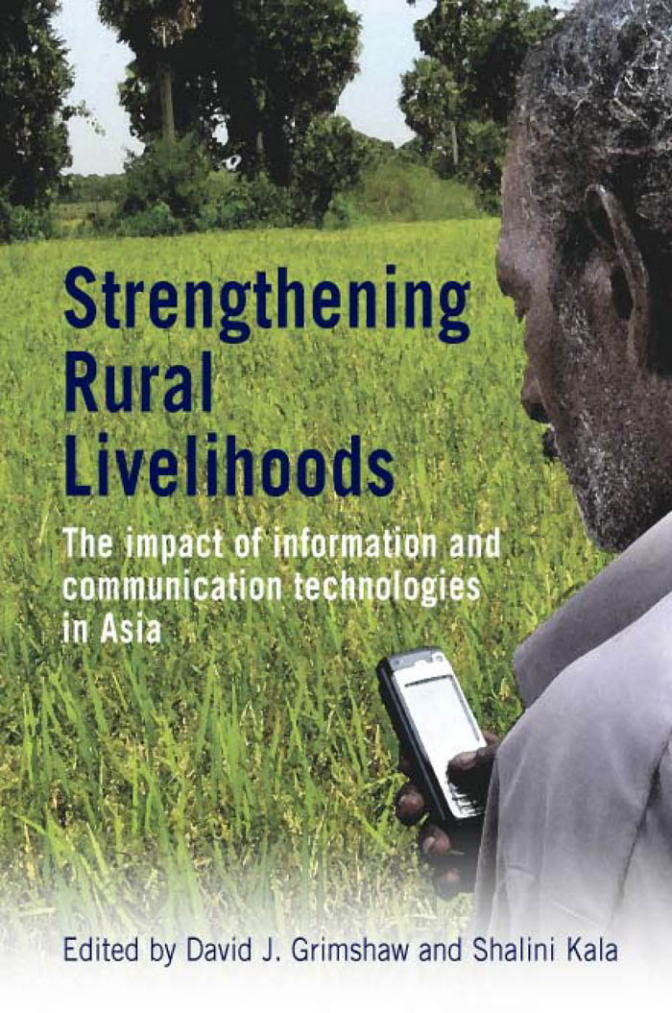
Strengthening Rural Livelihoods
The impact of information and communication technologies in Asia
Edited by David J. Grimshaw and Shalini Kala

Strengthening Rural Livelihoods

Praise for this book

'A fascinating collection that draws attention to the diverse and important roles of information and communication as resources for people to create sustainable livelihoods.'

Andy Dearden, Professor of Interactive Systems Design, Sheffield Hallam University.

'*Strengthening Rural Livelihoods* provides a useful and balanced review of the influence that mobile phones and the Internet can have on supporting the livelihoods of rural people, and particularly farmers in Asia. Drawing on six case studies from Sri Lanka, India, the Philippines and China, it shows the beneficial impact that such technologies can have for enhancing livelihood assets, reducing vulnerability, and complementing existing extension services. However, it also importantly highlights the differential impact that these technologies can have: farmers with larger amounts of land use these technologies most, and cultural factors often mean that women use them much less frequently than men'.

Tim Unwin, UNESCO Chair in ICT4D and Professor of Geography, Royal Holloway, University of London

'Based on thorough, balanced field research, this book makes a valuable contribution on the impacts of emerging information and communications technologies among rural farming communities in Asia'.

Ken Banks, creator of FrontlineSMS and 2010 National Geographic Emerging Explorer

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Cover photo: An Indian farmer using a mobile phone for crop information.
Credit: Mr Shanmugapriyan Elangovan, Ekgaon Technologies

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About the Editors

David J. Grimshaw is Head of International Programme: New Technologies with Practical Action and Senior Research Fellow at the Department for International Development. He was previously on the faculty at Warwick Business School, University of Warwick, the University of Leeds and Cranfield School of Management. Currently, he is a Visiting Professor in Information and Communications Technology for Development at Royal Holloway, University of London.

His research interests include ICT4D and the role of new technologies in development. He is the author of *Bringing Geographical Information Systems into Business*, second edition published by John Wiley Inc. (2000) and joint editor of *IT in Business: A Manager's Casebook* (1999). He jointly authored (with Surmaya Talyarkhan and Lucky Lowe) *Connecting the First Mile: Investigating Best Practice for ICTs and Information Sharing for Development*, Practical Action (2005). He has recently completed a DFID-funded project with a team at Royal Holloway on a systematic review of 'What are the key lessons of ICT4D partnerships for poverty reduction?' David has published many papers in academic journals, international conferences and the professional press.

He acted as a mentor to the EPSRC-funded project on 'Bridging the Global Digital Divide', was a member of an Expert Advisory Panel on ICT for Rural Livelihoods Programme, ODI and World Bank; and was Chair of Demos Committee for the ICTD2010 Conference in London 2010.

Shalini Kala has been interested in rural livelihoods and agriculture for over 20 years. During this time, she developed and managed programmes on rural enterprise and livelihoods for marginal and poor farmers; researched on agricultural policy reform for the fertilizer industry, seed sector and horticulture value chains as well as assisted programmes to improve linkages among farmers, agricultural research and public agencies. In the last 10 years her focus has been on improving conditions for small holders and the landless with a particular emphasis on access to information and rural knowledge systems to improve market linkages, productivity and incomes. She has worked across the Asia-Pacific, and has contributed to similar programmes in Africa, the Middle-East and Latin America. She has an advanced degree in Economics.

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Foreword

At the International Fund for Agricultural Development (IFAD) in our work to reduce rural poverty we find that poor people are constrained by limited access to information and poor communications technology.

While others elsewhere communicate almost instantaneously across continents, people in the remote areas where IFAD works often remain isolated and cut off from the information they need to improve their conditions. While some urban youth have the access and skills to capitalize on new communications technology and new access to information, most young people living in poor rural areas do not.

Through its collaboration with the International Development Research Centre (IDRC) in the Programme for Knowledge Networking in Rural Asia and the Pacific (ENRAP), IFAD took the opportunity to examine how information-related constraints in poor rural areas are being overcome and how information technology is being employed to the benefit of men and women, young and old who live there.

It supported studies in China, India, the Philippines and Sri Lanka. It looked at the use of 'information communications technologies' (ICTs) in providing agricultural extension services, getting timely market price information, finding out about rural wage labour opportunities, helping rural communities to build a sustainable asset base and understanding crop diseases and soil nutrition.

The results of the research are presented here. They bring together rigorously tested practices and methods of applying ICTs for improving rural livelihoods. Each research study has investigated how and to what extent a specific ICT intervention made a difference. Together they show how ICTs have empowered rural people and transformed livelihoods in agriculture: by filling information gaps, raising awareness, building skills and extending social networks.

We are pleased to have helped to finance this research to acquire evidence-based knowledge from the field that we can use in our work to reduce rural poverty. Through this publication we make the knowledge we have acquired accessible to others. We recommend it to development project practitioners and policy makers who design and implement policies or projects. We expect that, like IFAD, they too can benefit from the insights it gives us into what has worked and what has not in the use of ICTs to improve rural livelihoods.

Kevin Cleaver, Vice President, IFAD

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Preface

The International Development Research Centre (IDRC) has, for decades, been interested in the way in which information, and networked technologies, can play a role in spurring development outcomes. Amongst the most promising areas, the improvement of rural livelihoods has always stood out. As a result, IDRC developed a research programme through the Knowledge Networking for Rural Development in the Asia Pacific Region (ENRAP) project, with the express purpose of better understanding the extent to which ICT applications could support rural livelihoods. This book, jointly undertaken with the International Fund for Agricultural Development (IFAD), Practical Action and a cohort of Asian researchers, is the culmination of that work.

Our focus was on agricultural communities, as Asia's poor- and middle-income countries have primarily agriculture-based economies. However, we took a broader 'livelihoods' approach that would ensure we could observe the variety of ways ICTs can have an effect on rural communities. The scope of the research would take into account the range of on-farm and off-farm productive and reproductive activities that support farming households and communities. This required a holistic approach to understand how affordable and practical ICT applications can improve the livelihoods of small landholder households and communities taking into account how women and men in farming households make decisions, share resources, divide labour and generate secondary income *et alia*.

The means by which we knew ICTs could be used was through agricultural extension and through helping to reduce information asymmetry. When we first started very few projects had been able to demonstrate any kind of positive impact in dealing with the issue of information asymmetry. However, the studies undertaken under the aegis of this research programme helped fill that gap. Through evaluations of existing projects in Asia, many of which focused on enabling farmers to access the price of produce in local markets in real time, local researchers were able to shed light on the relationship between ICT usage and improvements in rural livelihoods.

It is of no surprise that mobile phones figure prominently in much of the discussion of this book. They have now reached all levels of society in Asia and are starting to revolutionize rural areas. For example, market information transmitted via mobiles helped farmers in Bangladesh reduce transport costs by 33%. Moreover, a pioneering study by Harsha de Silva, who was instrumental in setting the scene for this research, was able to quantify the 'cost of information' to show how information asymmetries in agriculture markets result in high transaction costs for farmers. By estimating that the cost of information constitutes 11% of farmers' total costs from the time of deciding what to grow to the time of selling (costs incurred as a result of poor information availability

along the agriculture value-chain), the study underscored how mobiles can help farmers make more informed decisions.

In conclusion, this book makes an important, and much needed, contribution to understanding the ways in which ICTs influence rural livelihoods. The recent 'great recession' and the corollary spike in worldwide food prices has again put food security on the global agenda. Our hope is that this book can play a small part in helping to improve practices related to rural livelihoods, and, as a result, help ameliorate agricultural productivity and food security.

Laurent Elder, IDRC/CRDI

Acknowledgements

First, thanks to Laurent Elder of IDRC who had a dream of this book in 2006. Since then the several small steps that were taken involved a host of researchers and practitioners – designing, researching or commenting – who helped refine this initiative. An important milestone in this journey was Harsha de Silva and Alexander Flor's scoping study. Sunil Abraham and Phet Sayo helped initiate the process. In early 2009, the research design and direction benefitted from comments of various experts including Aasha Kapoor Mehta, Shyamala Abeyratne, Ananya Raihan, Julian Gonsalves, Mahabir Pun, William Thies, Rohit Magotra, Nandasiri Wanninayaka, Osama Manzar, Murali Shanmugavelan, Djuara P. Lubis and Roshni Nuggehalli. This list would be incomplete without Rohan Samarjiva and his team of researchers at LIRNE*asia*. Our special gratitude to the selection committee members who painstakingly reviewed research proposals received and suggested useful changes to strengthen those selected for support.

This book is the result of dedication of the six research teams, some members of which are authors of papers in this book who laboured over several months beginning in 2009. Over a short period of time working against the uncertainties of weather that typically characterize occupations associated with agriculture, researchers managed to generate interesting data using rigorous methods. Without them this book would have remained a dream.

Thanks are also due to the team at Practical Action, Colombo led by Jayantha Gunesekara including Sampath Abeyratne and Ramona Miranda who worked closely with researchers and the IDRC team. The editorial support by Tushani and Chaitri to the research teams was invaluable. Sandya Wickremarachchi was instrumental in getting all researchers together twice, once at the beginning and once for the finalization of the book. It would have been impossible to generate the kind of energy this effort needed without Sandya's impeccable organization.

The acknowledgements would be incomplete without thanking IFAD, particularly Chase Palmeri at the Asia-Pacific division, for their partnership on ENRAP under which this ICT for rural livelihoods research was supported. Support of several other members of the IFAD family in the Asia-Pacific region has been invaluable. In particular Yolando Arban, Yingong Sun, Susan Perez and Anurah Herath helped with research design and commented on early drafts of the papers.

ENRAP in general and this research, in particular, benefitted from the interest and enthusiastic 'peer support' of Stephen Rudgard and Michael Riggs of FAO. Apoorva Mishra of IDRC was the backbone of this research initiative, bringing together all actors and all efforts with her amazing multi-tasking skills, for this book to become a reality.

Bill Carman of Communications at IDRC and Toby Milner at Practical Action Publishing helped with their sound advice and support on publishing aspects. There are several other colleagues at IDRC, IFAD and partner institutions who in some way or the other touched this effort, our heartfelt thanks to them too.

CHAPTER 1

Beyond technology: making information work for livelihoods

David J. Grimshaw

> 'Farmers can access market prices with a mobile phone, but if there is no road, how do they use that information?'
>
> (IFAD, 2003: 15)

The introduction to the book provides the reader with an overview of the six research projects within a research programme called 'Knowledge Networking for Rural Development in Asia Pacific' (ENRAP 2009). The role of information and communications technologies (ICTs) in development is first explored. The chapter then goes on to discuss the role of ICT to support livelihoods in the rural context of developing countries. A discussion of the livelihoods framework provides the overall conceptual framework that has been used by each of the projects. Some of the problems of using this framework in the context of an ICT intervention are elaborated and ICTs are positioned as having a functional role.

This volume attempts to do something new by reporting on a research programme that was specifically designed to measure impact on livelihoods. In five out of six chapters the methodology employed is derived from that used successfully in medicine: a control trial. The pros and cons of this methodology are discussed, including some of the ethical implications of using the method in a development intervention. The chapter concludes with an overview of each of the projects featured in the book.

The wider context

We all have visions. The vision at the heart of this book is that the communications and knowledge sharing capabilities of information and communications technologies (ICTs) will enhance the livelihoods of the rural poor. This is a big vision and sceptical readers will immediately wonder how computers or other technologies can deliver clean water, irrigation, improved yields, education, maternal health, etc.

