

Developing E-Banking Services for Rural India

Making use of Socio-Technical Prototypes

Yvonne Dittrich
Computer Science
IT Univ. of Copenhagen
Copenhagen, Denmark
ydi@itu.dk

Lakshmi Vaidyanathan
Jivass Technologies,
Chennai, India
vlakshmi@gmail.com

Timothy A. Gonsalves
School of Computing & Elect
Engg IIT-Mandi
Mandi 175001, India
tag@iitmandi.ac.in

Ashok Jhunjhunwala
TeNeT group, #331, ESB
IIT-Madras
Chennai 600036, India
ashok@tenet.res.in

Abstract— Information and Communication Technology (ICT) is one of the key enablers for including underserved communities in economic and societal development across the world. Our research analyzes several banking service projects developing technical solutions for rural India. This poster presents an experience report based on systematic debriefing of involved project leaders and initiators, triangulated with additional documentation. The concept of Socio-Technical Prototype is developed and used to show how to mitigate the challenges of ICT based banking service provision for socially constrained communities. The concept of Socio-Technical Prototype extends the notion of prototypes, as it implies a full functioning implementation of the service including all relevant stakeholders, in order to not only prototype end-user functionality but also the interaction of the solution with the specific social, technical and physical environment. The implications for software engineering in the development of such large-scale prototypes and pilots are outlined.

Keywords—ICT for Development, Participatory Design, Iterative Development, TeNeT, India

I. INTRODUCTION

Today, India, the world's largest democracy, is on the brink of a digital payments revolution, post its demonetisation drive. The journey itself can be seen as a large scale software engineering case study: In its journey for financial inclusion, basic banking services are an important factor contributing to the improvement of livelihood in underdeveloped parts of India. The current government is refocusing its efforts to enable every Indian to open a bank account [1].

Rural banking branch offices in India have low economical viability. Mobile technology-based E-banking is expected to provide more viable solutions as mobile telecommunication infrastructure and coverage becomes more ubiquitous and reliable. At the time of the case study, leapfrogging [2] the 'traditional', paper-based banking required much consideration. Developing ICT to promote development of under-privileged communities has never been easy [3]. The question being answered in retrospect is "what would it take to develop and deploy viable ICT based banking services specifically for rural India?"

This poster presents the experiential ICT based design approach of Socio-Technical Prototypes driven and coordinated by the TeNeT Group [4] at the Indian Institute of Tech-

nology in Madras (IIT-Madras) along with Rural Technology and Business Incubator [5], a work that eventually converged into the very current mobile payment solution for India (under the aegis of the Mobile Payment Forum of India, MPFI and the Unified Payment Interface, UPI). The work is based on a series of debriefing meetings of key project members, that resulted from Yvonne Dittrich's visit to RTBI and the TeNeT Group. Lakshmi Vaidyanathan has been the RTBI project lead for the first two Socio-Technical Prototypes, Timothy Gonsalves and Ashok Jhunjhunwala have been ideators and mentors of the initiative and have contributed with technical knowledge and research to the projects.

II. RESEARCH METHODS

The Socio-Technical Prototypes that are subject to the empirical analysis of this paper have not been planned as research, but were in the first place implemented as development projects and pilot studies. Being confronted with the account of the complexity and heterogeneity of the issues impacting the design and process, the authors decided to reconstruct and analyse the prototypes ex post to the extent possible. The research can be seen as a combination of a multiple case study and a systematic experience report.

To increase the reliability of the findings, case specific and cross case triangulation was conducted. In each of the cases, the accounts of the three project-participating authors were triangulated based on their role specific records. Additionally, scientific publications and documents by other project stakeholders in form of websites, press releases and 'grey literature' were analyzed. (Please refer to [6] for a full list of additional material.) Analysis categories used were restricted to those confirmed by all three cases. Further, the cross case findings were triangulated with additional literature on the telecommunication and financial sector in India.

III. THE CASES

Banking at the local Internet Kiosk – An early case study on rural banking was sponsored by the Ministry of Rural Development (MoRD) and United Nations Development Programme (UNDP) in cooperation with State Bank of India (SBI). Biometrics enabled banking clients was developed to be deployed in regular internet kiosks in four rural centres near Mayiladuthurai, a small town in the southern part of Tamil Nadu state. The core banking server was ac-

cessed over internet via the kiosk PC. Local biometric security validation via a USB connected fingerprint reader was used. As an intermediary, a “banking correspondent” agency (a special intermediary organization engaged by the bank for providing banking services at locations other than regular bank branches) was involved. The agency engaged trusted, local business correspondents as trained operators to act as agents of the designated bank. Via biometrically authenticated access of both the agent and the account holder, secure debit and credit services were provided.

