

Examining the viability of mixed framework for evaluating mobile services impact in rural India

Kasina V. Rao, Krithi Ramamritham and R. M. Sonar

Abstract— This paper examines the proposed framework for evaluating the impact of the intervention of mobile-based services on socio-economic development of Indian rural areas. Framework suitability has been studied using case study method with pilot test data. Existing literature shows multiple ways of studying mobile impact through different frameworks. The need for uniform framework is the felt need as various user-centric mobile services launched across rural markets. India becomes a field testing ground for most of the multinational firms who want to test their innovative business models. This framework provides a testing method for socioeconomic development impact on rural areas. This study adopted socio economic criteria (SEC) used by Indian marketers as basis for sample selection. The pilot study clearly shown that field is ready to test the proposed framework.

Index Terms— Mobile services, Socio-economic criteria, Socio-economic impact, User needs

I. INTRODUCTION

The mobile usage and acceptance across all ages, genders, per-capita incomes and areas in India is a phenomenon. It has provided extraordinary growth to mobile industry to come out with innovative new user-centric services at affordable costs. These initiatives by government and corporate organisations have come when India is changing at a great pace by inclusive growth with technology support into the mainstream. It is imperative for them to incorporate mobile technology-driven development initiatives for the betterment of people. The project initiatives started to deliver user-specific mobile services to rural areas which had been untapped markets for a long time. Such services are targeting about 70 percent of rural populations [1] who are mostly dependant on agriculture and allied sectors. All these years the development of rural areas had not taken place due to limited infrastructure. Governments are struggling to improve rural infrastructure due to inaccessible terrain, lack of funds and other reasons. The telecom revolution has given a chance to break these barriers and provide the basic value added services (VAS) to people living across rural areas. This has happened

due to the open policy of the government with public private partnerships (PPP) allowing private corporate collaborative projects.

The economic and social development of the rural people in India largely depends on the progress of rural sectors, especially agriculture and allied where the per-capita income is below 2 dollars a day. The poverty is seen at two levels: one is income based poverty and the other is non-income based [2], in terms of inadequate information delivery system usage. These two have formed a development divide for years. The solution is very clear: support innovative and creative projects while providing (user-required and demanded) services relevant to its users. The other option is to bring forward corporate organisations to extend their business into rural areas. The social and market driven forces are providing an opportunity to invent new business models to make mobile services reach unreached areas.

Emerging markets in particular, are playing a major role in showcasing how to use technology based information services for rural people in the context of development. This has provided a chance for the research community (technical, social and domain specific), to develop tools and applications to provide solutions for the need of the rural community, which is a major challenge. With these tools, innovative business models are helping channels to provide potential services to rural people. Hence, technology supported services are a need of the times. These services, if designed properly, can help in addressing their livelihood problems. As cited by [3], Olof-Ors said “when there’s more money at risk, there’s more demand for neutral information”. An innovative idea with rapid and responsive implementation into a creative and useful project is the key.

It has been proved that rural growth is more efficient than the urban growth just as the agricultural growth is more efficient than manufacturing growth [4]. Availability of quality information at the fingertips in local language improves their decision making, from what crop to plant, to whom and where to sell their produce with good returns, and also derive benefits from health and disease prevention advisory etc. The services for agriculture are rather appealing, as the outcome is of immediate use to the farmer thereby helping in saving money and time by reducing trips to markets and to extension centers for advice on crops. Adding wireless component to the existing limited mobility in rural areas brings a transition in adopting flexible mobile ICT applications and services. The present decade has seen an

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exponential growth in telecom technologies, particularly wireless. There is something driving people to adopt mobiles into their personal life irrespective of urban or rural. As per Confederation of Indian Industry and Earnest & Young, by 2012, India is expected to have 200 million rural telecom connections at 25 percent penetration rate. The mobile phone has gained a position for itself as a personal entity and occupies a key place in people's pocket along with their money purse, keys etc [5]. Such indirect impacts create a long-term effect on development rather immediate ones.

The new projects are built up after careful field studies taking user needs as the basis. These studies found that the services to be offered based on availability of sufficient funds, technological strengths, user-centric services and localised content. The various critical factors contributing to the success of these projects include the role played by the users and business partners, type of mobile services based on user needs, business model adopted, and implementing innovative working model. These projects are providing mobile services on agricultural knowledge and crop advisory tips, local market prices of crops, social networking with nearby village people, information regarding social, political and economic activities and micro-finance aspects. The preliminary observed benefits on user side are of socio-economic nature.

This paper presents an effort at evolving a systematic framework for assessing the impact of mobile services' intervention. This need was felt as specific user-need-based projects had started implementing mobile services for the past three years and they are yet to reach a critical break even stage by fulfilling user needs. To break even a minimum user number is critical as the price at which mobile services offered is quite low. The positive contribution from this work is to standardize a framework for India which can be used to assess socio-economic impact of mobile services intervention.

The published literature on mobile services impact in the development world [6, 7] is quite small. The impact study of mobile services comprises two distinct schools of thought, each comprising a host of qualitative research and some quantitative enquiry. In this multi-disciplinary research study, country specific analysis can provide a way to standardize the methodology to implement in future studies. Fortunately, a small but methodologically diverse set of research studies have examined the mobile services intervention in rural India. Indicating a need for a mixed framework to standardize impact studies to compare and contrast in all domains. That need is going to be fulfilled with our proposed framework.