All these 'things' or technologies depend on 'know how' or knowledge to make them work. ICTs can facilitate the exchange or sharing of knowledge. Thus in the language that we develop later in the chapter, this book is about the functional role of ICTs in promoting rural livelihoods. Knowledge and information cannot be easily pinned down; in fact some have described the process as

'trying to nail jelly to a wall'. How do we measure the impact of knowledge and information on livelihoods? Many attempts have been made to measure the impact, often using case studies that were never designed as research projects; rather, they were development interventions.

This volume attempts to do something new by reporting on a research programme that was specifically designed to measure impact on livelihoods. In five out of six chapters the methodology employed is derived from that used successfully in medicine. A medical intervention, typically the trial of a new therapeutic drug, is assessed by a randomized control trial. Broadly, the idea here is to have two groups: an intervention group that takes a prescribed drug and a control group that takes a placebo. The results from the two groups are then analysed. In the sixth project, based in China, the impact of the intervention is analysed via a survey. All the projects yield both quantitative and qualitative data.

The application of these approaches to ICT4D interventions has not been systematically applied previously. The reader should be aware of some inherent problems that are presented. First, unlike a prescribed drug that can be given to someone in a measured dose and where others are excluded, information when given to one person can be shared at little or no cost. This is what economists call a zero marginal cost of production. Secondly, information needs to be timely, accurate, verifiable and relevant for its use to be transformative. In practice many imperfections can be either knowingly or unknowingly introduced.

The contribution that this book makes to the field of ICT4D is twofold. First, there is a contribution to the literature on ICTs for rural livelihoods that each of the chapters makes by contributing to the known evidence in the field. Secondly, there is a contribution to impact methodology.

The role of ICTs in development

Many international initiatives have been established to harness ICTs for development on a global scale, in particular since the publication of the World Development Report on Knowledge for Development (World Bank, 1998). These include the Global Knowledge Partnership (founded in 1997), the DOT-Force (created in 2000) and the UN ICT Task Force (created in 2001). The International Telecommunication Union (ITU) has hosted an international summit on the Information Society in 2003, the second phase of which took place in 2005. These initiatives aimed to build partnerships between civil society, the public and the private sectors to harness ICTs for development (Chapman et al., 2003).

One of the outcomes of The World Summit on the Information Society held in Geneva in December 2003 was a declaration of principles, one of which stated that:

> 'We strive to promote universal access with equal opportunities for all to scientific knowledge and the creation and dissemination of scientific and technical information, including open access initiatives for scientific publishing'.
>
> (WSIS, 2003: 28)

In the same declaration a further principle is around the issues of intellectual property rights and knowledge sharing:

> '. . . the wide dissemination, diffusion, and sharing of knowledge is important to encourage innovation and creativity. Facilitating meaningful participation by all in intellectual property issues and knowledge sharing through full awareness and capacity building is a fundamental part of an inclusive Information Society'.
>
> (WSIS, 2003: 42)

> 'The ultimate goal of using ICTs for human development is to empower people to actively shape the world around them, enabling solutions that promote economic prosperity with equity, fostering democracy that is socially just and opening new opportunities for the realization of our full human potential'.
>
> (Gomez et al., 2003)

These high aspirations for ICT contributing to development were largely shaped in an era when the internet, as delivered via telecentres, was the predominant model. Driven by a wish to improve access to knowledge and information the telecentre approach has since been criticized for failing to deliver benefits to poor people. Changes of the availability of technology, most evidently the mobile phone, have enabled access to information for a wide range of rural poor people. Customization of information and knowledge and their delivery via easy-to-use interfaces are found to be key success factors.

Low-income countries have fewer telephone lines, mobiles, computers and internet hosts. Mobile penetration rates reached 68% in developing countries at the end of 2010 (ITU 2010). Despite these statistics there is some encouraging news in the fact that the number of mobile phones has now overtaken land line phones in Africa. This shows that where there is an appropriate new technology it can 'leapfrog' earlier technologies.

There is a consensus that ICTs can play an important role in development, for example by connecting people to more accurate and up-to-date information, equipping them with new skills or connecting them to an international market. However, there is concern that the 'digital divide' is increasing the gap between the 'information haves and have nots' and this is the preoccupation of many of the initiatives established to address ICTs for development. In recent years many studies have been published, particularly by practitioners in the development field, on the use of ICTs for development. The term 'ICTs

for development' incorporates a variety of different uses of ICTs: for health, e-governance, agriculture, advocacy and many more.

ICTs for development projects have been criticized for failing to build on existing systems or work in a participatory way. Critics argue that 'top down' projects, driven by the donor agenda, fail to achieve local ownership (Gumicio Dagron, 2001; Lloyd Laney, 2003). The concept of the 'design-reality gap' (Duncombe and Heeks, 1999) highlights the distinction between the context in which an ICT project or application is designed and the context of its use in developing countries.

Although ICTs have been applied to development for the past 15 years, the technology itself has not remained static over that period: there has been continual innovation in terms of hardware, software and applications. It is possible to conceptualize this distinction between innovation and applications as shown in Figure 1.1. Using the diagram helps us to place the work of the ENRAP projects as being applications in the domain of agriculture (right-hand side of the diagram). However, some contributions are made to the left-hand side of the diagram, for example, the chapter concerning agricultural price transparency in Sri Lanka tests business models that are innovative and if successful will lead to sustainable change benefiting rural people's livelihoods.

Figure 1.1 shows a mind map of the current ICT4D landscape where two streams of research activity are distinguished. The purpose of drawing this distinction is to highlight two approaches of researching and gathering evidence about the effectiveness of ICTs. Mainstreamed activities are shown on the right-hand side; these are applications of ICT where the evidence base for action is robust. In recognition of the innovative nature of ICT (as new technologies and business models emerge) the left-hand side of the diagram shows areas of research that need to be pursued independently of the application areas. As

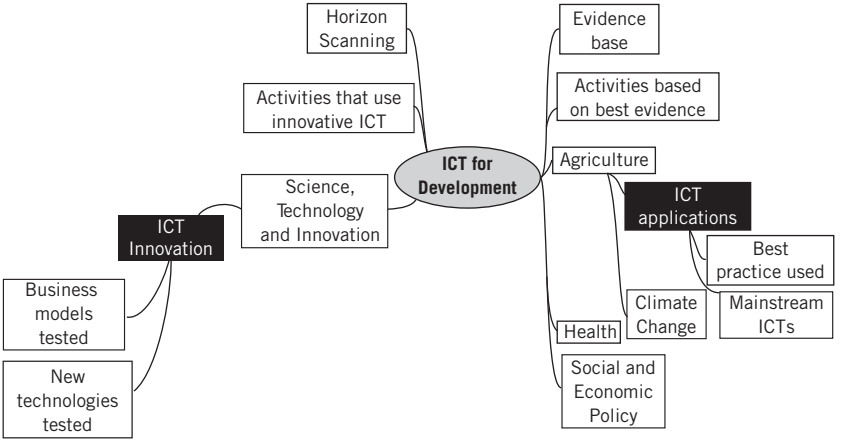

Figure 1.1 ICT applications and innovation

with any classification or taxonomy the two categories are not always mutually exclusive.

Why ICTs for livelihoods?

The notion of an 'application of ICT' has inherent within it the idea that the domain of knowledge, in this case agriculture, is the key to success. In other words it is the value of the information and knowledge that is transformative. Information is the resource that can be transmitted, but knowledge is in two parts: first the existing framework of understanding of the recipient or provider of information; and secondly, the new knowledge that can be assimilated as a result of the ability to transmit information (and whether ICT is an effective tool to convert information into knowledge). The ICT is a way of delivering that information. Taking such a starting point gives an emphasis to knowledge about agriculture and in particular an understanding of the ways in which poor people can improve their agricultural and non-agricultural activities in rural areas.

Using the livelihoods approach provides a framework for thinking about ICT interventions and research that is primarily focused on the needs of poor farmers rather than on the technology. It also serves to remind us of the inherent complexity of poverty (World Bank, 2007). The framework was used as a basis for the ENRAP series of projects as the following extract from the programme describes.

> 'Agriculture remains the predominant rural livelihood in the Asia-Pacific region. Although rural livelihoods are not exclusive to agriculture-based activities, they comprise the lion's share of rural livelihoods in the Asia-Pacific region. Information and communication play an important role in agricultural production and rural livelihood resilience. As regions become more connected and at once exposed to the vulnerabilities of globalization, what role can information and communication tools play in strengthening livelihood outcomes for the rural poor? Despite increasing anecdotal evidence of ICTs improving livelihoods in developing countries, this unfortunately has not translated into a proportionate body of evidence-based research to support such claims. ENRAP's ICTs for livelihoods research component seeks to build this evidence through supporting a number of evaluation and action research studies in this area and analysing the findings using a robust research framework. Through the ICTs for Rural Livelihoods Research initiative of ENRAP, it is hoped that the outcomes of this research can be shared and made accessible to enhance livelihoods. Thereby, providing opportunities for replication and up-scaling of practices and approaches, particularly in the context of IFAD projects and partners, for rural development'.
>
> (ENRAP, 2009)

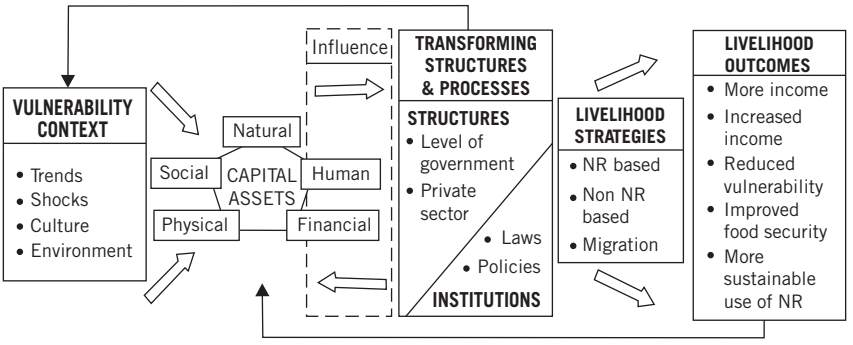

Figure 1.2 Sustainable livelihoods framework
Source: after Carney et al. (1999)

There have been a few attempts to apply the livelihoods framework to assess poverty reduction and ICT, for example by Chapman and Slaymaker (2001) and Batchelor and Norrish (2010). Duncombe (2006) suggests a modification of the livelihoods model (see Figure 1.3) to specifically show a role for information. His model has two roles for information: an analytical role and a functional role. The analytical role envisages the ways in which information can be used to assess vulnerability, while the functional role envisages how ICTs can be applied to create favourable outcomes. The projects discussed in this book are using the livelihoods model in this latter functional role.

The research projects applied the model by assessing the contribution of information and knowledge to the livelihood assets: social, physical, financial and human. Chapter 8 assesses the impact of the projects in a table derived from this framework. The main impacts were measured in terms of the livelihood outcomes such as increases in income, reduced vulnerability and improved food security. Some additional outcome measures not explicitly included in the framework came within the remit of the projects. These covered the ways in which ICT had an effect on social networks.

Social networks could be considered as part of the structures and processes box in Figure 1.3. Other issues covered here include the mobile phone network operators, the business models deployed by them and the actors themselves in the research process. Governance and wider policy considerations also come within this framework and these were noted by researchers but played little role in the analysis of the outcomes.

The challenges of using ICT for rural development

What do we know about the successful employment of ICTs for rural livelihoods? The evidence to date tends to be based on successful case studies; this gives an on-going challenge of how to scale these projects. A review held by the World Bank (2007: 1) concluded that 'the challenge is to understand better what business models and technology models work best in a given context,

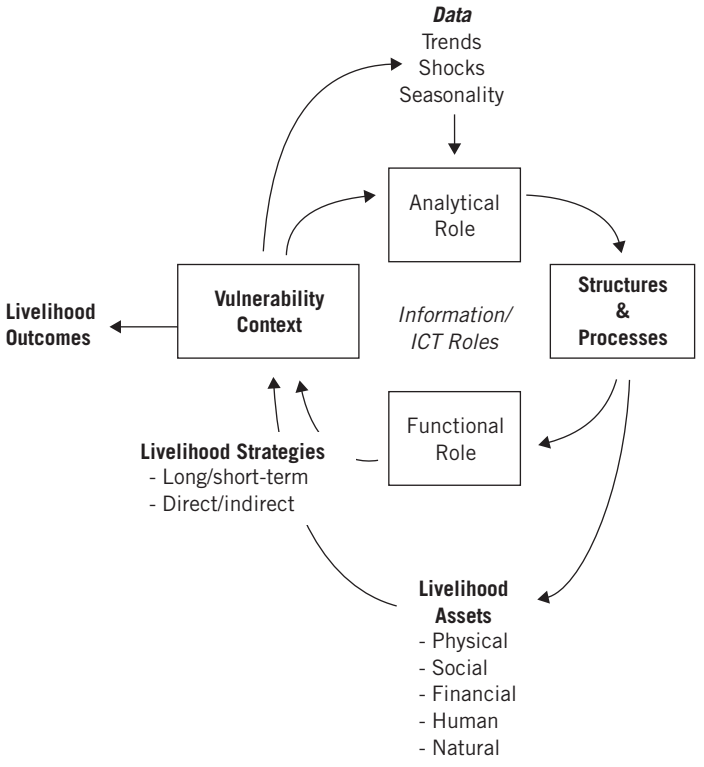

Figure 1.3 ICTs within the livelihoods framework
Source: Duncombe (2006)

and what roles should be played by various partners in scaling these models in different contexts. It does seem clear that the needs and demand are so great that small scale entrepreneurial efforts and donor pilots will not be sufficient'. We might also usefully ask what do we know about the successful use of ICT (full stop)?