The Grammateller Rural ATM – The second project, also UNDP/MoRD sponsored, came about along with the Banking Correspondent agent model. The idea was to develop a low-cost biometric ATM that worked in the physical and social environment of rural India. A technical prototype was first deployed at the campus of the IIT Madras in cooperation with the State Bank of India and with network switch support from FSS, a company focussing on financial software and systems. After initial debugging, it was deployed at four rural sites in the Cuddalore district of the state of Tamilnadu in India.

Mobile Banking – The experiences with the above two prototypes and economic viability issues lead to exploring mobile phone based financial services. The ubiquity of the mobile phone and the experimentation with mobile-based payment in other parts of world provided the impetus. The Mobile Payment Forum of India (MPFI) was founded with the mandate to do research in banking technology and to form standards for the Indian banking sector. MPFI brought together governmental agencies, banks, telecommunication providers, regulatory authority as well as technical experts in the coordination and development of services, protocols and applications.

In 2009-10, MPFI developed interoperability standards to support person-to-person payments using mobile phones. Each bank account is identified by the holder’s mobile phone number and a Mobile Money Identifier (MMID). Payments are effected by a transfer between the two bank accounts. Several banks including the State Bank of India have implemented the service. With the possibility of voice biometrics, voice-based banking services and payments became available even for semi-literate users of mobile phones.

IV. SOFTWARE ENGINEERING FINDINGS AND INSIGHTS

Table I summarises different dimensions of learning for a viable and sustainable solution that were mediated through the socio-technical prototypes in the context of underprivileged communities. The analysis confirms results of other similar sector project deploying ICT that emphasise participation [7]. The importance of relating the development to a wider context, the need to involve the intended users in order to co-develop the social context together with the technical design, and the intrinsically iterative and evolutionary process [8, 9, 10] are key success parameters.

In comparison to prototyping in the context of user centred development or agile development, the prototyping here does not only address the design of individual applications, but also includes the social embedding and social deploy-

ment context of the integrated software and hardware prototype. First, hardware and software interfaces need to be negotiated as part of the software project. As the hardware setup is subject to the prototyping as well, these interfaces might change even late in the project. Secondly, as the sharp prototypes require integration with existing software and infrastructures, developers need to cooperate across organisations while at the same time comply with the standards and regulations applied in their own organisations. In highly regulated domains like banking software, these might be conflicting requirements. Third, the software development needs to be able to react to the change of requirements after the system is deployed. The approaches to combine user centred design and, for example, agile software development [11, 12] are still subject to research, and can be adapted to cover the initial development. However, these methods require that user experience work can be directed to inform the design of specific features. This is not at all possible in the socio-technical prototypes; the socio-technical prototypes described above all resulted in changes to software as well as hardware that have not been anticipated.

More research is needed to better understand these dynamics.

TABLE 1. SOCIO-TECHNICAL PROTOTYPE LEARNING DIMENSIONS

<p>Usability</p> <ul style="list-style-type: none"> • Usability issues originate in the specific social cultural context and relate to the functionality as well as to the interface design. • Such usability issues are only discovered after prolonged deployment.
<p>User Participation</p> <ul style="list-style-type: none"> • Processes and strategies of user involvement need to take social and cultural circumstances into account • A fully functional version of the system is needed to make functionality and design comprehensible to intended beneficiaries.
<p>Deployment and Service Provision</p> <ul style="list-style-type: none"> • The whole infrastructure to provide the prototyped services needs to be addressed to identify economic, technical and legal constraints. • Developing ICT-based services includes the development of an economic model that supports all actors involved.
<p>Software Development context</p> <ul style="list-style-type: none"> • Working with the development and iteration of sociotechnical prototypes requires empowered project teams that can take decisions locally. • Sharp Socio-Technical Prototypes require long-term commitment. • Interdisciplinary project teams are crucial.
<p>Political and legal context</p> <ul style="list-style-type: none"> • The deployment of ICT might expose conflicts with legal regulations and influences on the political system. • Relevant public agencies need to be involved.
<p>Infrastructure</p> <ul style="list-style-type: none"> • Deployment of ICT-based services are highly dependent on the underpinning infrastructure. • Prolonged deployment makes these dependencies visible, so they can be addressed explicitly.

ACKNOWLEDGMENT

The projects described here are multi-year efforts involving many people in a number of organisations. These include the N-Logue, TeNeT Group, Legend Systems, TCS, FSS, RTBI, IIT-Madras, Vortex, UNDP, MoRD, Vortex, IDRBT, MPFI, SBI and some others.

Poster presented at the ICSE 2017, Buenos Aires

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