Initiative logic is adapted to the conceptual link from the inputs of an initiative to its output and, subsequently, to the achievement of the results and outcomes of this initiative. A comprehensive evaluation will systematically examine the validity of this logic, particularly in the case of a developing country where baseline surveys are not made and monitoring and evaluation systems are too weak to undertake any structured evaluation studies. Evaluation studies are undertaken with different approaches to achieve intended results. But these results vary as per the approach used on the same project therefore not to be easily generalized over entire

population [8]. A working framework standard for mobile services impact for the country is achieved in this paper. The paper goes on to report the findings from a pilot study with a case to demonstrate that the framework is ready for implementation.

The rest of the paper is organized as follows: we start by reviewing the literature specific to India in the area of mobile based services and applications impact on society in Section II. In section III the framework fill the existing research method gap is examined. Section IV analyses evaluation research methodology. Section V looks at the research approach of the study. Section VI looks into a sample case analysis based on proposed framework. Section VII provides discussion on results obtained from survey undertaken in the pilot case study. Section VIII contains the conclusion.

II. REVIEW OF LITERATURE

While urban community is fairly well connected with multiple information gateways, rural India lags far behind. Researchers have found that the interconnections across ICT-based projects in businesses and social organizations have demonstrated that multi-faceted inter-linkages across social, cultural, political and economic capitals are possible [8]. Till date, there is no sufficient evidence to state that technology intervention brings development. But evaluative studies with various approaches are performed. The results vary with every approach on the same project itself; therefore results cannot be generalized over entire population [8]. The technologies act as a mass medium for bi-directional information transfer and exchange among communities. The technology features provide electronic capabilities such as battery, processing power, memory [9], reach to customers, provide privacy, anytime and anywhere contact - less services and preferred personal carry item [9]. Keeping these factors and the needs of people in mind, customized applications and services are launched through initiatives for information dissemination over mobiles. The impact of mobile phones on the lives of rural adopters, therefore, will be insightful [10].

There are definite benefits from mobile phones in supporting the development, although assured criteria is necessary for their applications and services to be successful [11]. Rural people are struggling to catch up with the urban standards in development outline. The demand and need of development depends on timely of advice about their crops, market information on produce, sustainable financial support for inputs, health of community and their animals, education and sanitation, etc [12]. Most of the farmers unable to get correct value for their crop yields. They often get as little as 25 percent against 40-50 percent of actual value as in developed countries. Nokia-Common wealth telecommunication (CTO) research study has shown that all stakeholders must fulfill their roles to people in remote villages, to deploy and employ new technologies (mobile phones) for economic growth, by enhancing employment and socio-economic well being [13]. In light of this concern in particular, mobile phones have gained footing within South Asia through various initiatives [14]. This change brought a personal identity, social structure

and social network which may be linked to business, economic and financial transformations of the people [14].

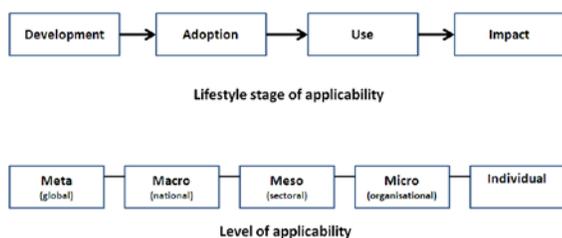


Fig.1. Applying livelihood framework in development informatics [15]

The impact of any intervention will follow (Fig.1) development, adoption, use and impact steps. Impact is observed only after the intervention absorbed by the users. The level of applicability of research starts from individual or household level to organizational environments at all levels (Fig.1), including local, sectoral, national, and even global [15]. This approach has research value as it illustrates the transfer of knowledge between different levels of applicability. The impact study of mobile services comprises two distinct schools of thought each comprising a host of qualitative research and some quantitative enquiry.

Table I
COMPARISON OF RELATED STUDIES

Studies	Design	Strengths	Weaknesses
R. Jensen, "The digital provide: Information (technology), market performance, and welfare in the South Indian fisheries sector [15]"	<ul style="list-style-type: none"> Quantitative study Econometric analysis Time-series data analysis Micro level analysis 	<ul style="list-style-type: none"> The best quantitative study in the area till date The economic quantification is measured for about five year period Mobile acceptance reduced price in fishing supply chain 	<ul style="list-style-type: none"> The social component of development is missing Mobile acceptance on non-economic poverty is not tested The socio economic development of fisherman was not studied
R. Abraham, "Mobile phones and economic development: Evidence from the fishing industry in India [16]"	<ul style="list-style-type: none"> Case study method Quantitative study Cost-benefit analysis Micro level analysis 	<ul style="list-style-type: none"> The best quantitative study within case study method Mobile role in information asymmetries in fishing supply chain is measured 	<ul style="list-style-type: none"> The social component of development is missing The socio economic development of fisherman was not studied
David Souler, Nigel Scott, Christopher Garforth, Rekha Jain, Ophelia Mascarenhas and Kevin McKemey, "The Economic Impact of Telecommunications on Rural Livelihoods and Poverty Reduction: A study of rural	<ul style="list-style-type: none"> Quantitative study Individual interview as survey instrument Statistical analysis Both macro and micro level analysis 	<ul style="list-style-type: none"> The quantitative study to find out telecom impact on poverty in rural livelihoods Study was undertaken to build strong evidence based for policy development contexts 	<ul style="list-style-type: none"> It is a general study where the sample is collected from various pilot projects to conclude It is a broader study to know investment vs benefits for rural livelihoods The socio economic development of

communities in India (Gujarat), Mozambique and Tanzania [17]" Krishna Reddy P., "A Framework of Information Technology Based Agriculture Information Dissemination System to Improve Crop Productivity [12]"

Meera, S.N., Jhamtani, A. and Rao, D.U.M., "Information and communication technology in agricultural development: A comparative analysis of three projects from India [18]"

Surabhi Mittal, Sanjay Gandhi and Gaurav Tripathi, "Socio-economic impact of mobile phones on Indian Agriculture [19]"