There is a literature on the use of ICT by business organizations which goes back over four decades. One framework from that literature might be useful to help us frame the challenge of learning about new technology and using it effectively. The learning phenomena have been observed before in other domains of application of ICT, most notably in general business. First noted by Gibson and Nolan (1974) was the notion that organizations go through a series of stages in their utilization of ICT. Amended by Nolan (1979) and many others subsequently (see Galliers and Sutherland, 2003), all variations of the model show an 'S-curve' over time as illustrated in Figure 1.4. Broadly, this concept suggests that over time there are periods of rapid deployment of ICT followed by some consolidation. There is pure enthusiasm followed by learning and changes in practice.

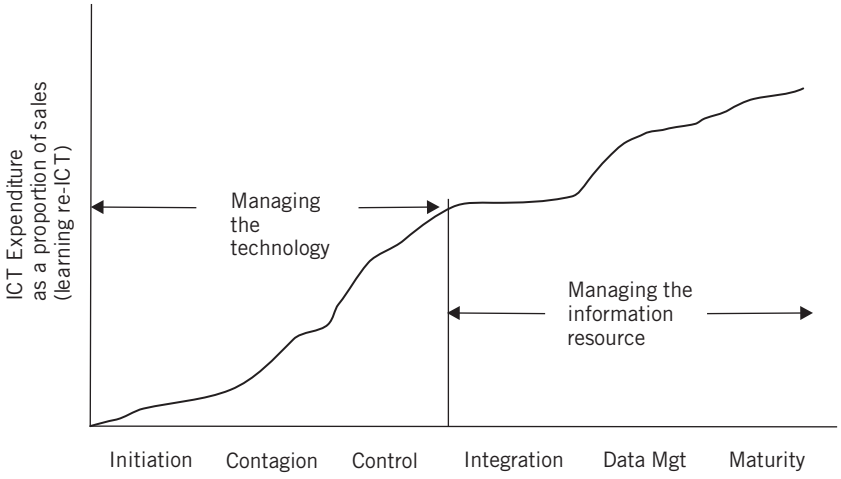

Figure 1.4 Uptake of ICT over time
Source: Amended from Nolan (1979)

These concepts, although much debated and criticized in the literature, are at the very least a useful way of thinking about stages that people and organizations go through as they adopt new technologies. Since ICTs, by their very nature, are generic there is always scope for innovation, adaptation and change. For example, we know that the mobile phone was originally designed for voice communication yet one of the key successful applications is text messaging. These emergent properties of ICT are a key challenge to manage yet at the same time they offer the opportunity to customize applications to specific needs.

The ENRAP's programme set out with the high-level challenge of how to increase the sharing of knowledge and information for rural poverty reduction. This was further articulated as two indicators. First, that IFAD projects and associated partners are making greater use of regional and country programme networks to actively share knowledge and information. Second, ICT applications that have proved successful in improving rural livelihoods are accessible to network members for replication and scaling up.

The programme worked towards this through supporting IFAD projects and partners at the regional and country level in Asia, to strengthen their knowledge sharing mechanisms and processes. In addition it supported research in the area of ICTs for enhancing rural livelihoods.

ENRAP had a vision to expand horizontally to cover the full complement of countries (between 16 and 18 countries), loans and grants in the region. At the same time, using the insights and skills acquired through the introduction of new technologies during the second phase, ENRAP was to reach down vertically – beyond project management units – to find more ways to help rural communities and households apply ICTs to improve their livelihoods. To do this the IFAD–IDRC partnership was used to test, document and

disseminate information on community-level ICT applications tailored to IFAD intervention groups for replication and scaling up.

The challenge of scaling up is in proving that the success of ICT applications can be undertaken. The following questions occur: What constitutes 'proof'? What level of evidence is required? How is success to be defined? It is to these questions that we turn in the next section.

Towards evidence-based practice

Over many years ICTs have been used in development projects. Yet the effectiveness of these interventions is still contested. One of the key areas of debate is the extent to which numerous pilot studies, case studies or other small-scale interventions can add to the body of evidence. How reliable are the findings from a small pilot study carried out in only one location? How can such study be compared to apparently similar studies carried out in other locations? Is a project that uses a mobile phone to deliver information comparable to one that uses the internet? In essence all these questions are about how generalizable findings are. In a philosophical sense Popper (1957) observed that action changes meaning.

Different interpretations of projects also complicate the gathering of evidence. Some projects may be conceived as development interventions where the design of the project is to deliver specific outcomes in the field that are measurable. Data can then be collected, most typically by the beloved 'logframe' and fed back to donor communities to show accountability for the spending of the aid money. Yet other projects are specifically designed as research projects to test out an idea, hypothesis or perhaps sometimes some specific new technology. How can a development project be compared with a research project?

Over the past decade the development community have been assessing the use of randomized control trials (RCT) to measure the impact of interventions. Long used in the field of medicine, typically the trial of a new therapeutic drug is assessed by an RCT. Broadly, the idea here is to have two groups: an intervention group that takes a prescribed drug and a control group that takes a placebo. The results from the two groups are then analysed. This approach has often been referred to as the 'gold standard' of evidence gathering (Barahona, 2010).

The main reasons for conducting an impact evaluation have been well summarized by Leeuw and Vaessen (2010) as:

1. Providing evidence on 'what works and what doesn't'.
2. Measuring impacts and relating the changes in dependent variables to developmental policies and programmes.
3. Producing information that is relevant from an accountability perspective.
4. Benefit from individual and organizational learning.

Barahona (2010) draws attention to two problems with the RCT methodology. First is the need to limit the impact indicator(s) to those that can be accurately measured; and secondly, the level of control needs to be good enough to render any contamination effect negligible. Both of these limitations are cause for concern in the context of development interventions.

It should be recognized that some indicators of livelihood used in the studies are inherently difficult to measure accurately, for example income levels. Two types of contamination are mentioned by Mohr (1995). Inherent in development interventions is the risk of contamination of the control group. For example there may be multiple NGO, government or civil society initiatives taking place in a particular location. It is then difficult to be certain that the difference between the control and the intervention group is due to the intervention alone. This can undermine the strength of the RCT methodology. Contamination can also occur where people in the control group are able to 'learn' from the activities taking place in the intervention group.

A further consideration when assessing the merits and validity of control trials are the ethics of such 'experimentation' on people. Most research domains, such as medicine, involving people have a well-regulated set of guidance and standards to ensure that research is carried out ethically. Yet in the domain of international development this is far from the case. There could be many reasons for this. Perhaps the interventions are not classed as research or the jurisdiction of a research committee is not felt to extend across diverse geographical boundaries. The main ethical issue is that the people in the control group are being deliberately excluded from an intervention that could benefit them. There are many arguments here; including the one that in the real world resources are always limited and some groups would be excluded from a development intervention.

How do the methodologies employed in the ENRAP projects compare to the RCT 'gold standard'? The authors of each chapter make detailed comments on their individual methodologies; the purpose here is to offer some introductory overview. Some form of control group was used in the research reported in Chapters 2–6. In Chapter 7 a control trial was not feasible because the ICT intervention was on a province-wide scale and so a survey instrument was used. Each project was designed as a research project but it was also a development intervention and as such was inevitably making changes to the lives of real people. The authors were all aware of the ethical issues outlined above and in the cases where there was 'leakage' of information from an intervention group to a control group appropriate note was taken. For example, in Chapter 3 the intervention was facilitated by a service provided on a mobile phone by a network operator, Dialog, in Sri Lanka. In this case all people could subscribe to the service if they wished and some from the control group did choose to do so. These events are fully documented and accounted for. The view taken was that it would be ethically wrong for people to be denied access to information.

There are many other issues raised by research that is attempting to measure and evaluate impact, and it is not within the remit of this chapter to discuss them all. For example, the size of the sample, the choice of the unit of analysis (individual or household) and the period of time over which the outcomes are measured. Where relevant, each chapter will refer to such issues.

An overview of each project

A synthesis of what each project has achieved is given in the final chapter. Here we consider the broad topic of each chapter and the technology used. There are many issues that poor farmers face. Four key issues that relate to information are tackled in the first four chapters: crop prices, nutrient information, agricultural advisory services and non-agricultural livelihood options. In terms of technology, Chapters 2–5 could be said to discuss the use of the mobile phone and Chapters 6 and 7 the use of the internet. However, this is an oversimplification and in reality some information needs are delivered using a variety of channels, for example LifeLines in Chapter 4 uses of land lines or mobile phones at the user end but complex databases at the backend. Often technologies complement one another, although the end user may only interact with one technology. This section starts with an overview of the key topics explored in each chapter.

One of the most often quoted reasons why farmers buy mobile phones is said to be 'to access market prices', see for example Annerose and Sène (2005). Lokanathan, de Silva and Fernando (Chapter 2) explore a common problem that small-scale rural farmers face, namely how to plan the type of crop, volume and timing to best reflect demand. The work is based on the notion that achieving an efficient balance between supply and demand requires price transparency. The project aims to gather evidence about the impact on farmer livelihoods of accurate real-time price information. Issues of sustainability are discussed in relation to medium- and long-term considerations. When, for example, the majority of farmers have access to the same information will forward markets become viable?

Each small farmer tends to plant crops at different times and in different soil types. So providing information about appropriate nutrient levels has in the past depended on nutrient suppliers, with obvious problems. Daniel Anand Raj et al. (Chapter 3) explore how access to timely, accurate, reliable and most importantly customized nutrient information has an impact on livelihoods. This project involved the design, development and implementation of a (software) system that could deliver customized information about nutrients relevant to the particular crop (in this case rice). A key variable measured is the income of the farmers in the intervention group compared with those in the control group. Issues around building trust in the information supplied are discussed and the authors make some recommendations about the importance of socially embedding the technology with the help of local institutions.

In rural areas price and nutrient information are only two of the information-based issues facing poor farmers. In an attempt to be more comprehensive the next chapter explores the lack of knowledge from a demand-driven point of view. If farmers have a question, where can they go for advice? The LifeLines system discussed by Rizvi (Chapter 4) is a phone-based agricultural advisory service. An impact evaluation of LifeLines is undertaken using both an intervention and a control group. Again, as in Chapter 3, a key variable measured is the income of the farmers in the intervention group compared with those in the control group. Overall the impact of the system is mainly assessed by measuring the increased incomes. In addition to measures of inputs like seed, nutrient and price the research also included the value added by such things as financial advice and education.

Chapter 5 (Balasuriya and de Silva) is about an intervention to tackle the issue of the non-agricultural labour market in Sri Lanka where opportunities for paid ad-hoc work are often an important source of household income but are neglected by policy makers. This chapter also makes contributions to the development of methodologies by demonstrating that impact assessment of evidence can be collected in a systematic way. The authors draw important methodological distinctions between *learning* and *proving*. A further general issue explored in this chapter is the importance of trust. For many people who have traditionally relied on family and friends for information, the transition to information supplied by ICT is a large jump.

The final two projects took place in the Philippines and in Ningxia, China. They can be distinguished from the above chapters by the technology used, namely the internet. However, a more important distinction is that in both these locations government policies have a direct bearing on the projects.

Barrios et al. in Chapter 6 discuss an impact assessment of the e-AGRIKultura project in agrarian reform communities of the Philippines, started in 2005. The work has been carried out by an independent group of statisticians at the University of the Philippines. The approach used here is based on the perceptions of the end users (450 respondents) who were surveyed by the research team. The authors put forward an interesting four-phase model of the introduction of ICTs into rural communities.

Chapter 7 (Nie et al.) is an impact evaluation of a rural information project in Ningxia Province, China. In Ningxia the government introduced a village information centre (VIC) into every village so the research team could not find an appropriate control group for the evaluation. Instead the team carried out a sample survey of 628 household face-to-face interviews in 54 villages. The findings are presented in terms of both the livelihoods framework and the factors affecting ICT use. The top level finding is that 85% reported that the project had contributed to an improvement in quality of life, local economy and society. A key point to note here is that the purpose of the intervention was wide ranging and not just confined to agricultural livelihoods. Quality of life or well-being was also perceived as important by both the funder and user of the system.

The challenges of mainstreaming ICT into rural livelihoods and measuring the impact have been set by the projects reported in this book. Each is an interesting, evidentially based work that demonstrates the impact of information on the livelihoods of poor farmers. This collection of research goes beyond technology to examine the impact of knowledge and information in a quantitatively rigorous manner. It goes beyond the individual projects by offering evidence from the field across a range of application areas, geographies, cultures and technologies.

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CHAPTER 2

Price transparency in agricultural produce markets: Sri Lanka

Sriganesh Lokanathan, Harsha de Silva and Iran Fernando

Rural poverty in Sri Lanka accounts for 82% of the poor in the country, with the majority engaged in some form of agriculture. Small farmers in Sri Lanka are unable to engage effectively in agricultural markets which are prone to inefficiencies. The high seasonal, inter- and intra-day price volatilities have meant that farmers are unable to plan the type, volume and timing of crop harvest and cultivations to reflect demand conditions. This Action Research Pilot was conducted to increase price transparency by leveraging an ongoing ICT-based intervention and thereby contribute to improved farmer livelihoods.

The evidence suggests that accurate, real-time price information improves farmer livelihoods. Furthermore, the new service has facilitated behavioural changes that enable farmers to improve their ability to coordinate supply and demand for agricultural produce based on price signals. If such changes were adopted by the large majority of farmers in Sri Lanka it could contribute to the structural changes needed to reduce systemic high price volatilities prevalent in the agricultural sector of Sri Lanka and thereby improve livelihoods for poor farmers.

