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Actor-Networks and "Practices" of Development: Impact of a weather information system in West Bengal

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Abstract. In this paper, we leverage an actor-network theory approach to examine an information system that produces and disseminates weather forecasts and associated agricultural recommendations to small-scale and marginal farmers in two districts in West Bengal in India. We find an actor-network important in understanding technology-related social practices. The emphasis ANT places on the negotiations and contestations in the context of a technological initiative allows us to understand the mechanisms (rather than merely the outcomes) of such developmental interventions.

Keywords: actor network theory·ICT4D·capability approach·practice theories

1   Introduction

Practice theories have become increasingly prominent in fields such as Human Computer Interaction (HCI), Information Systems (IS) and ICT for development (ICT4D) [1–3]. By centering the analysis on what people do, practice provides a useful lens to "open the black box" of processes of change that involve technology [4]. That is why practice theories are being adopted for research which recognizes and allows for deconstruction of complex sociotechnical relationships involved in IS.

Actor Network Theory (ANT), in particular, is a practice theory that has been gaining popularity in IS and ICT4D research [3–5]. ANT has the aim of resolving the social determinism/technological determinism dichotomy and help bridge the duality between the technological artefact and the agent [6–8]. ANT sees society as made of a network of human and non-human actors, or actants [9–11]. It features a strong theorisation of the artefact, placing it in a symmetrical position with that of humans [12], providing for technologies to exercise agency–though not intentionality [10]–by becoming "delegates who stand in and speak for particular viewpoints" [8, 13]. It inverts the traditional use of descriptions of social structure as a means to explain processes,

focusing instead on description of processes to explain resulting structures [4]. Furthermore, an ANT approach sees the social world as inherently unstable and capable of falling apart but for negotiations between actors [9, 10]. Actor-networks are heterogeneous networks of aligned interests which can include people, technologies, standards, and organisations. Actors, through a process of translating their interests, enrol and align themselves with the network

We apply ANT to the case of an information system to produce and disseminate weather forecasts and associated agricultural recommendations to small-scale and marginal farmers in West Bengal in India. The system was initiated as part of the UN Adaptation Fund and implemented by a non-profit organisation called DRCSC. The intended impact of the system was to enable farmers to better understand changing weather patterns and respond with changes to their agricultural practices. The objective of our analysis is to understand developmental impact of the IS. In conceptualising what constitutes development, we align ourselves with the capabilities approach [14–16]. We draw on existing research on capabilities and ICTD [17–19] to position our findings from the ANT framework within the broader discourse of development.

2   Methodology

We adopt a case study approach [20] to examine the weather information system. A case study oriented approach entailed using multiple methods, collecting data through participant observation, semi-structured interviews, informal conversations, focused group discussions, taking pictures at various sites as well as collection of work materials and project documentation. We have limited the scale of our case and analysis to a single village and have based our descriptions and interpretations on observations of and interviews with actors such as the NGO field workers responsible for the system, local village volunteers, village heads and local self-help group (SHG) members from both men's and women's groups. Field visits spanned a few days up to a week at a time, and were conducted monthly between June and December 2016.

The methodological approach to the field study as well as the analytical approach taken in this paper is based on the "moments of translation" framework within the ANT tradition [9]. The starting point of the study was the central actor – the implementing organisation, DRCSC – and we then followed the way they sought to involve other actors in the project [4]. Interviews with head office staff were followed by an introduction to the field offices. From there, the actor-network was traced through the work of the field office and in the villages. We use the four "moments" of the ANT translation framework (as defined in [9]) – problematisation, interessement, enrolment and mobilisation to examine the working of the information system. While we have by necessity included references to parts of the actor-network that extend beyond the village, our attempt has been to delineate our discussion by the geographical area of the village. We have sought to describe the case in detail while also providing our interpretations and explanations of the context [5]. This follows from our intention to illustrate how ANT can elucidate processes of capability enhancement.

3   Applying an Actor Network lens: Moments of translation

Problematisation: While initial participatory vulnerability assessment exercises revealed a long list of problems and challenges, including lack of jobs, nutrition, lack of government linkages, and poor access to credit, the "summary of problems" to be addressed by the project (as written in the funding proposal) were defined by the central actor's focus on agriculture: "water availability", "drought", "long rain break", "depleting natural resources" and "uncertain climactic pattern". The proposal suggested that "*crop-weather advisories will help to reduce the risks and damages caused by climate change. It will capacitate the farmers to take more effective decisions regarding farm management*". The initial project proposal highlighted how experts need to be engaged to prepare meteorological forecasts and appropriate agricultural advisories which should "*minimize the loss of farmers and also optimize input and thereby its costs in the form of irrigation, seed, fertilizer or pesticides*". While the range of issues that emerged from the appraisal was wide, what was eventually proposed by the organization were based on the areas in which the organization had capabilities. The "obligatory passage point" [9], thus, became the local, related issues of water availability, drought, reduced rainfall and depleting natural resources; which were also in alignment with the external interests–that of the UN Adaptation Fund. The problematisation in the actor-network was how the organization made itself indispensable by bringing in its capabilities to negotiate the obligatory passage point.

Interessement: Here, the organisation set forth several processes to lock-in other actors into its network. It conducted a Participatory Rural Assessment (PRA) exercise to raise awareness of the programme and introduce villagers to the weather data, recruit interested parties and highlight challenges which the project might address. Further, the organisation sought permission from the village head or *majhi*, to run the programme in the village. However, as one of the NGO staff members expressed, there was initially some resistance to using the data, as the villagers were not aware that creating such predictions was even possible at all. The organisation also installed a blackboard on the main road leading through the village, and collected phone numbers from some of the villagers, with the intention of sending them weather updates via SMS. The organisation sent two sets of messages, after which it became clear that messages using Bengali script were not readable on the villagers' phones.