Aditya Dev Sood, "The mobile development report [9]"

- Quantitative study
- Pre-post study method
- Statistical analysis
- Micro level analysis

- Qualitative study
- individual interview as survey instrument
- Statistical analysis
- Micro level analysis

- Qualitative study
- Focus & Individual interview as survey instrument
- Both micro and meso level analysis

- Extensive qualitative case studies
- Case survey of individuals
- Micro level analysis

- It is a well structured pilot project with base-line data
- Knowledge & information transfer impact studied well
- The pre-post method applied to see the impact on rural people economic development
- Implementation & uptake of three projects are studied
- Looked well perceived implementer's view

- The quantitative study tested well how agriculture extension services can reach to a small farmer
- Study co-related productivity with mobile extension services
- Well focused qualitative study
- Study looked well about social dynamics
- In-depth qualitative case study on individuals' life to see the benefit due to mobiles

- rural livelihoods were not seen
- The social component of development impact is missing
- Pilot to commercialization stage is missing – so the study loses its strength on results
- The study lacked socio economic impact on rural people
- Usage and information needs seen not of their impact on their life become easy

- The study looked through all stake holders in extension system rather farmer focused
- The quantification of economic component is missing
- It is general study on urban and rural individuals
- Case survey was not supported by quantitative impact values to generalize the outcomes

We review here the qualitative and quantitative literatures that have contributed to both schools of thought for the past few years within Indian context (Table-I). Compare and contrast the core opinion all along with the respective findings in the studies. This literature review (Table. I) is to redress the methodological gaps evident in the previous studies.

III. NECESSITY OF A MIXED FRAMEWORK

Initiative logic is adapted to the conceptual link from the inputs of an initiative to its output, and, subsequently, to the achievement of the results and outcomes of the initiative. A comprehensive evaluation will systematically examine the validity of this logic, particularly in the case of a developing country where baseline surveys are not made and monitoring and evaluation systems are too weak to undertake any structured evaluation studies. Adequate data for quantitative assessment is not available for most of the ICT projects. The collection of such data using a standard measurement framework for selected projects is the task to be undertaken at the beginning [8]. The framework is able to find out the counterfactuals of the intervention undertaken within the projects since impact assessment is the critical objective within it. Most of the evaluation works in developing countries including India have not used a general framework to predict the results or outcomes based on purposive sampling. Those studies presented different outcomes which are non-comparable and generalizable to say that specific ICT intervention on socio economic development of rural areas.

On one side, the projects are pushing user need-based services to expand and sustain in rural market and users are subscribing for such services which will fulfill their needs to make their life easier. As a result, these push-pull based mobile services should attain user satisfaction. Till date the basic needs of rural communities are considered from research outcomes.

IV. DERIVED EVALUATION METHODOLOGY

Evaluation may be regarded by some as a diabolical exercise. However, if evaluations are well conducted, and if the results are used by decision-makers, they can contribute to increased transparency, accountability and cost-effectiveness [21]. It may be difficult to identify what effects are actually caused by an initiative and to separate these effects from the countless other influences on the socio-economic problems. The distinction is important by which outputs should be directly identifiable, but identifying its immediate results and outcomes may be far more difficult. The results and outcomes arise through a series of complex interactions between initiatives (mobile services) and society. The evaluation method arrived at from the existing evaluation techniques used to measure outcomes.

A. Methodology issues

Let us consider 'ex-post evaluations' which are conducted either 'upon' or 'after' the completion of an intervention (mobile services). Ex-post evaluations are 'summative in nature', and are often conducted to express intention of 'analyzing an initiative's impact'. The information needed to assess an initiative's impact may often not be fully available until several years after the programme launched [21].

But waiting for several years to study any initiative's impact in the society is difficult. In case of intervention of mobile services, the 'quasi-experimental design' is the more practical approach to undertake. Here control groups still can be used,

but these have to be created through some non-random process. Alternatively, one can examine the initiative's beneficiaries 'before' and 'after' their exposure to the initiative's intervention. Before-and-after design simply compares the situation after the initiative's intervention with the situation beforehand and attributes any difference to it.

Administering a before-and-after design is relatively easy, but causal inference tends to be quite weak. There is always a possibility that something else besides the intervention may account for all or part of the observed change over time. An improvement on the before-and-after design is the 'interrupted time-series design' [21]. It involves obtaining additional information over time, both before and after exposure, to an intervention in order to create a 'time-series of observations'. But in practice, we can have a variation to undertake the study. The 'counterfactual' can be derived with position of time frame denoted by a simple relationship such as: $[(a - b) - (c - d)]$, where a, b represent time position of pre and post observed of experimental group and c, d similarly for control group. In other words it is a 'delayed pre-test/post-test' design with a comparison group.

It is a useful design to be implemented where 'base-line data' does not have with projects. The minimum gap expected to measure the observed changes after intervention is about 6 months. In India, most of the projects do not provide or have baseline data; hence evaluation studies have limited feasibility to undertake studies. The above method will fit better to fill the gap well. Let us formulate the method to be implemented for the intervention study.

The impact of mobile services intervention is formulated what the situation of participating people (or the treatment group) would have been, had they not participated in the project. This is referred to in the literature as 'Potential Outcome Model' [22]. The model is denoted as follows:

$$T_i = Y_i(1) - Y_i(0)$$

where T_i is the treatment effect for the individual i , $Y_i(1)$ is the prospective outcome for individual i where and when treated (the concrete outcome) and $Y_i(0)$ is the potential outcome for individual i when (s)he would not have participated (the counterfactual). The missing data problem need to be solved by constructing a realistic counterfactual, i.e., the possible outcome if this person would not have participated [23].