Introduction

There is evidence in the ICT literature that points to the crucial role played by ICTs, and in particular, the mobile phone in increasing market price transparencies that foster higher incomes for farmers and fishermen (Jensen, 2007; Aker, 2008; Goyal, 2008). The research reported here aims to provide further evidence on the positive livelihood impacts for small farmers (who suffer from a higher degree of price information asymmetry than larger farmers) by increasing price transparency in the agricultural sector through the use of mobile phones.

In much of the developing world, agriculture remains at the forefront of the economy (IFAD, 2001). Even while its share of GDP in a country has been declining and is often the lowest contributor to GDP (as compared to the industry and services sectors), it is still the largest source of employment in most South Asian countries (Table 2.1). In Sri Lanka, rural poverty accounts for

Table 2.1 Share of GDP and labour force by sector for select South Asian countries

		Bangladesh	*India*	*Pakistan*	*Sri Lanka*
Share of GDP (2009)	Agriculture	19%	17%	21%	14%
	Industry	29%	28%	24%	28%
	Services	53%	55%	55%	58%
Share of labour force (year)	Agriculture	48.1% (2005)	52% (2008)	43.6% (2007)	31.3% (2007)
	Industry	14.5% (2005)	N/A	21% (2007)	26.6% (2007)
	Services	37.4% (2005)	N/A	35.4% (2007)	38.7% (2007)

Source: World Bank, http://data.worldbank.org/; and Ministry of Finance, Government of India (2009)

82% of the poor (Department of Census and Statistics, 2008) with the majority engaged in some form of farming.

Farmers in developing countries such as Sri Lanka are often unable to engage effectively in agricultural markets since these markets are prone to inefficiencies (Barret and Mutambatsere, 2008; Fafchamps, 2004; World Bank, 2002, among others). Small and subsistence farmers in particular tend to have unfavourable linkages to markets due to a lack of market orientation (Timmer, 1997). The commercialization of agriculture and the subsequent structural complexity it has induced in the food system has meant that poor farmers in the developing world face higher transaction costs to access competitive markets (Pingali et al., 2005; Pingali, 2006). The lack of effective engagement translates into the inability of farmers to utilize market information in their livelihood decisions. These suboptimal decisions in turn restrict the possibility for farmers to leverage their produce or commodities to improve and sustain their incomes, by engaging, for instance, in financial instruments such as forward contracts. The inability to enter into such contracts precludes them from access to crop insurance and working capital loans using their produce as collateral (e.g. a forward contract or commodity-backed financing using warehouse receipts).

Providing access to accurate and timely market price information without physically visiting markets is the first step in reducing transaction costs and allowing farmers to engage effectively in agricultural markets. Ratnadiwakara et al. (2008) argue that greater price transparency allows farmers to reduce their transaction costs while also increasing their bargaining power in market transactions especially with middlemen who facilitate the sales (also Jaleta and Gardebroek, 2007). A crucial benefit of having access to market price information (especially forward and/or future prices) is that it gives farmers more control over their crop planting and harvesting schedules which they can then optimize so as to align their agricultural outputs to meet the demand in local and external markets. This in turn would help facilitate a more stable revenue stream from their produce.

ICTs can play an important role in the fight against poverty (Kizilaslan, 2006) and there are countless examples from the developing world of initiatives

to improve farmers' livelihoods via ICT-driven linkages to markets (see, de Silva et al., 2008 for examples from South Asia). The current reality on the ground, with respect to ICT utilization, is such that access and connectivity in the developing world is primarily driven by mobile phones, as opposed to PC-based telecentres. Aker (2008) showed how just the expansion of mobile coverage in Niger resulted in the reduction of price volatility in the country-wide grain market. Her research suggests that the impact on price dispersion was more significant as the number of markets with cell phone coverage increased; the argument being that lower search costs via cheaper access reduces information asymmetry.

However, assessing the potential of ICTs to positively impact overall rural livelihoods requires a more nuanced understanding of such livelihoods which captures their needs, capabilities, adaptability, vulnerabilities and their relationship to the social, legal and institutional environments in which they live (Chambers, 1987, 1995; Chapman et al., 2003). In this context, ICTs can allow farmers to engage more effectively in agricultural markets by increasing the flow of information as well as by facilitating the confluence of relevant actors and laws/policies that affect rural livelihoods.

Problems in price transparency in the agricultural sector of Sri Lanka

The agricultural sector of Sri Lanka is divided into plantation and non-plantation sub-sectors. The plantation sector covers export cash crops; predominantly tea, rubber and coconut and holds a considerable share (37%) of cultivated lands. The non-plantation sector on the other hand comprises crops grown mainly for domestic consumption by small farmers in small pieces of land, a majority of them with less than 2.5 acres of land. Rice is the major crop grown by these small farmers along with a variety of other field crops such as maize, cowpea, *mung* bean, chilli, onion and other fruits and vegetables (Mudannayake, 2006).

Crops for domestic consumption are mostly traded at one of eight regulated dedicated economic centres throughout the country. Of these the largest is the Dambulla Dedicated Economic Centre (DDEC). Its geographically central location in the country as well as comparatively better transportation linkages to the rest of the country has allowed it to become the main wholesale market in the country. Nearly LKR 500 million (approximately USD4.5 million) of produce is traded every day and it attracts farmers [sellers] and buyers from all over the country to its 144 stalls owned by middlemen/traders who facilitate the trade. Wholesale prices realized at this market serve as the benchmark for the rest of the country. Unlike markets in other countries such as India, wholesale prices in Sri Lankan markets are not determined by some form of auction mechanism. Rather prices for produce are determined via individual negotiations between farmers, middlemen and buyers, which are not made available publicly. The middleman sometimes plays the role of a broker, merely

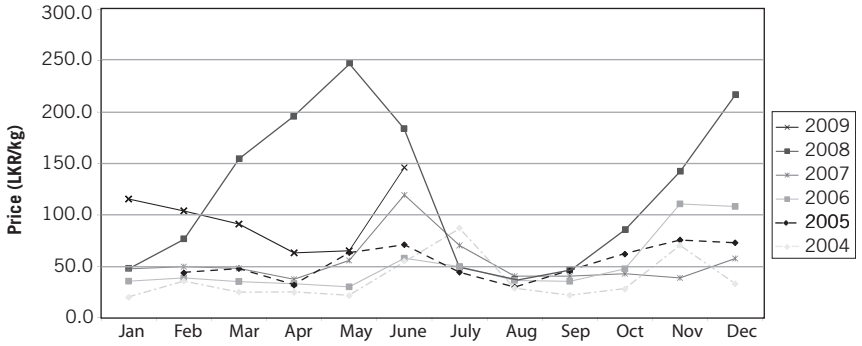

Figure 2.1 Average monthly price for cabbage at the DDEC (Jan 2004–June 2009)

facilitating the trade and sometimes as a trader who buys from the farmers and sells to other buyers. However, in both instances the middleman charges a commission from the farmer.

High information asymmetry results in very weak price signals which inhibit coordination between the farmer and the consumer. Furthermore, the lack of standardized quality grading metrics in the domestic market does not allow for the convergence of prices. Both of these reasons contribute to the high levels of seasonal and intra-day volatilities (see Figure 2.1).

A representative study of small farmers in Sri Lanka by Ratnadiwakara et al. (2008) found that farmers spent as much as 11% of their total production cost purely on information search costs, much of it during the deciding stage. Despite such high costs on information search, the prevailing high price volatilities meant that for the most part the prices these farmers realized for their harvested crops were often less than their expected value prior to cultivation.

Achieving efficient signaling between supply and demand would require in the first instance a significant increase in price transparency especially in spot markets. At present small farmers get market price information through one of the following means: visiting the market, asking others who visited the market or by calling traders and/or others who visited the market. In addition average daily prices at DDEC are published in newspapers as well as made available via the radio and TV. But in all instances the information is neither timely nor does it capture the high prevailing intra-day volatility, which limits their use. Given the potential of ICTs to reduce information asymmetry, there are a number of pilot initiatives in the country but again the prices reported are average prices. The publicly reported DDEC prices in mass media as well as through the existing pilot ICT initiatives are in most instances ultimately sourced from a not-for-profit company called *Govi Gnana Seva* (GGS)[1] or 'Farmer Intelligence Service'.

However, increasing price transparency in the spot markets is just the first step. Achieving longer term stability in prices would require introduction of commodity differentiation based on standardized quality metrics, and more

importantly, the functioning of forward markets. The latter requires the confluence of a variety of factors, chief among them being the ability to enforce (forward) contracts which is currently difficult in Sri Lanka.

Forward contracts in the agriculture sector of Sri Lanka have not been very successful. Tri-partite forward agreements were introduced by the Central Bank in 1999 as a means to reduce price volatilities. In the fiscal year 2008–2009 only a total of 23,431 agreements were established with 92.7% of these just for maize and the remaining only for paddy, soyabean and big onions (Central Bank of Sri Lanka, 2009). High price volatility in the spot markets for fruits and vegetables has facilitated a vicious cycle whereby forward contracts are often broken when spot prices are higher on the date of delivery of these contracts.

From December 2009, GGS's price updates are now available on a real-time basis through mobile phones via a platform called Tradenet developed by Dialog Axiata PLC, the largest mobile operator in Sri Lanka.

Research objectives

Against this setting, this Action Research Pilot (ARP) was conceived to leverage the Tradenet service to increase price transparencies in the spot market and create the necessary preconditions for a functioning forward market to emerge in the agricultural sector. Increased price transparency and the creation of forward contracts even at a regional level would have facilitated a behavioural change in farmers, whose crop decisions will possibly change as a result of being able to enter into a forward contract. Hence the primary research question of this ARP was to understand how an ICT intervention to bridge the information asymmetry between what the farmer produces and what is required by the wholesale buyer could impact farmer livelihoods. Due to the short duration of the ARP 'forward' trades are yet to occur via Tradenet and will take a longer time to materialize (see page 27), but the real-time price updates from the platform itself has positively impacted farmer livelihoods at the conclusion of this research.

Methodology

Research design

The ARP was conducted over a period of 10 months from December 2009 to September 2010 with a select group of farmers engaged in multi-cropping, primarily in fruit and vegetable cultivation over two crop cycles. Informed by the Sustainable Livelihood Framework (SLF), (refer to Chapter 1) the ARP is based on the premise that farmers face a variety of vulnerabilities, chief among them being the price volatility. This results in sub-optimal livelihood outcomes since their livelihood strategies are constrained by the unpredictable prices trends. This ARP thus sought to explicate the livelihood impacts on small vegetable farmers in Sri Lanka as a result of an ongoing ICT intervention to increase price

transparency. With the exception of natural capital, the other four livelihood assets were expected to be impacted in the following manner:

- Financial capital: By reducing vulnerabilities associated with spot and future price trends, the ARP would increase the farmer's financial capital.
- Human capital: The farmers' capacities to leverage information to their benefit in their decision making ability (i.e. strategic ability) would possibly be enhanced by the ARP.
- Social capital: The ARP might facilitate the enhancement of the social and functional networks that farmers access in their livelihood activities.
- Physical capital: The ARP would increase physical capital by reducing crop wastage emanating from the inability to sell harvested crops during periods of oversupply in the market. In addition the ARP would reduce vulnerabilities associated with access to ICTs.

A farmer group consisting of 61 farmers (subsequently dropping to 55 over the course of the intervention) was selected to participate in the ARP and another farmer group of 30 farmers were selected to serve as the control. Both groups shared similar socio-economic conditions (i.e. monthly income of between USD100–200) including attributes such as farm size (between 0.5 and 2 acres), similar cropping patterns in fruits and vegetables and roughly the same distance from DDEC (between 10 and 15 km from the market), but on opposite sides. The relatively close proximity to the market limits the extensibility of the findings to farmers far away from their closest market. The extent of use of mobile phones or which operator they utilized was not used as considerations in the selection of the farmers.

As part of the ARP three assessments were carried out on both the participating farmers as well as the control group. The baseline survey was carried out prior to the introduction of the intervention and prior to the sale of any of the crops grown by the farmers. The interim assessment was carried out immediately following the sale of the first crop after the baseline study. The final assessment was carried out after the sale of the next produce from the second crop cycle. The period between each of the surveys was about 4 months.

Modified household surveys were utilized at each of the assessment stages to capture income and expenditure changes. The surveys were also designed to elicit perceptions of farmers with respect to the intervention and their willingness to pay for the intervention as a fee-based service. In addition the assessments were complemented by in-depth focus groups as well as one-on-one interviews with farmers over the course of the research to understand any behavioural changes and the underlying rationales.

The ICT intervention

GGS is a not-for-profit company dealing in the collection and dissemination of produce trade information, with the aim of reducing information asymmetry

among farmers, collectors and traders. GGS has been operational on a pilot scale since 2003 at DDEC, Sri Lanka's largest wholesale produce market. Via a partnership with Sri Lanka's largest mobile operator, Dialog Axiata PLC, the price information collected by GGS is now available (since December 2009) on mobile phones (initially only for Dialog subscribers) through Dialog's Tradenet platform. The Tradenet platform is accessible via a variety of technologies including SMS, Internet, WAP, Unstructured Supplementary Service Data (USSD) as well as a dedicated call centre (accessed by dialing '977' from any Dialog phone). During the course of this ARP, the basic service was available for free and only calls made to the dedicated call centre were charged at a premium rate of LKR 3 (USD0.03) per minute. During the initial phase of this service, farmers could subscribe to receive price alerts for free on their mobiles via SMS (either in English, Tamil or Sinhala) for up to five vegetables and up to five price alerts per vegetable per day from any of the three markets currently covered by GGS.