Enrolment: The organisation sought to work through the existing network of power in the village by asking the village *majhi* to be a volunteer for the project. They also installed a manual rain gauge on his property for him to use in collecting weather data for the village–this data was intended to be used by the meteorologist to improve forecasts. The *majhi* related that he saw little benefit in undertaking the work involved and thus passed the responsibility to one of his male relatives. The male relative in turn, feeling that he did not have time to conduct this work, handed the responsibility to his 18-year-old daughter. These events initially caused the network to be unstable, with long periods of data not updated on the blackboard. However, once the daughter got involved, the regularity of management of the blackboard picked up. Being literate, and studying in class 12, made it possible for her to undertake the activities of the project. She expressed how she felt happy to have the responsibility as there were

no other jobs for her in the village. The organisation recruited a young woman who had undertaken college education, as a field officer in charge of the village. The establishment of this village-level infrastructure by the organisation – volunteer & field officer – provided some organisation to the network. It was not only the enrolment of human actors that the organisation was involved in. Noticing that weather data dissemination over SMS was not functioning as expected, the organisation adopted paper print-outs of forecasts and recommendations which were provided to the field worker and the volunteer. They, in turn, shared them with the villagers in group meetings.

Mobilisation: Taking the case of the blackboard on the central street, the now regular updates on the it provided a visual reminder of the existence of the weather forecasts. It also provided a performance of the village volunteer's (the *majhi's* relative's daughter) role in the network. Her role furthermore included regularly collecting the rainfall measurements from the rain gauge installed on the *majhi's* plot. Along with the other female village worker, she began introducing the weather recommendations to the women's groups of the village. As women in the village do not regularly spend their time in the public spaces of the village main street, only a few members of these groups were even aware that the blackboard with weather data existed. As the volunteer introduced them to the weather forecasts, they began to apply the knowledge of predicted temperatures to decide whether to allow their livestock to graze or children to go to school. Thus, we see that while the project's stated focus was to provide recommendations for issues such as pest management and irrigation, the inclusion of temperature measurements allowed the print-outs to act on behalf of the network to engage the women's groups in it. Having a public role in the village, along with interactions with the *majhi* and the responsibility to speak on behalf of the project, provided the village volunteer with a new position in the actor-network of the village. As she related in answer to the question: "*Do you think you get better treatment from the village after becoming the [volunteer]?*"

"*Yes, I think my friends become jealous of me and aged people seek solution regarding the weather information from me.*"

Through these four stages we have illustrated the initial establishment of the actor-network in the village over two years. They highlight how the network has passed through several moments of negotiation and potential instabilities – for example the general lack of interest from the *majhi* and his male relative or the inaccessibility – and therefore lack of use – of the weather data by the women. We trace the establishment and endurance of the network in the face of these challenges to the ANT concept of "substantial, material and procedural devices", the interplay of which establishes the network [5]. The substantial device is the weather data, forecasts and agricultural recommendations. The maintenance of   the actor-network depended on the existence of multiple parallel material and procedural devices. SMSes proved to be an unsuitable material device to the local conditions, whereas paper print-outs worked better. The material device of the blackboard served to interest men in the project, but the inability of movement between the network of women and the network of the public space acted as an initial barrier to women's participation. The pre-existing village SHG meetings were a procedural device that not only suited existing information exchange patterns, but also enabled the discovery of productive uses of the

information for the women of the village. The procedural device of writing on the blackboard served to mobilise the village volunteer through her public performances, publicly associating her with the knowledge she thus shared. Throughout, we found that the introduction of a new technology was about the processes of constant negotiation that lead up to short-term stability in the social world, rather than a final, stable outcome. Examining how the effort of actors together holds changes tells us a lot about the process of development and social change. Specifically, it tells us about the capabilities that actors have developed and could leverage.

Following a capabilities approach to development, ICTs are a means by which an individual's capability set can be increased [17]. In this view, ICTs do not themselves contribute to development but are resources which, when combined with personal, social and environmental "conversion factors"[1] can result in capability enhancement [17, 18]. We strive to understand *the process* by which this is achieved through two foci: the role of human actors, and the role of technological actors.

One of the examples of capability enhancement could be seen in the village volunteer. Through participating in the actor-network, she became an actor–within the village–who had a direct relationship to the village *majhi*. The ANT analysis highlights the role that specific resources–pre-existing social relations, education and material devices–played in enabling the capability enhancement of the volunteer. In terms of the technologies, we see that the format of the print-outs and the resulting negotiation of women's participation in the actor-network enabled capability enhancement outside of the problematisation by the leading actor. For example, even though livestock is recognised as an important aspect of women's lives in the district, the initial proposal to the UN Adaptation Fund considered only the management of "water scarcity" and financing. The provision of temperature data in the print-outs, however, enabled women to maintain the health of their children and livestock by keeping them home on the hottest of days. While this was not considered in the proposal, it resulted from the interplay of devices and negotiations taking place in the actor-network.

4   Conclusion

We used an ANT lens to illustrate the working of an IS. The lens allowed us to treat the agency of the human and the technological actors symmetrically and to appreciate how a process of technological adoption and social change involves constant negotiation. Through the limited examples elaborated above, we propose that understanding capability enhancement through the interplays and negotiations of an actor-network provides a valuable perspective to highlight some of the complexities and locally situated practices which can enable or hinder development. While we focus on demonstrating the actual practices around a development initiative, our broader aim will be to understand how social processes of negotiation help people enhance their freedom and capability to make choices.

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[1] Conversion factors are those that allow an individual freedom to achieve certain capabilities, using all the commodities at the individual's disposal (the means to achieve). For a detailed explanation, see Zheng [19].

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