For constructing a 'realistic counterfactual', we need to consider two steps. First is the decision to participate in the project and second, the processes and aspects influencing socio-economic outcome indicators [24]. Since participation in the project is voluntary, one cannot simply compare participants with non-participants, as it is expected that they are different with respect to various observable and unobservable characteristics which can influence the outcome indicators irrespective of participation [23]. To arrive at a suitable estimate of impact, the effect of selection (based on observed as well as unobserved characteristics) must thus be accounted for.

A 'good control group' will be formed by conducting 'qualitative research' at an early stage of fieldwork, by taking

into account the unobservable differences (e.g. motivation) during the sampling method of the survey and by using econometric data analysis to control observable differences such as family size, age or size of farm before project initiation. But it does not happen with all projects in general in India. A ‘delayed pre-test/post-test design’ with ‘comparison group’ is to be adopted as various observable and unobservable characteristics influence along with mobile services intervention gets eliminated. The final evaluation method will therefore be ‘delayed pre-test/post-test’ design with a comparison group which is known as ‘Potential Outcome Model’.

One of the ‘shortcomings’ of such research conducted is that the relation between project activities and the impacts are not always clearly explained [25]. This is partly due to the lack of a comparison to comparable non-participating people. However, even if a good control group is used, the relation between project activities and changes will need to be clear to make the results convincing.

B. Frameworks issue

The project type and necessity form the base for any framework. What we are considering here is a multi-project, multi-disciplinary problem; hence the selected framework could be an appropriate mix and provide at least some degree of compatibility [25]. Based on this, a mix of two frameworks clearly set for the intervention of mobile services study is adopted.

The first considered one is a four dimensional general one for any kind of intervention process: ‘input-output-outcomes-impacts’ framework, which stresses the need to identify the relationships between project activities and the impacts measured, and the measurement of impacts at different levels. This builds on a standard ‘input—process—output model’ to create ICT4D resources and processes. It is divided into four for assessment - readiness, availability, uptake and impact form the ICT4D value chain. To some extent – and particularly in relation to outputs, outcomes, and development impacts – the main focus is on assessment of impacts rather than other value chain stages [25].

The project impact is subdivided into three sub-elements: outputs (micro-level behavioural changes), outcomes (specific costs and benefits) and development impacts (contribution to broader development goals). Major goals are the main objectives a group wanted to achieve with the projects (might typically relate to outputs and/or outcomes and/or development impacts); undesirable outcomes are unexpected outcomes that a group did not want to happen but which did happen [25].

Measuring the impact of a project thus requires a multi-dimensional perspective. The project goals can be interpreted to have moved beyond an increase in yield and quality to the broader aim of reducing poverty, measuring its impact thus becomes more complex. The ‘sustainable livelihoods framework (SLF)’ provides an all-embracing framework for assessing the impact of projects on individuals and communities based on context, assets, institutions, strategies

and outcomes. The points of intervention and impact of projects can be mapped on SLF, as an attempt is made in development projects [25, 26, 27]. The framework views people operating within a context of vulnerability in which they have access to certain assets [28]. The influence over, and access to these assets is partly determined by the prevailing social, institutional and organizational into five capitals: financial, human, natural, physical and social. It provides ‘flexibility of indices selection’ from ‘each capital’ before undertaking impact study.

C. Adopted evaluation method

The adopted evaluation methodology is to interview about: change - "before" and "after" in terms of asset changes, and causation - investigating how the change was causally related to the ICT4D [25]. Hence, the change is measured with ‘delayed pre-test/post-test’ design with a comparison group and causation is measured with ‘input-process-impact’ combined with ‘sustainable livelihood framework’ choosing indices from capitals on need based. This evaluation methodology is the basis for ‘mixed evaluation framework’ design to measure mobile services intervention impact.

V. RESEARCH APPROACH

To study mobile services intervention impact, a two-phase research approach is adopted – a case study approach and a semi-experimental approach which corresponds to two phases, namely the qualitative and quantitative phases. By combining these two approaches a realistic counterfactual can be constructed.

A. Semi-experimental approach

The quantitative answer to the research question is planned using a quasi-experimental design that a comparison is possible because of naturally occurring ‘treatment groups’, i.e. ‘participating population’ in the project areas versus ‘non-participating population’ (i.e. control group) outside the project area. Apart from their participation in the project, the participating people and the non-participating people need to be as homogenous as possible. Besides constructing the ‘counter-factual’ based on the comparison of the socio-economic situation of these two groups, a ‘before-and-after counterfactual’ will be constructed using the results of the ‘baseline study data’ if available, else a ‘delayed pre-test/post-test’ is conducted to measure the required results.

B. Case study approach

Case study research more often recommended as part of a ‘multi-method’ approach [29] (i.e. ‘triangulation’) in which the same ‘dependent variable’ is investigated using multiple additional procedures (e.g. survey research, cost-benefit analysis, etc) [30]. The case study is used as a framework to collect and document evidence about a phenomenon such as mobile services intervention. Case study method applied in a vertical approach to study in-depth mobile services intervention of each case is considered. Not only observational study, a qualitative measure is incorporated along with

focused and open interviews. In view of the fact that the ‘causal links’ between the outputs and outcomes of the projects and the socio-economic well-being of the communities are ‘multi-faceted’. Hence case study approach is useful in answering part of the research questions.

A case study approach is defined as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used” [31]. This definition of Yin clearly states the importance of taking into thought the background in which the projects are implemented and the importance of involving various stakeholders, thereby obtaining an extensive insight into the impact of the projects on peoples’ well-being. The case-study approach is used to support and clarify the result of the quantitative analysis using survey.