The Tradenet platform also allows for the trading of agricultural produce.[2] Buyers and sellers can post buy and sell orders on the platform which will match demand (buyer) and supply (farmer) and alert them. Buy and sell orders can also be for the future which allows the Tradenet system to function as a quasi-forward market exchange for agricultural produce. Initially, the actual transaction between buyer and seller would be offline, outside of the system. Buyers can also search for all available sell orders for a specific date for a specific agricultural produce. Similarly, farmers can search for all available buy orders for a specific vegetable on a specific date.

While formal forward contracts are struck prior to cultivation, the Tradenet platform can allow farmers to strike trades for shorter periods. In the first

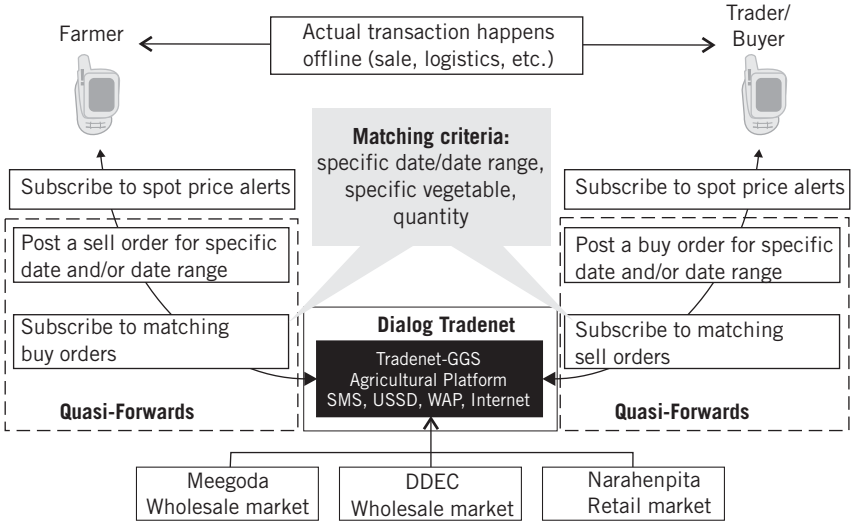

Figure 2.2 The Tradenet platform

instance these pseudo-forwards would be struck close to the harvesting date and as these signals are fed into the market system (via the Tradenet platform's forward prices), eventually prices would start stabilizing allowing contracts to be struck for even longer durations to the point where they were struck before cultivation at which point formal contracts would be viable. It is envisaged that this entire process would take several years to mature.

Project activities

While Tradenet was accessible nationally, the researchers did not mention the service to the control group who were approached only to conduct the baseline, interim and final surveys. However, word-of-mouth as well as advertising for the service conducted by Dialog, meant that some farmers from the control group as well as from other groups had approached the researchers for information on the service. These farmers were told to contact the operator and sign up for the service. While exact numbers are not available at the conclusion of this research, there were at least six confirmed new subscribers to the system who had earlier approached the researchers and field staff.

The intervention farmer group however was continuously engaged throughout. An in-depth training workshop on using Tradenet was held following the baseline survey. Farmers were also provided with Sri Lankan Rupees (LKR) 200 (approximately USD1.8) of phone credit per month for the duration of the ARP. Fourteen farmers who did not possess a Dialog connection were also given Dialog SIMs.

The constant engagement with the farmers translated into period adjustments of the intervention. For instance the baseline study had found that some farmers sometimes sold a small portion of their harvest at weekly fairs rather than at DDEC. Hence the field staff collected and disseminated

Table 2.2 Key livelihood impacts for farmers

	Intervention farmers	*Control group*
Farmer incomes	Increase of USD 0.045–0.09 per kg above the average price for the day which translates to average increase of 23.4% on average daily prices for all 55 farmers	Between LKR 0.009–0.045 per kg lower or higher than the average price for the day which translated to average increase of 4.23% on average daily prices for all 30 farmers
Social networks	Increase in interactions with traders, other farmer groups, relatives and neighbours	No increase in interactions
Farmer knowledge	131% perceived increase in knowledge of price trends	No perceived increase in knowledge of price trends
Vulnerabilities	Reduced vulnerability to price volatility but increased vulnerability to ICTs	No reduction in vulnerability towards price volatility

the prices from the weekly fairs on a regular basis either in person or via a phone call (but not through Tradenet). In addition, over the course of the ARP it was realized that prices were sometimes higher in the mornings at DDEC since there was demand for produce sourced from DDEC but destined for other wholesale markets in the country. Hence the price collection by GGS staff was adjusted to also cover the morning time frame as well when there are very few trades.

Research results and findings

Impact of the new service on livelihood assets

With the exception of natural capital, all other livelihood assets showed changes over the course of this research and were by and large in line with expected results.

Financial capital for intervention farmers has been positively impacted by the new service. Farmers were able to get LKR 5–10 (USD0.045–0.09) per kg higher for their produce by leveraging the new service to increase their knowledge of price trends as well as to figure out when to enter the market. While only a few farmers gained this benefit during the first cycle, nearly all had been able to realize higher prices by the end of this ARP. These findings were confirmed by the farmers themselves in the last survey (see response to Statement 5 in Table 2.3). Farmers in the control group however were, by and large, getting prices closer to the average daily price for their crops throughout each of the assessment stages with a spread of LKR 1–5 (USD0.009–0.045) on either side of the average price for the day of the sale of a specific crop.

As a result of the new service, farmers were now aware of more traders dealing in their specific produce. The farmers (81.8%) reported an increase in their interactions with other traders (also see responses to Statements 8 and 9 in Table 2.3) even if the final sale was often to the same trader as before. Furthermore, the new service has facilitated increased farmer interactions on livelihoods between farmer groups, relatives and neighbours with the percentage of farmers reporting an increase being 26.4, 15.1 and 34.0%, respectively. With the exception of one farmer, none of the others from the control group reported increases in network interactions of the research time period. As the service adoption matures, it is likely that the level of interactions would increase further.

Human capital also showed signs of increase. Based on the farmer's perceptions, knowledge and understanding of price trends among them had increased by nearly 131% over the research time frame. (Also see response to Statement 1 in Table 2.3.) The control group however showed no increase. The service had allowed farmers to monitor prices in real time, as opposed to the earlier lag time of one to two days which had enabled them to improve their livelihood outcomes. Roughly half the participating farmers had also subscribed to receiving price alerts for vegetables outside of their requirement but which they

Table 2.3 Farmers' assessment of impact of Tradenet system[a]

Sl no.	*Statement*	*Average score*	*Variance*
1.	Tradenet has helped me get a better idea of price fluctuations at the market	4.44	0.37
2.	Tradenet has helped me better decide when to cultivate my crops	4.12	0.77
3.	Tradenet has helped me better decide when to harvest my crops	4.19	0.86
4.	Tradenet has helped me better decide when to take my crops to the market to sell	4.25	0.22
5.	Tradenet has helped me get a better market price for my produce	4.23	0.89
6.	Tradenet has helped me to increase my bargaining power with traders	4.08	0.94
7.	Tradenet has helped me to figure out what crops to grow in the future	4.04	0.79
8.	I now have more knowledge about which traders I can use to sell my crops	4.13	0.91
9.	I now approach more traders when selling my crops	4.08	0.87

[a] Farmers were asked on a scale of 1–5 how much they disagreed or agreed with each of the statements above where 1 was 'strongly disagreed' and 5 was 'strongly agreed'

believed were higher value crops. This had created a demand for additional services such as crop advisory and extension services, which are currently limited. One unintended side effect of the new service was that farmers who had initially accidently signed up to receive alerts in English (as opposed to the local language) had kept that language configuration to learn the English names of vegetables.

Physical capital also showed some signs of increase through the elimination of wastage for participating farmers. However, this remains inconclusive since wastage among participating farmers prior to the intervention was already quite low given their relatively close proximity to the market. In addition, four participating farmers bought mobile phones over the course of this ARP. They initially attributed the purchase decision to the free usage credit provided by the researchers but by the end of the research felt that the value derived from the new service had more than justified their purchases. However, the vulnerability context with respect to access to ICTs for participating farmers had increased marginally. This was because the GGS price alerts were available only through one service provider whose coverage turned out to be patchy in the farmlands of the participating farmers (also see the discussion in the section on 'Impact on transforming structures and procedures').

Impact on vulnerability context

The spot market price alerts have allowed farmers to significantly reduce their vulnerability to intra- and inter-day price movements. The real-time price alerts have allowed farmers to figure out the ideal time to harvest and take their produce to the market based on the price movements that they follow via the service. However, the ARP has also slightly increased their vulnerability with respect to access to ICTs with cell phone reception by the service provider being limited in their farmlands.

Impact on livelihood decisions

The new service had brought significant changes in participating farmers' livelihood decision-making processes. A better understanding of real-time price trends have allowed farmers to choose the harvesting time as well as when to enter the market so as to realize higher prices for their crops (see responses to Statements 3 and 4 in Table 2.3). The accuracy and real-time nature of these alerts has meant that the relative importance of the market price in their decision on when to go to the market has increased compared to other considerations such as availability of transport or other chores that require their attention. This is clearly evident from an account given by a farmer, Dissanayake, who was able to leverage the price alerts to harvest and sell his cabbage crop so as to be able to sell at the highest price that week (see Box 2.1).

Furthermore, farmers also credited Tradenet for improving their decisions on when to cultivate their crops (see response to Statement 2 in Table 2.3). However, there is danger of deciding cultivation times based on a false assumption of future low supply (and by correlating high prices) based on current price trends, especially if the uptake of the system increases to the point where the majority of the farmers in the country were looking at the same data. Subsequent focus groups' discussions revealed that the participating

Box 2.1 The story of Dissanayake's cabbage crop

When Dissanayake's cabbage crop was ready for harvesting he did not harvest it immediately because the price alerts informed him that the prevailing cabbage price in the market was rather low compared to his expectations. Then one day he noticed increasing price trends over the course of the day. In the morning the price was USD0.18/kg. By late afternoon (and three price alerts later) the price had gone up to USD0.32/kg. Realizing the upward trend, he quickly gathered his family and harvested his cabbage crop, even using torches at one point since it was past sunset when the final cabbage was harvested. He quickly transported his crop to the market and sold it off. The final price he received was USD0.41/kg which was a premium of USD0.14 (51.8%) on what he had hoped to make that week for his cabbage crop.

farmers were in fact aware of this danger, but felt that they possessed first-mover advantage since changing cropping decisions would be a slow process for most farmers.

The ARP had also shown to have affected the farmers' livelihood decisions with respect to which crops to grow (see response to Statement 7 in Table 2.3). Multi-cropping patterns had always existed among farmers as a way of hedging against price volatilities, but the breadth of crop choices was limited by their knowledge of different crops (cultivation practices, access to inputs and knowledge of best practices, among others). For the participating farmers this knowledge extended to only about 10–13 different types of crops. The participating farmers had now started following price trends for crops outside of their expertise. They felt that increasing their knowledge of higher value crops would improve their ability to choose the right crop-mix so as to hedge against price volatilities and thereby maximize profit. While the Tradenet service could allow them to identify higher value crops, they could leverage this knowledge only if they could increase their access to information on cultivation practices and inputs for these new crops, which is limited right now.

The farmers also felt that their bargaining power had increased (see response to Statement 6 in Table 2.3). However, they showed no signs of having actively bargained with traders about prices. The likelihood of them openly questioning the offered prices was even less if they depended on a specific trader for working capital or emergency loans. However, the farmers felt that the mere fact that the trader knew that the farmer was receiving accurate and real-time price information from the market decreased the incentive of the trader to offer a lower price. While farmers professed to being more knowledgeable about additional traders and as well as interacting with more traders in the market (see responses to Statements 8 and 9 in Table 2.3), they generally continued to utilize the same traders with whom they had prior relationships since they also served as a source of emergency and work capital loans (also see the following section).

Impact on transforming structures and procedures

The relationship of farmers to the institutional framework (both formal and informal) surrounding the agricultural sector has a great bearing on their livelihoods. As noted earlier farmers depend on traders for emergency and working capital loans from time to time and these are often non-interest bearing and without a specified time period for repayment. Hence relationship maintenance with these traders remains very important to farmers. As a consequence farmers rarely (if ever) haggle on the price. The introduction of Tradenet has started to change the dynamic of this relationship. Knowledge of the farmer's access to information created fewer incentives to offer them lower prices. Furthermore, traders were using the price alert information from the previous

day as a benchmark for determining prices at the start of trading in the morning. Among the participating farmers, those who went in the morning were now getting a premium of LKR 2–5 (USD0.018–0.045) per kilo on the closing price of the crop on the previous day.

The ICT infrastructure in the region is of paramount importance if farmers are to have consistent real-time access to price information. The patchy phone reception in the lands of the participating farmers could limit adoption of the service in other farming areas in the country. However, as the market potential of Tradenet in the agricultural sphere becomes clearer, it is creating incentives for the operator to improve signal quality in these areas even though the dependence of GGS on just one operator continues to be an issue of concern.

Forward trades. The ability of the Tradenet platform to facilitate forward trades between farmers and buyers/traders was designed specifically as the interim step towards establishing a more viable forward contract system in Sri Lanka, which has so far not succeeded with fruits and vegetables (see the section on 'Research design'). However, the ARP has revealed that adoption of this service will take some time – something that could not be realized during the short duration of this research, even if the technology to facilitate trades had been ready prior to the start of the study and not midway through it.

One-on-one interviews and focus group discussions with traders revealed that they were hesitant to quote a forward price on the system (even one that was further negotiable offline) given the high volatility in the spot market. In addition they remain concerned about the platform's potential to circumvent the middleman in these trades. However, some of them acknowledged towards the end of the ARP that they occasionally glanced over sale orders from the farmers posted on the system as a means of identifying new supply sources. At the conclusion of the ARP the number of sale orders on Tradenet for agricultural produce was less than 15 and the majority of them were from the intervention farmers in the ARP who hoped to utilize the system to reach out to new buyers and traders.

