal actor (SVM) helped other actors overcome or avoid series of problems. Due to effective strategies and interactions the actors were able to overcome the obstacles. Therefore, the mission of actor network was achievable as they were routed through the OPP. This establishes that the focal actor had helped the other actors in their actor network by getting them through obstacles, by
acting as boundary spanners and introducing them to the local tribal network, also facilitating knowledge exchange through regular meetings and channeling the actors in same direction.

The significant point was how this focal actor could lock actors in a way that would make them work smoothly and collaboratively. The focal actor created multiple or different devices for various actors in the actor network. Many interaction opportunities and control of budgeting process enabled this to certain extent, but the main contribution came from actors imparting their roles by providing support and technology. Other actors like IU used different technologies to impart their role and to bind other actors. This research suggests that ICT4D practitioners/focal actor/OPP should create tools and devices to engage not just main actors but also look deeply into each main actor and support them in working well within their actor network.

This research applied ANT as its analytical framework, but due to limitations of time and resources the study did not consider contexts outside the actor network. For future research it is suggested that a context analysis would deepen the understanding of interactions from a broader view.

References