Each considered ‘project’ is a ‘case’ and the ‘multi-case study approach’ is going to be applied in this type of research. Since ‘multi-case’ studies follow replication logic not of sampling logic, each individual case study consists of a ‘whole study’, in which facts are gathered from a range of sources and conclusions drawn on those facts [32]. It is an essential part in multi-case study, but desirable for a single-case study – a case protocol should contain more than the survey instrument [33]. A multi-case study design is a research strategy for generalizing to a target population of cases from the results of a ‘purposefully selected sample of cases’.

The research framework is arrived with two characteristics, namely a ‘cross-site analysis’ and testing the ‘limited conditions’ within the sample of case studies [34]. It uses the main features of a multiple case study design framed by Yin and Winston [31, 32]. These features complement to each other and, taken together, provide a logical structure that supports valid inferences from the sample of cases to the target population. It can be ‘generalizable’ to whole of the targeted population, if the sample of cases adequately represents the ‘heterogeneity’ of that population on the explanatory factors important to the subject of the study. This feature is an ‘appropriate case selection’, allowed under multi-case study research which is going to be shown as a case example. This ‘case survey’ or ‘content analysis’ approach provides a mean towards ‘cross-site analysis’ [34, 35].

Multiple-case designs are desirable when the intent of the research is descriptive, theory building, or theory testing. It permits us for cross-case analysis and in turn contributes towards extension of theory. Multiple cases yield more general research results [36]. The selection of multiple cases with diverse strengths is considered to test the ‘research hypotheses’. It is not feasible to conduct impact evaluations for all interventions. But the type of intervention that can provide impact are, when intervention is useful or when pilot programs/initiatives are substantially scaled up or interventions for which there is scant solid evidence. All three types of interventions quietly fit for mobile services intervention. Hence, a multi-case study based cross-site analysis is adopted.

VI. PROPOSED FRAMEWORK

Existing literature found that the major needs of rural people are timely help in advice about their crops, market intelligence of crops inputs and produce, financial support and social connectivity [12]. These basic needs form objectives of ICT4D projects to serve users with user-centric mobile services. At the same time they have to sustain in rural market to serve the rural people for better market linkages.

Table II
LIST OF PROJECTS UNDER STUDY

Project	Description
aAQUA Mini	Local SME Agrocom started agri-domain venture catering to farmers’ needs through real-time decision support mobile services. The major strength of the project is agri-advisory on various crops to farmers. The services are provided with text sms and voice enabled mms. This is a revenue generating business model with company’s strength lying in R&D to develop tools and applications for mobile and Internet platform to cater to socio-economic development of rural areas.
Reuters Market Light (RML)	Reuter’s most valued initiation for third world countries is RML project. Its major strength is market intelligence along with automated crop advisory services for farmers. The sms based services are catered to farmers based on chosen crops and markets in their local language. This is public private partnership (PPP) revenue generating business model. Its strength lies in knowledge and information lifecycle execution.
Village Varta	SMSOne is a non-governmental organisation (NGO) catering to the needs of rural people. It is headed and implemented by rural people. Its strength is in providing social information networking across and within villages. The services are looked through as village varta (means news), which is a local sms community newsletter. This NGO based revenue generating business model relies on building rural youth force as social entrepreneurs. It looks at rural youth work for rural people.
Mobile Microfinance / Banking	Ekgaon is a local SME having strength in ICT and management services building mobile based banking and micro finance management for rural people. The services are started with self help groups (SHGs) mostly formed by rural women. The strength of it is to carry out all the banking operations online through mobiles or through Internet at user place and providing action taken receipts. This is private-NGO partnership revenue generating business model with company’s strength lying in novel approaches to rural financial services using ICTs and management services.

Based on four major needs stated above, we have picked up four related projects based on their strength in delivering such need. The proposed framework (Fig. 2) considers these four projects as cases to validate itself in the study of mobile services intervention impact. The four projects chosen (Table-II) include Agrocom’s aAQUA Mini, Reuter’s Reuters market light (RML), SMSOne’s village varta and Ekgaon’s mobile microfinance are providing mobile services. The specific strength of the project is considered here against each project to see how they fulfill user specific needs. The operations of these projects have spread across a few states in India at present. As clearly stated in the research approach, the participating and non-participating people need to be as homogeneous as possible. This is satisfied within a specific state geography (e.g. Maharashtra) where social and cultural issues are considered to be homogeneous is the basic requirement for the study to be undertaken. Under this

condition, all projects should have operations across various zones of the state and having acceptable user density. The proposed framework can now be used as a standard framework at micro and meso level.

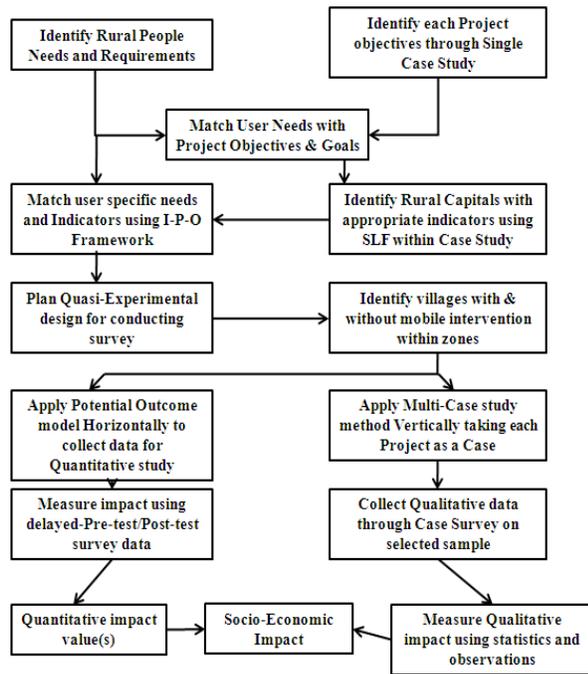


Fig.2. Proposed Framework

Survey method is used extensively to collect primary and secondary data in any evaluation studies for triangulation. The structured and semi-structured questionnaire are used to collect qualitative as well as quantitative data from any case (project) to study triangulation to find out mobile services intervention outcomes. The sample collected should well represent the entire population is critical.