The 'forward' trades will most likely occur when a much larger population of Sri Lanka's farming population start adopting the price alert service. Such a large-scale increase in price transparency might reduce price volatility to the extent where forward trades become more attractive for both farmers and buyers alike. Even then the initial formal forward contracts will need to be flexible instruments in terms of the strike price, maybe through the use of floors and caps tied to the prevailing market price.

Conclusion and recommendations

It is clear that real-time access to market price information via ICTs can positively impact farmer livelihoods. Farmers utilize such information to

improve their decisions on when to harvest and sell their crops and thus gain higher prices than what they got earlier. More interesting is the fact that small farmers, while poor, are capable of sophisticated and strategic thinking in their livelihood strategies. This is evident from the fact that farmers participating in this study understood the limits to which they could leverage timely price information to increase their comparative advantage against those farmers who did not have access to such information.

Continuously build stakeholder buy-in

Creating the right social, institutional, legal and market conditions to make forward contracts viable requires the confluence and support of multiple stakeholders, be it in Sri Lanka or in any other emerging economy with inefficient agricultural markets. GGS has shown success in building credibility with traders as well as with the related government ministries but ensuring the project's longer term success requires additional buy-in. GGS will have to continue to engage regularly with policy makers, traders, farmers and others in this symbolic environment, even while working with operators to increase service adoption. As such, GGS will have to also be opportunistic in their advocacy so as to intervene with appropriate evidence when policy windows arise.

Meet demand for other services

As farmers consider other higher value crops for cultivation, as a result of increased price transparency, it creates additional demand for crop advisory and extension services that need to be met. Should such behavioural changes become more prevalent, as more and more farmers reduce their information asymmetry with respect to market prices, such additional services are vital. If these needs are not met, farmers will continue to be restricted in their crop choices, which in turn would limit their ability to react effectively to the demand signals in the agricultural sector.

Capacity building for farmers

Country-wide differences in farmers' level of comfort with non voice-based technologies such as SMS, will dictate the level of capacity building required for acceptance and use of such services. Given that the poor in Sri Lanka are more comfortable with the use of SMS as compared to those from other South Asian emerging economies such as India, Pakistan and Bangladesh (Samarajiva, 2009), farmers in this ARP required only minimal training to use Tradenet. However, this does not preclude the need for building more awareness among the farmer community on how this new service could be leveraged for better livelihood outcomes.

Further research

While this study has shown promising impacts on farmer livelihoods by the use of ICT-based services for increasing price transparency (see Table 2.2), the longer term impacts are less clear. This necessitates the need for further research, both to understand longer term impacts as well as the impacts on farmers who depend on collectors and aggregators to sell their produce at the market. Furthermore, if price volatility can only be significantly reduced by the use of forward contracts, then appropriate evidence-based research will go a long way towards creating the necessary preconditions and contract innovations required to make forward markets viable.

Ensuring sustainability of such ICT interventions

Ensuring the sustainability of ICT-based initiatives for farmers can only be achieved by creating a viable long-term business model, backed by applicable research such as this. GGS' current content-provider agreement with Dialog is proof of this. However, building the business case requires continuous research on the impacts and needs of small farmers so as to increase the value proposition to all stakeholders, which includes both small farmers as well as the providers of such services. In GGS' case, it will need to consider exploring business relationships with other operators as a risk mitigation strategy. This might only be feasible once adoption of the price alerts through Tradenet increases and provides other operators proof of a viable business proposition. Exploring partnerships with other operators becomes more imperative the longer this service remains accessible only to Dialog subscribers.

Creating the necessary pre-conditions for viable forward markets

The findings also suggest that forward markets for fruits and vegetables might only become viable when price transparencies are increased to the extent where price trends will no longer give one farmer a comparative advantage over the other given that at this stage the majority of farmers will have access to the same information. But even then, forward contracts in fruits and vegetables in developing countries with large populations of small poor farmers will have issues with respect to enforceability of contracts (since it might likely be financially as well as legally impracticable to prosecute small poor farmers for broken contracts). Hence these forward contracts will most likely have to be flexible instruments in terms of the strike price, maybe through the use of floors and caps tied to the prevailing market price so as to reduce incentives to break the contract while ensuring a relatively stable and predictable income stream.

Notes

1. GGS was founded by Harsha de Silva and is managed by Sriganesh Lokanathan, both of whom are the primary researchers in this study.
2. In addition to agricultural produce, the platform was also designed to facilitate trades in all types of goods and services.

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About the authors

Sriganesh Lokanathan (sriganesh@lirneasia.net) is a Senior Research Manager at LIRNE*asia*, a regional ICT policy and regulation think tank based out of Sri Lanka. Sriganesh works on understanding the mechanisms needed to facilitate large-scale adoption of ICT-based initiatives to increase market efficiencies in the agricultural sector of emerging economies.

Harsha de Silva, PhD (harsha@lirneasia.net) is Consultant Lead Economist at LIRNE*asia*.

Iran Fernando is a Junior Researcher, LIRNE*asia*.

CHAPTER 3

A crop nutrient management decision support system: India

Daniel Anand Raj, A. V. Poo Murugesan, Vijay Pratap Singh Aditya, S. Olaganathan and K. Sasikumar

Rural poverty reduction is closely related to increase in agricultural growth and productivity. While agriculture remains the main occupation in villages, agriculture sector growth has been showing a declining trend since 1991. One of the key reasons for this is poor crop and soil management practices, as well as imbalanced application of fertilizers over the years by farmers due to lack of timely, accurate and reliable information on nutrient management and crop cultivation practices. Mobile phone growth over the last few years has made it a ubiquitous device and it can help reach out to a large number of farmers. Through this action research, a system was designed, developed and implemented at the farm level to answer the question whether providing customized crop cultivation and nutrient management practices to farmers can improve livelihoods, and if so, what are the implications of such an effort. This study has shown that information and communications technologies (ICTs) when appropriately harnessed can increase farmers' access to information. Tailor-made information to individual farmers can improve farm productivity. Farmers still need to attain greater level of awareness on new crops and management practices and mobile phones can be the vehicle to support this. Farmers are interested in bundled services providing a variety of information related to crop production, processing and sale. This study also indicates the importance of socially embedding the technology with the help of local institutions to effectively address the information needs of farmers.

Introduction

Agriculture is the main occupation of the majority of rural households in India, a bulk of which comprise tiny land holdings. Though 58.4% of the population of India depends on agriculture, the contribution of agriculture to the GDP of India was only about 20% in 2009 and in the past several decades the sector has grown very slowly (National Portal of India, 2010). Since 1949, agricultural productivity has grown at less than 2% (Reserve Bank of India, 2008) and is currently in the range of 0.5–1.2 (Balakrishnan et al., 2007), while in other developing countries such as China, agriculture on the other hand grew at 6% per annum.

Poor agriculture performance has contributed to high rural poverty. Historically, in India rates of poverty reduction have been very closely related to agricultural performance – particularly to the rate of growth of agricultural productivity (Rao, 2005). Recent comparisons made across countries show that increases in agricultural productivity are closely related to poverty reduction (Hazell et al., 2007). Countries that have increased their agricultural productivity the most have also achieved the greatest reductions in poverty (Department for International Development, 2004). At the macro-economic level, growth in agriculture has been consistently shown to be more beneficial to the poor than growth in other sectors.

There are many reasons for decline in the growth of agricultural productivity in India such as poor access to irrigation, soil nutrient (carbon, nitrogen, zinc, phosphorus) depletion, delays in planting, decrease in solar radiation (Ladha et al., 2003). A number of studies have established that a marked decrease in soil nutrients has noticeably affected crop yield per hectare (Jagannathan, 2010). Imbalanced fertilizer use is the root cause of poor crop yields and poor soil fertility status (Subba Rao, 2005). Micronutrient deficiencies in soils are also emerging as yield limiting factors. Unchecked nutrient depletion has major implications for the sustainability of agricultural systems and future food supplies.

A field-specific approach to nutrient management will be required to improve factor productivity and yields (Dobermann et al., 1996). At present, however, most national agricultural research systems provide nutrient management recommendations on a regional or district basis, and this level of aggregation is far too large (Cassman et al.,1997). The problems of farmers at the individual level vary based on management practices. Therefore, each farm is a unique ecosystem and this uniqueness is hardly addressed by the presently available information systems.

Even when relevant information is available at the national and international research institutions, it remains inaccessible to small and marginal farmers because of the missing last mile accessibility on the information highway. Farmers rarely have access to consistent, reliable, updated information that is tailored for their use. Further, no single source is able to provide the breadth of information required by the farmer through the demands of the farm cycle (Mittal et al., 2010). ICTs can help smallholder farmers maximize the return on agricultural inputs, provided timely and relevant information is provided to them (Porcari, 2010). In recent years, there has been a rapid increase in mobile phone subscription in India and it is one of the fastest growing industries in the world (TRAI, 2010). India has also developed its skill in Information Technology (IT)-enabled services which could help in solving some of the problems Indian farmers are facing.

The Sustainable Livelihoods approach provides a useful framework for thinking about the potential contributions of ICT to enhancing rural livelihoods and combating rural poverty, since it serves as an important reminder of the

complexity of rural poverty and of the equally complex strategies that the rural poor deploy to address their daily challenges (InfoDev, 2007).

Role of ICT

ICT could make the greatest contribution by telescoping distances and reducing the cost of interaction between stakeholders (Bertloni, 2004). The present ICT environment with reference to infrastructure and hardware facility in India is highly conducive to attain this objective. The Indian telecommunication industry is one of the fastest growing telecommunications industry in the world. Growth of wireless subscription was a phenomenal 44.5% between June 2009 and June 2010 (TRAI, 2010). Overall tele-density has reached 56.83%. The number of telephone subscribers based in India as of June 2010 was 671.69 million. Out of this, mobile phone connections alone count for 635.71 million (95%). More and more people in rural India are using mobile phones. At present the rural subscriber base in India is 31% of the total existing subscription base. The rural mobile base subscription is expected to reach 320 million by 2012. This creates an opportunity to provide useful information available more widely and to a large number of farmers in rural areas.

The research problem and objectives of the study

Farming in India is being undertaken by a large section of population under extremely diverse conditions. As argued earlier, most of these farmers are small and marginal who do not have access to relevant and timely information that could reverse the adverse affect on agricultural growth and productivity. Therefore, the research problem is:

- Poor soil health, which is due to imbalanced application of nutrients and thus leads to reduction in yield.
- One of the reasons being, that the present information on nutrient management through conventional channels is too generalized and information does not reach individual farmers at the right time.

Objectives of the study

Given the above, a system can interact with individual farmers to provide accurate, unique and timely information customized to his/her needs to improve farm productivity, and through that, farmer livelihood. Accordingly, the objectives are:

- To develop and provide a simple, customized and effective last mile accessibility tool for nutrient inputs and management in paddy cultivation, using ICT tools through short message service (SMS) and interactive voice

Figure 3.1 Web page individualized for each farmer

response system (IVRS) by using mobile phones and providing detailed information through individual Web pages (see Figure 3.1).

- To test whether provision of such customized information helps in enhancing the livelihoods of farmers in rice cultivation.

Research question and hypothesis

Can, customized information on crop nutrient management for paddy farmers through convenient and cost-effective ICT tools lead to an increase in their yield and/or reduce their cost of cultivation; and if so how? Based on this research question, the hypothesis is considered:

> If site specific, timely, appropriate and customized information on nutrient management is provided to farmers through convenient and cost-effective ICT tools, it may improve their yield and/or reduce their cost of cultivation.

Description of the project area

To test this hypothesis, a study was conducted on 450 paddy farmers from five villages of Sirkali Taluk in Nagapattinam district in the state of Tamil Nadu,

India. Two hundred and twenty-five farmers consisted of intervention farmers who were members of Kazhi Kadamadai Farmers Federation (KKFF) while another 225 farmers were selected to be the control group and were not members of KKFF.

Sirkali Taluk is located at the northern-most end of Nagapattinam district on the coast at the tail end of the delta region of the river Cauvery. It is bounded by the Bay of Bengal on the east. The traditional cropping pattern of cultivation is *kuruvai* as the first crop of paddy during the months of June to September followed by *thaladi* (also known as *samba*) during the months of October to February as the second crop. The farmers raise pulse crop (black gram) after *samba/thaladi* paddy using the residual moisture in the paddy field.

The actual villages involved in the pilot project are given in Table 3.1.

Vulnerability of the sample area. This district is one of the six backward districts of the state and ranks low on the human development index (HDI) (17th rank). The productivity of paddy in Nagapattinam district is only 1.65 tons per hectare, which is very low compared to the state average of 2.67 tons per hectare. This district ranks 25th in paddy productivity in the state (Chelliah, 2001).

Irrigation water for these delta villages in a normal year becomes available when it is released from Mettur reservoir which is located 330 km upstream across Cauvery river. For the past two decades, water in Mettur reservoir has frequently become insufficient to allow enough outflow to reach the tail end of the delta region. On the other hand, Nagapattinam also gets frequently flooded due to cyclones or depressions in the Bay of Bengal during the months of November to December leading to water logging. In both situations agriculture is affected (Sivanappan, 2007). Proximity of agricultural lands to the sea makes them vulnerable and a high proportion of marginal farmers' lands are prone to floods and cyclones. River water having become irregular, in this proximity to the sea has led to ingression of sea water into the subsoil making it saline which is increasing over time.