Table III
SOCIO ECONOMIC CLASSIFICATION (SEC) 1998 MODEL FOR RURAL AREAS [37, 39, 40]

Education of chief wage earner (CWE)	Type of House		
	Pucca	Semi-Pucca	Kuchcha
Illiterate	R4	R4	R4
literate but no formal school (Self-learning/home based oral learning)	R3	R4	R4
Below SSC (<10th Grade)	R3	R3	R4
SSC/HSC (10th or 12th Grade)	R2	R3	R3
Some college education (Not Graduate)	R1	R2	R3
Graduate / Postgraduate (Professional)	R1	R2	R3

CWE – the person who contributes the most to the household expenses
Pucca House – One which has walls and roof made of burnt bricks/stones (packed with lime/cement)/cement concrete/timber, etc.
Kuchcha House –The walls and/or roof of which are made of material other than those materials mentioned in Pucca house.
Semi-Pucca House – A house that has fixed walls made up of pucca material but roof is made up of the material other than those used for pucca house. (Def. of houses – Min. of statistics & planning, GOI)

To cover the population well, a criteria based sample selection is planned for such impact studies. The classification considered is socio-economic criteria (SEC) of Indian marketers (Table-III) to cover rural population. These categories are very important since they help segmenting markets effectively and target well to communicate with core consumers [37] across rural areas uniformly. In addition to income and consumer classification, Indian rural households can also be segmented according to the occupation and education levels of the chief earner of the household (the person who contributes most to the household expenses). This provides the purchase behaviour and consumption pattern of the households [38]. The prepared division members share similar values, interests, and behaviour [39].

Table IV
SURVEY SAMPLE DESIGN

Project	With or without	Zone-1	Zone-2	Zone-3	Zone-4
Pro-1	WI	V-M-11 (40)	V-M-12 (40)	V-M-13 (40)	V-M-14 (40)
	WOI	V-W-11 (40)	V-W-12 (40)	V-W-13 (40)	V-W-14 (40)
Pro-2	WI	V-M-21 (40)	V-M-22 (40)	V-M-23 (40)	V-M-24 (40)
	WOI	V-W-21 (40)	V-W-22 (40)	V-W-23 (40)	V-W-24 (40)
Pro-3	WI	V-M-31 (40)	V-M-32 (40)	V-M-33 (40)	V-M-34 (40)
	WOI	V-W-31 (40)	V-W-32 (40)	V-W-33 (40)	V-W-34 (40)
Pro-4	WI	V-M-41 (40)	V-M-42 (40)	V-M-43 (40)	V-M-44 (40)
	WOI	V-W-41 (40)	V-W-42 (40)	V-W-43 (40)	V-W-44 (40)

Vertical study (Case study)

WI – With mobile intervention; **WOI** – Without mobile intervention
V-M-11 – Village-with mobile intervention-Project-1 and Zone-1

Based on control and experimental groups, the villages, households are selected and using SEC for undertaking survey. Table-IV show the sample villages falling under four zones evenly of Maharashtra state of the selected projects (cases) which is a pre-requisite for evaluation study. But most of the studies did not consider this aspect. The vertical study (case study method) and horizontal study (counter factual method) are considered based on the data collected. A sample size of 40 per village is considered as per SEC groupings R1, R2, R3 and R4 at the rate of 10 each. Four villages are going to be chosen in control and experimental groups each. A sample of 160 for mobile intervention (experimental) and 160 for non-intervention (control) making 320 for each project (case) under study. A sample size of 4 x 320 (1280) is going to be considered since four projects are selected in the study.

VII. DISCUSSION OF SURVEY RESULTS

Impact evaluations are usually of specific interventions in a specific context. The findings can't be generalized to the same intervention in different contexts. A theory-based approach helps us to understand the context in which the intervention did or did not work, and so help in generalizing to validate the

proposed framework.

To test and show the intervention, the pilot impact study was undertaken within the selected projects areas. Study was undertaken to help us be contextualized. This is a felt need, as these projects are about three year old after piloting and field testing in rural markets. The uptake taking place with innovative business models but are yet to reach breakeven stage to sustain them. The optimum user density spread across the zones of the state is the basic question to be answered before undertaking any intervention impact study. To get an answer to the question raised, a basic pilot study was undertaken to see.

Table V
AGE Vs OPERATOR TYPE

Age	Operator Type	
	Private	Government
13-17	12	2
18-35	126	15
36-60	19	4
Above 60	1	0
Total	158	21

A sample size of 179 users across projects is considered to study the feasible sample density, requisite adoption rate of users from all SEC categories to undertake the intervention study. This secondary data is collected from user registration data, field staff feedback process, annual records and personal interaction with the implementation team. The data consists of household's issues and secondary mobile services. The users are of different age groups, education, religion, profession, per-capita, gender, family size and health status. Crops grown and other secondary services registered for family members are also looked at.

A clear-cut acceptance of mobile services is seen from two types of users, such as the youth in the age group of 18-35 (Table-V) and users with basic literacy irrespective of the profession they are in. About 70 percent of mobile service users are from this age group. The next best age group is 36-60. This clearly shows that youth is adopting technology based solutions instantly if they fulfill their needs at affordable cost. The acceptance pattern is observed to be the same irrespective of their per-capita.