Profile of the sample farmers. The sample consisted of intervention and control farmers. Intervention farmers (216) in the selected villages are members

Table 3.1 The villages in the project area

Sl no.	*Name of villages involved in the project*
1	Perunthottam
2	Chinnaperunthottam
3	Mullayampattinam
4	Manigramam
5	Annapanpettai

of the KKFF. Since no baseline study existed, another 236 farmers of similar socio-economic status were selected to be the control. The intervention and control farmers were from different villages. Intervention farmers were to use the information provided through their mobile phones and implement them. Control farmers were free to follow their own usual practices.

Table 3.2 gives the details of the status of the farmers in terms of their landholding area.

Irrespective of the size of landholdings, all farmers had different sources of agricultural information. All the farmers were above 20 years of age, male, and had different levels of formal education ranging from class III to undergraduate. All of them grew at least one crop of paddy during the *samba/thaaladi* season, that is between the months of September and October to January and February. After the paddy crop, the majority of the farmers sow black gram by utilizing the residual moisture.

While farmers get agricultural information from various sources, the primary source of information is the local fertilizers and pesticide dealer (see Table 3.3). All farmers selected for the study had at least one mobile phone.

All farmers were involved in cultivating irrigated paddy crop and their main source of irrigation was water from Cauvery river. Some farmers also have bore wells which they use for supplementary irrigation in case water is not available from canals for a short period.

Table 3.2 Landholding of farmers in acres

Intervention farmers		*Average (ac)*	*Overall average of intervention farmers (ac)*	*Control farmers*	*Average (ac)*	*Overall average of control farmers (ac)*
Less than 1 acre	24	0.71	1.63	11	0.7	1.72
1–2 acres	174	1.42		197	1.49	
>2 acres	18	2.75		28	2.96	
Total	216			236		

Table 3.3 Sources of nutrient information

Source	*Ranking*
Local fertilizer and pesticide dealer	1
Other progressive farmers	2
Department of agriculture	3
Newspaper and magazines	4
Radio and TV	5

Methodology

This research study consists of three major components which include complete design, implementation and evaluation of the system. The design of the system took into consideration the local information needs of the farmers and deploying the system through a local institution KKFF that enjoyed a high level of credibility and trust among farmers.

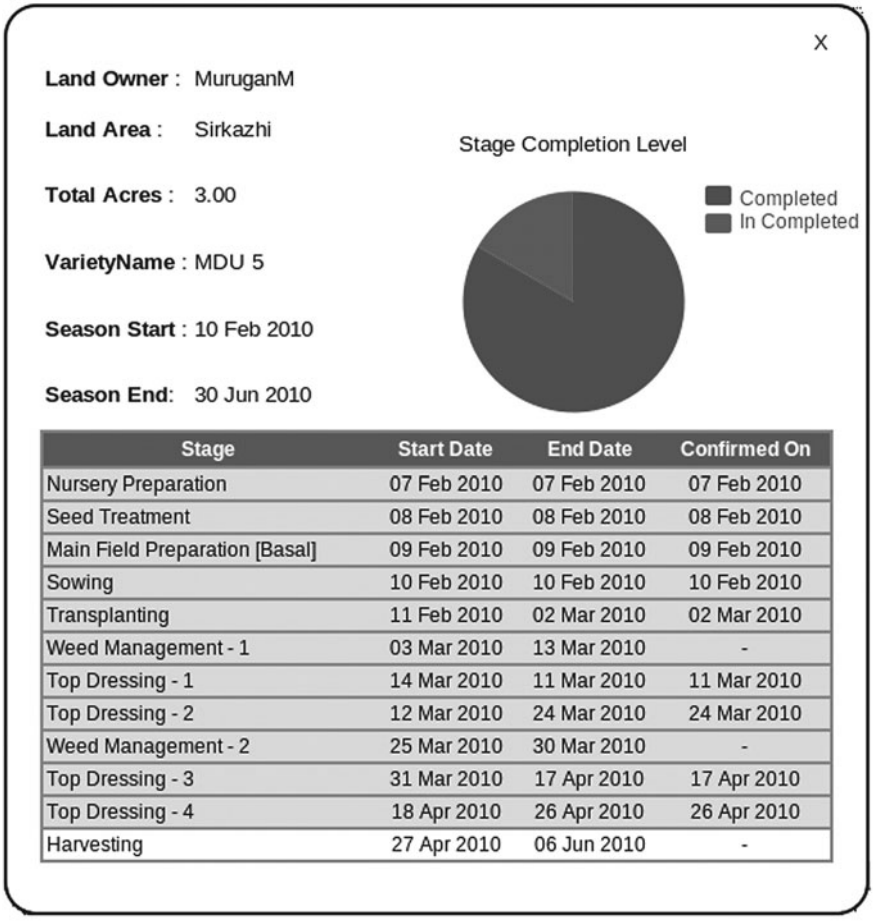
Originally, it was planned to conduct this action research in two locations (one in Nagapattinam district – the present study) and another in Tirunelveli district among women self-help group (SHG) members. As the project progressed, it was noticed that it may not be possible to proceed with the same rigour if this study is done in two locations. The second location in Tirunelveli district did not have the requisite staff members like KKFF to follow up with the farmers. Therefore, it was decided to drop the second location and concentrate on farmers in Nagapattinam district alone under KKFF.

Data collection. The project farmers were mobilized through KKFF. KKFF staff were also involved in facilitating the project as well as having regular meetings with the farmers. Data was collected through a printed questionnaire comprising details of geography, farm, economics, crop and nutrient management history and planned crop. Regular farm-related data was collected through a number of meetings conducted with individual farmers by the field staff. It was also accompanied by a number of focus group discussions with farmers on specific issues relating to adoption of ICT for their information needs on nutrient management for paddy cultivation.

Every farmer was visited once in two weeks in order to verify whether they had implemented all the alerts received by them and at the same time, whether they had sent the implementation reports to the server. Confirmation by the farmer after the completion of each activity was automatically updated on the central database on a real-time basis. The confirmation on field activity by the farmers had been facilitated through SMS and IVRS. A sample screen shot of the completed activities and also the dates are provided in Figure 3.2.

Measurement of variables. For the purpose of this study, increased farm income and/or reduced cost of cultivation was taken as a measurable outcome. In this study, an attempt was made to find out whether the provision of agricultural information services helps in improving yields and/or reduces cost of cultivation.

For the purpose of analysis in the study, comparison of the income data of intervention farmers with those of control farmers using ANOVA was completed. A detailed monitoring of all the inputs used by the intervention farmers as well as control farmers was carried out.



Stage	Start Date	End Date	Confirmed On
Nursery Preparation	07 Feb 2010	07 Feb 2010	07 Feb 2010
Seed Treatment	08 Feb 2010	08 Feb 2010	08 Feb 2010
Main Field Preparation [Basal]	09 Feb 2010	09 Feb 2010	09 Feb 2010
Sowing	10 Feb 2010	10 Feb 2010	10 Feb 2010
Transplanting	11 Feb 2010	02 Mar 2010	02 Mar 2010
Weed Management - 1	03 Mar 2010	13 Mar 2010	-
Top Dressing - 1	14 Mar 2010	11 Mar 2010	11 Mar 2010
Top Dressing - 2	12 Mar 2010	24 Mar 2010	24 Mar 2010
Weed Management - 2	25 Mar 2010	30 Mar 2010	-
Top Dressing - 3	31 Mar 2010	17 Apr 2010	17 Apr 2010
Top Dressing - 4	18 Apr 2010	26 Apr 2010	26 Apr 2010
Harvesting	27 Apr 2010	06 Jun 2010	-

Figure 3.2 Detailed online scheduling of tasks, showing when they are completed

System design

System design primarily consisted of four components which include the users, interface, middleware and the core system (see Figure 3.3).

Users. The users consisted of farmers (all the registered farmers), partners (KKFF) and the project administrator. Farmers were the end users of the system who interacted through interfaces such as text messages, voice calls and the internet. Partners played the role of facilitating the system with farmers by registering and help in interacting with the system. The project administrator was in charge of developing and managing the alerts content.

Figure 3.3 System design for paddy cultivation information

Interface. The interface layer is the tool for different users to communicate with the system. This includes text messages (SMS), voice calls (IVRS) and the internet.

Middleware. Middleware acts as an intermediary between the core system and the user interface. This includes the SMS gateway, voice gateway and internet gateway. The SMS gateway enables receiving and sending of text messages to the registered farmers on their respective crop stages. This also initiates voice call facility to the farmers where it transforms the text message requests to automated voice call. The voice gateway acts as an interactive voice response system (IVRS) in helping farmers to listen to expert ideas/suggestions/clarifications on the use of different methodologies and nutrients for the farm. The internet enables the partners and farmers (optional) to access their respective information on the convenient Web platform.

Core system. This forms the key element in the entire design which includes a database server, application server and knowledge base. The database server enables storage of individual farmer data including the complete activity of the farm cycle, scheduled SMS/IVRS/Web content and configurable user and user roles. The application server runs the set of instructions on predefined triggers and user actions. A knowledge base consists of all information related to a crop, variety, pest and diseases, stage, nutrient requirements and geographical parameters.

The nutrient database includes the tabulation of the details of various forms of nutrient inputs used by the farmers as well as the content of individual nutrient form. This tabulation was dovetailed to the software and was loaded to the server.

Developing SMS alert content and IVRS. In order to provide timely information on nutrient management the server sends automated alerts to individual farmers. The content of this alert was designed and programmed into the server. These alerts, contents were in the form of localized text messages (SMS) and voice alerts and were delivered to registered mobile phones. These alerts were synchronized with the age and date of sowing of crop. Information on various crop management practices was also provided on demand over mobile phones through (IVRS) (Figure 3.4) which were triggered through coded SMS by the farmer.

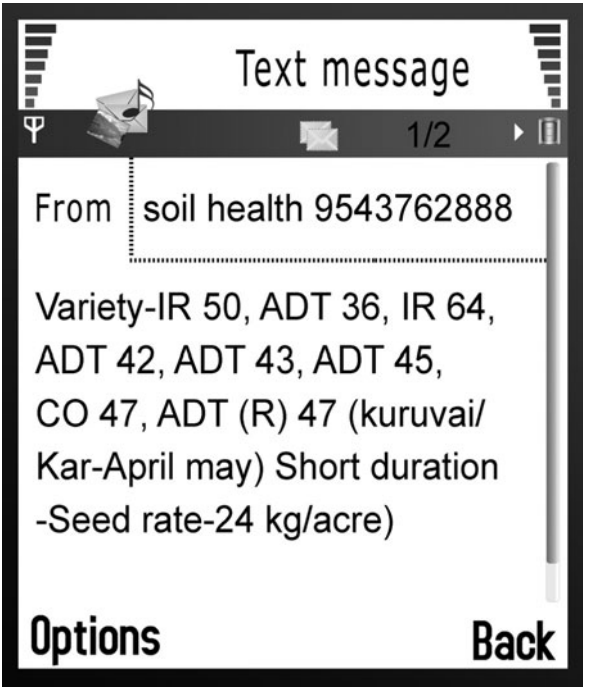


Figure 3.4 Text message on paddy sowing rate

Through this system each farmer received approximately 106–110 SMSs during the cropping season of 4 months. These SMSs included actual crop cultivation practices along with nutrient management advice. A number of reminder SMSs and other information on pest and disease management were also sent. All text messages were sent from SMS gateway based on GSM/GPRS modem. A total of 20 different varieties of paddy were cultivated by farmers during the season in the five villages. Intervention farmers cultivated seven different varieties which were included within the 20. Automated alerts were provided to all the intervention farmers on these seven varieties. A total of 760 IVRS calls were provided to farmers based on demand.

Soil health user guide. The soil health user guide (see Figure 3.5) is a booklet that is distributed to each farmer in order to make them understand the agro advisory system (crop management practices) for which he/she has been registered. This helps the farmer to utilize the system to its full potential. It contains the details on access to information, how to send reports and do self-updating of all operations as and when it is carried out. The guide had been prepared in Tamil, which is the local language in the state.

Results and discussions

Introduction of ICT led to change in cultivation practices among the intervention farmers and some significant reduction in the cost of cultivation.