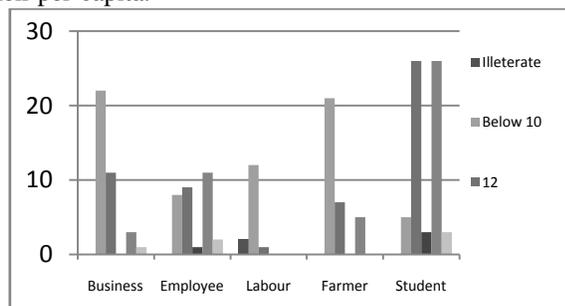


Fig.3. Age Vs Profession Vs Literacy Cross Tabulation

The Fig. 3 clearly shows the literacy pattern among users. Illiteracy is mostly found in farm-labour category within

adopted age groups with 2 percent adoption rate. The critical adopters in every group are mostly literate and their education is up to 12th class. The adoption of services has evenly fallen across small SMEs, employee and farmers. Students are major adopters at 35 percent of these families. But farmers as head of the family have adopted about 20 percent of the services themselves. Considering overall farmer families' adoption the percentage goes up to about 50 to 60 of users. This clearly shows that user need based value added services can reach rural families. The commercial and allied crops grown farmers' adoption to mobile services is quite high as show in Table-VI.

Table VI
CROP PRODUCTION STATISTICS

S. No.	Type of crops	Crops grown with percentage	Total percentage
1.	Pulses	Pulses (25.7) + Groundnut (1.7)	27.4
2.	Commercial crops	Sugarcane (20.1) + Soya (19) + Zinzar(2.2) + Turmeric (1.1) + Onion (10.6)	53.0
3.	Grains	Wheat (6.7)+ Jowar (17.9)	24.6
4.	Fruits & Vegetables	Fruits (2.2) +Grapes (11.7) + Vegetables (0.6)	14.5
5.	Flowers	Flowers (6.7)	6.7
Total:			126.2

The total percentage may cross hundred as farmers grow different crops in parallel to fulfill their needs. A better balance between grains (for consumption) and other crops (for cash) give farmer a better life. The services offered by projects and the crop pattern matches clearly to support such cause. Objectives of projects and user needs are just matched for better impact. At the same time, a small percentage of below poverty line (BPL) families are adopting services. This shows that rural society is at large ready to accept mobile services irrespective of their per capita. To conclude, youth and literacy are the critical drivers which are moving mobile services adoption irrespective of users' per-capita, profession, religion and location where they live.

VIII. CONCLUSION

India is a complex country in which each state has its own cultural, social and economic variations. Hence the study had to be limited to a particular state where most of the projects are operational for a minimum time with sufficient number of users available across all its regions. The user density across all regions within a state is the limitation to undertake intervention impact study. The proposed framework has been built by adopting existing methodologies and frameworks available in the literature across various disciplines. The field is ready to test the proposed framework to study the impact due to mobile services intervention. The framework is going to be tested in the state of Maharashtra where most of the projects spread across and adoption rate by users are quite high. The future work is to generalize the framework to extend to entire country (macro) to know the intervention impact.

REFERENCES

- [1] COI, "Census data 2001.Number of Literates & Literacy Rate," available at: http://censusindia.gov.in/Census_Data_2001/India_at_glance/literates1.aspx, 2001.
- [2] Meitei, L. Santa and Devi, Th. Purnima, "Farmers information needs in rural Manipur: an assessment," *Annals of Library and Information Studies*, vol. 56, pp. 35-40, 2009.
- [3] IKWarton, (2009), "Dial 'M' for 'Mackerel': Can new mobile services promise economic empowerment?," India Knowledge Wharton published on 27th August, available at: <http://knowledge.wharton.upenn.edu/india/article.cfm?articleid=4403>.
- [4] Danielson Anders, "When do the poor benefit from growth, and why," Poverty and Growth workshop, Lidingo, 2001.
- [5] Rao, V. Kasina and Sonar, "Farmers Needs and the Use of Mobile Services and Applications: A Study on Indian Pilots," *Proceedings of the International Conference on Knowledge Management and Intellectual Capital*, Institute of Management Technology Ghaziabad, India, 2009.
- [6] J. Donner and M. Escobari, "A review of the research on mobile use by micro and small enterprises (MSEs)," *Proceedings of the International Conference on Information and Communication Technologies and Development*, Doha, CA: IEEE, pp.17-26, 2009.
- [7] J. Donner, "Research approaches to mobile use in the developing world: A review of the literature," *The Information Society*, vol.24, pp. 140-159, 2008.
- [8] Subhash G. Bhatnagar and Nupur Singh, "Results from a Study of Impact of E-government Projects in India," *Proceedings of the International Conference on Information and Communication Technologies and Development*, (ICTD 2009). Doha, CA: IEEE, pp.183-191, 2009.
- [9] Helen Nierinck, "Mobile proximity payments: Scenario for market development," Analysis Mason, Research Report table 1.1., 2008.
- [10] Aditya Dev Sood, "The mobile development report," Research Report, Nokia – Center for knowledge societies (CKS), Bangalore, 2006.
- [11] Banks, K. and Burge R., "Mobile Phones: An appropriate tool for conservation and development," *Fauna & Flora International*, Cambridge, UK, 2004.
- [12] Krishna Reddy P., "A Framework of Information Technology Based Agriculture Information Dissemination System to Improve Crop Productivity," *Proceedings of 22nd Annual Conference of APEA*, 2004.
- [13] NSN-CTO, "Towards effective e-governance: The delivery of public services through local e-content," Research Report, Nokia Siemens Networks, Nokia and Commonwealth Telecommunications Organization (CTO), 2008.
- [14] Purnasri, "Cellphones and (Rural) development," Think Change India, Web Magazine article, Available at: <http://thinkchangeindia.wordpress.com/2008/04/25/cellphones-and-rural-development-part-two/>, 2008.
- [15] Richard Duncombe, "Using the livelihoods framework to analyze ICT applications for poverty reduction through microenterprise," *The Massachusetts Institute of Technology, Information Technologies and International Development*, vol. 3.3, pp. 81-100, 2006.
- [16] R. Jensen, "The digital provide: Information (technology), market performance, and welfare in the South Indian fisheries sector," *Quarterly Journal of Economics*, vol. 122, pp. 879-924, 2007.
- [17] R. Abraham, "Mobile phones and economic development: Evidence from the fishing industry in India," *Proceedings of the International Conference on Information and Communication Technologies and Development*, (ICTD 2006). Berkeley, CA: IEEE, pp. 48-56, 2006.
- [18] David Souler, Nigel Scott, Christopher Garforth, Rekha Jain, Ophelia Mascarenhas and Kevin McKemey, "The Economic Impact of Telecommunications on Rural Livelihoods and Poverty Reduction: A study of rural communities in India (Gujarat), Mozambique and Tanzania," DFID KAR Project 8347, 2005.
- [19] Meera, S.N., Jhamtani, A. and Rao, D.U.M., "Information and communication technology in agricultural development: A comparative analysis of three projects from India," Network Paper no. 135, Overseas Development Institute, London, 2006.
- [20] Surabhi Mittal, Sanjay Gandhi and Gaurav Tripathi, "Socio-economic impact of mobile phones on Indian Agriculture," Working Paper no. 246, Indian Council for Research on International Economic Relations (ICRIER), New Delhi, 2010.
- [21] Nigel Nagarajan and Marc Vanheukelen, "Evaluating EU expenditure programmes: A Guide," Ex post and Intermediate Evaluation, XIX/02-Budgetary overview and evaluation Directorate general-Budgets, European Commission, 1997.
- [22] Robin, "Estimating Causal Effects of Treatments in Randomized and Nonrandomized Studies," *Journal of Educational Psychology*, vol. 66, No.5, pp. 688-701, 1974.
- [23] Fedes Van Rijn, Kees Burger and Eefje Den Belder, "A Socio-Economic Impact study of the DE Foundation Coffee Project Peru," M.Sc. Thesis, Wageningen University, 2008.
- [24] Bryson A., Dorsett R. and Purdon S., "The use of propensity score matching in the evaluation of active labour market policies," A study carried out on behalf of the department for work and pensions, Policy Studies Institute and National Centre for Social Research, London, 2002.
- [25] Heeks, Richard and Molla, Alemayehu, "Impact assessment of ICT-for-development projects: A compendium of approaches," Working Paper Series, Development Informatics Group, Institute for Development Policy and Management, University of Manchester, Manchester, 2009.
- [26] Parkinson S. and Ramirez R., "Using a sustainable livelihoods approach to assessing the impact of ICTs in development," *Community Informatics*, vol.2.3, pp.116-127, 2006.
- [27] Molla A. and Al Jaghoub S., "Evaluating digital inclusion projects: a livelihood approach," *International Journal of Knowledge and Learning*, vol.3.6, pp.592-611, 2007.
- [28] DFID, "Sustainable Livelihood Guidance Sheet Section 2," DFID, London, Available at: http://www.livelihoods.org/info/guidance_sheets_pdfs/section2.pdf, 1999.
- [29] Laura Hosman, Elizabeth Fife and Laura Elizabeth Arney, "The Case for a Multi-Methodological, Cross-Disciplinary Approach to the Analysis of ICT Investment and Projects in the Developing World," *Information technology for Development*, Vol. 14(4), pp. 308-327, 2008.
- [30] Garson, D., "Case studies", Chass PA765, available at: <http://www2.chass.ncsu.edu/garson/pa765/cases.htm>, 2005.
- [31] Yin, R., *Case Study Research, Design and Methods*, Sage Publications, Beverly Hills, California, 1984.
- [32] Winston T., "Introduction to Case Study by Winston Tellis," *The Qualitative Report*, vol.3.2, 1997.
- [33] Winston T., "Introduction to Case Study [68 paragraphs]," *The Qualitative Report* [On-line serial], vol. 3.2, 1997.
- [34] R. Yin, *Case study research: design and methods*, 2nd Edition, Beverly Hills, CA: Sage Publications, 1994.
- [35] Miles, B. Matthew, "Qualitative data as an Attractive Nuisance: The problem of analysis," *Administrative Science Quarterly*, vol.24 (4), pp. 590-601, 1979.
- [36] Izak, Benbasat, David K. Goldstein and Melissa Mead, "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly*, vol.11.3, pp. 369-386, 1987.
- [37] RetailBiz, "Socio Economic Classes (SEC categories)," Available at: <http://indiaretailbiz.wordpress.com/2006/10/15/socio-economic-classifications-sec-categories/>, 2006.
- [38] Naukarithub, "Socio-Economic Classification," Available at: <http://www.naukarithub.com/india/fmcg/consumer-class/socio-economic/>, 2008.
- [39] Kotler Philip, Keller Kevin Lane, Koshy Abraham and Jha Mithileshwar, *Marketing Management - A South Asian Perspective*, 13th Edition, Pearson education publication, 2009.
- [40] MSP, Socio Economic Classification (SEC), Ministry of Statistics and Planning, Available at: http://www.mospi.gov.in/ecs_Ins_Manual_part_I_two.htm, 2005.