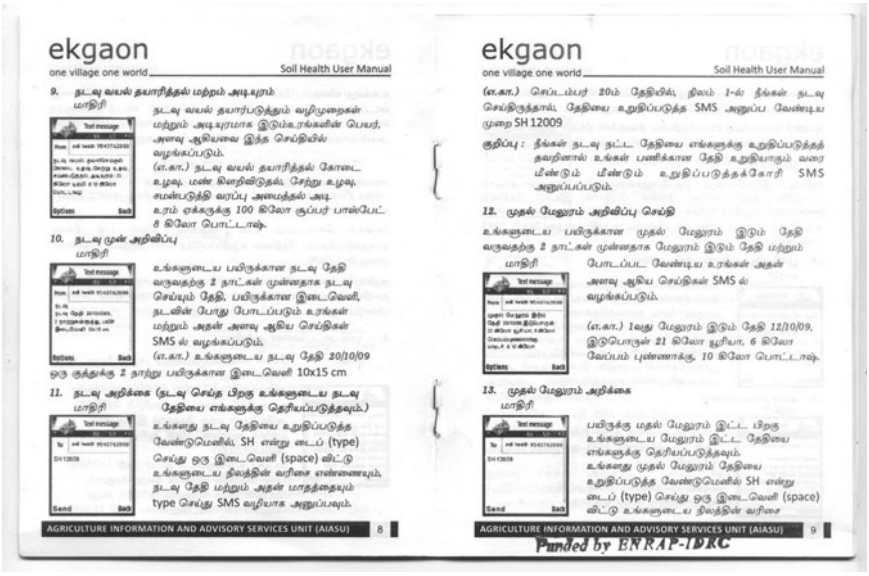


Figure 3.5 The soil health user manual (in Tamil) helps farmers make the best use of the agro advisory system

Table 3.4 Comparison of intervention and control farmers with reference to inputs costs and income

Inputs/activities	*Intervention farmers (n = 217)*		*Control farmers (n = 236)*			
	Mean (Rs)	*SD**	*Mean (Rs)*	*SD*	*p value***	*S/NS****
Seeds	895	360	985	390	0.01	S
Nursery preparation	1,583	1,073	1,706	945	0.2	NS
Main field preparation	800	225.6	763	136	0.03	S
Basal nutrient application	401	215	511	406	0.0004	S
Transplanting	1,242	261	1,266	261	0.32	NS
First top dressing	393	183	450	206	0.0015	S
Second top dressing	314	140	393	160	0.000007	S
First weeding	355	236	410	256	0.018	S
Second weeding	261	366	307	200	0.09	NS
Harvesting	4,268	1,316	3,956	1,263	0.01	S
Gross income	15,944	3,797	15,469	4,081	0.02	S
Net income from paddy	3,494	4,472	2,961	4,058	0.099	S

* Standard Deviation

** *p* value is the probability value. Alternative (1 – *p* value) gives the level of confidence. (For example, if *p* value is 0.05 then 1 – 0.05 = 0.95 and it means that we could say with 95% confidence that there is a significant difference between the intervention and control group

*** *S means significant/NS means not significant*

Intervention farmers had more significant cost reductions than control farmers in all crop production operations as is evident in Table 3.4. Overall, net income of the intervention farmers was 15.2% higher than that for the control group. The intervention group was able to reduce costs by using appropriate quantities of seeds and inputs, and realizing better market prices as they had better information available on these. The cost reduction was significant in the amount spent on seeds, nutrient management and first weeding.

Seeds, nursery and field preparation. Intervention farmers spent Rs 895 (US$20), which was significantly less than Rs 986 (US$22) spent by control farmers. The main reason for the reduction in cost of seeds used by intervention farmers was because of the recommendation of the correct quantity of seeds to be used per acre. Only 12–24 kg of seeds was recommended for one acre (Figure 3.4). While

the quantity of seeds used by intervention farmers ranged from 20 kg per acre to 25 kg with an average seed rate of 24 kg per acre, the quantity of seeds used by control farmers ranged between 35 and 45 kg with a mean of 39 kg per acre. Apart from information on seeds, information on seed treatment and usage of bio-fertilizers was also sent through SMS to intervention farmers (Figure 3.6). The cost of seeds was the same irrespective of the varieties used by farmers.

All the farmers in both the intervention and control categories raised nursery for sowing paddy seeds. Intervention farmers spent Rs 1,583 (US$35.17) which is Rs 123 (US$2.7) less (but not significant) than control farmers who spent Rs 1,706 (US$37.91). All farmers raised wet nurseries. Intervention farmers used more organic manures than control farmers. Organic manures included farmyard manure 450 kg for 8 cents of nursery (Figure 3.7). Most of the organic manure used by the intervention farmers was their own and they did not use urea/DAP in their nurseries.

The main field preparation included activities such as puddling, bund trimming, etc. Data from the field shows that the cost of main field preparation is higher for intervention farmers compared to control farmers. The expenses incurred by intervention farmers were Rs 800 ($18) per acre while the cost of main field preparation for control farmers was Rs 763 (US$17). The difference was only of Rs 37 (US$0.82) but significant.

Figure 3.6 Text message on seed treatment

Figure 3.7 Text message on compost application

All farmers in the project transplanted their seedlings. In this project, no significant difference was found in the cost for transplanting between intervention and control farmers. Intervention farmers spent Rs 1,242 (US$28) per acre for transplanting while control farmers spent Rs 1,266 (US$28). The difference was Rs 24 (US$0.5) per acre but that is not statistically significant.

Nutrient management. The reduction in cost for intervention farmers was due to the elimination of application of urea as basal fertilizer. Intervention farmers applied only DAP. The cost of urea is around Rs 450 ($10)–Rs 500 (US$11.1) per quintal (100 kg). Half a bag of urea is 25 kg, which costs approximately Rs 112 (US$2.5). Thus, the information about basal nutrient application to intervention farmers has reduced their application levels.

The normal practice of the farmers (control farmers) was to apply about 32–40 kg of urea during the first top dressing. The information system recommends 22 kg of urea for the first top dressing. This means only 10 kg of nitrogen nutrient (as urea has only 46% nitrogen) is applied at this stage of the crop. This is a reduction of 10–18 kg of urea, which works out to a reduction in cost of approximately Rs 36 (US$0.8) to Rs 56 (US$1.25) for the first top dressing.

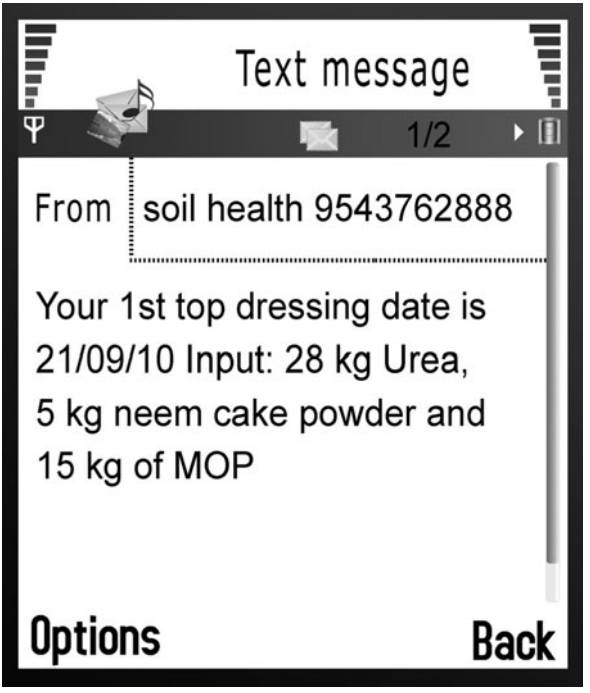


Figure 3.8 Text message on top dressing

A model alert for first top dressing is provided as shown in Figure 3.8. The alert also provides information on mixing of urea with neem seed cake powder. Mixing of neem seed cake with urea reduces loss of nitrogen through nitrification. This leads to slow release of nitrogen from urea, thus saving cost of nutrients as well as increasing the efficiency of applied nitrogen nutrient.

Depending on the date of sowing, the date of transplanting and the variety used, the second top dressing coincided with the panicle initiation stage. Accordingly, intervention farmers spent Rs 314 (US$7) per acre, which is Rs 79 (US$1.75) less than the Rs 393 (US$8.73) spent by control farmers. This difference is statistically significant. The normal practice of the farmers is to use one full bag of urea with muriate of potash (MOP). The recommended dose of urea according to the information system is 22 kg while control farmers used about 50 kg of urea. Intervention farmers used approximately 25 kg of urea compared to control farmers using around 45–50 kg of urea. According to the farmers, this reduction in usage was due to the information provided to them through their mobile phones.

Weeding. Intervention farmers spent Rs 355 (US$8) per acre for weeding their plots, which is Rs 55 (US$1.2) less than the Rs 410 (US$9.1) spent by

control farmers. Weeds normally out-compete paddy in growth, at least during the early stages, especially when there is higher concentration of inorganic nitrogen. Intensity of weeds is higher in fields with higher applied inorganic nitrogen. It is possible that since intervention farmers did not apply basal nitrogen, they found fewer weeds in their fields than control farmers.

The second weeding is done normally at about 45 days after transplanting. Intervention farmers spent Rs 261 (US$5.8) per acre for the second weeding, which is Rs 46 (US$1.0) less than control farmers who spent Rs 307 (US$6.7) per acre. The difference was significant at 10% but not significant at 5%. Since the second weeding is normally done at 45 days after transplanting, it is possible that the crop canopy would have covered the land and therefore the cost incurred in weeding was less than the first weeding. Thus, approximately Rs 90 (US$2) less was spent by both intervention and control farmers for the second weeding.

Gross income. Intervention farmers earned Rs 15,944 (US$354) per acre, which was Rs 475 (US$11) more than control farmers who earned Rs 15,469 (US$344) per acre. This difference was significant. Income is closely related to market prices and market prices for paddy vary on a day-to-day basis. Normally the price of paddy is low during harvesting time and increases during off season. A small increase in sale price benefits the farmer especially if paddy is sold during the off season. Therefore, information on market price coupled with an enhanced storage facility of farmers will definitely give better income.

Limitations of analysis

The alerts were developed for a normal season with a maximum rainfall variation of 20%. Analysis of rainfall during the cropping period indicates a wide variation of rainfall distribution. Many of the nutrient management aspects could not provide the anticipated results due to low rainfall and excess rainfall during the months of September–December 2009.

Sowing dates varied from mid-September to mid-November. This can be one of the reasons for a high degree of variability in crop yield as well as input costs which are one of the limitations of this analysis. This analysis is based on the results obtained in one agricultural season.

Conclusions and recommendations

Conclusion – impact of customized service

Customization of information is a key contributing factor to the success of this research. This was made possible by incorporating the dynamic needs of farmers into a flexible delivery system through convenient modes of access such as SMS and voice calls in the local language. This initiative was also able to

show that tailor-made information delivery to farmers at their convenience has resulted in an increase in net income by 15% more than the control group.

This demonstrates that in a dynamic system, customization of information is the key to better productivity.

Conclusion – capacity building

On average three reminder SMSs were sent for each farm activity including assistance from the staff of KKFF. This was because they were not very familiar with interacting with the system, indicating the need of capacity building of farmers on the utility of mobile phones as a tool for receiving and posting information on agriculture. This paves the way for enhancement of livelihood of farmers. Therefore, for the success of any system, the capacity building of the clients (in our case the farmers) in using the system is important.

Conclusion – template designed

The pilot system, which can be taken as a template, was designed and tested with farmers and has been found to be successful in increasing the profitability of farmers. Similar systems can be designed for other crops and other regions of the country.

Conclusion – linking with other systems

The system developed through this research study has provision by which the health status of crops could be monitored on an individual farmer basis.

Such micro-level information is extremely valuable to formal institutions such as insurance, banks and other government as well as quasi-government schemes which help reduce the vulnerability of farmers. This can help in fine-tuning the delivery of insurance products to individual farmers. This is expected to create a win-win situation for farmers as well as crop insurance agencies in the long term. The same information can be used for linking with banks for credit.

Conclusion – importance of working with local intermediary institutions

For adoption of technology or service it has been demonstrated that mobile phones can be utilized as last mile information delivery tools to a large number of farmers. The credibility of KKFF among farmers was one of the key contributing factors for the successful completion of this action research. This clearly points to the fact that local facilitating institutions that can aggregate an individual farmer's needs are necessary for the success of any future similar initiatives.

Conclusion – sustainability

Farmers using this system were able to increase their income by 15% more than control farmers even in an unfavourable year. Those farmers who received agricultural information were able to get an additional Rs 475 (US$10.5) per acre in a 4-month duration of a season. In a favourable year this can even double up to Rs 1,000 (US$22.2) per acre. If the farmers are ready to pay a maximum of one tenth of this amount (that is Rs 100 (US$2.2)) per season, then the return on investment is 1:10 for the farmer. With uncertainty due to climate change, agricultural practices have become more unpredictable. In such a context, it will be a challenge for existing formal structures to provide updated information for the farming community. This research study has shown a way through which extension can be localized and paid for by farmers. This is expected to pave the way through which private money (payment by individual farmers) for extension services rendered will be utilized for public good (increased agricultural productivity). Output of this research can lay the foundation for this transformation at the village and district levels. The scale-up process will bring down the cost of the delivery of service due to a higher number of subscribers and the use of optimum technologies for such delivery. Funneling of various services through the local institution will provide a convergence model for bringing various services to the doorstep of farmers with an income-generating possibility for the local institution on a sustainable basis.

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About the authors

Daniel Anand Raj is an agronomist with 17 years of experience in bringing modern technologies to agriculture and enabling ICTs for better agriculture productivity. Daniel is Director for Agriculture Information and Agro Advisory Services unit at Ekgaon.

A. V. Poo Murugesan is an agriculture graduate with experience in assisting farmers to adopt innovative practices for better productivity. He has been

working with the farmers' group to get them insurance, loan facilities, branded seed varieties and better market prices for their produce. He is the Executive Director at Kazhi Kadaimadai Farmers Federation (KKFF).

Vijay Pratap Singh Aditya is a social entrepreneur and development professional having experience of designing systems and institutions for enabling access to services and markets for rural producers and artisans. Vijay brings in experience of technology innovation and understanding of the socio-economic environment in developing economies for providing IT-enabled services. Vijay is co-founder, Director and Chief Executive Officer (CEO) of Ekgaon.

S. Olaganathan has more than 20 years of microfinance experience. He has been programme coordinator in CCD, Madurai helping develop and strengthen its microfinance programme. Olaganathan represents self-help groups as director in a microfinance support company called Sarva Jana Seva Kosh Limited promoted by Assefa, Madurai, Tamil Nadu. He is Director of Microfinance and Value Added Services at Ekgaon.

Kannaiyan Sasikumar is a finance and management control systems professional with experience in microfinance and technology enabling systems for credit delivery. Sasikumar has been working in the Product Development Unit of Ekgaon leading the delivery systems service area for microfinance, health insurance, climate and weather information services and refinancing institutions for 3 years and has developed systems for both urban and rural microfinance institutions and banks. Sasikumar is Regional Head (South India) and Assistant Vice President (Product Development) of Ekgaon.

CHAPTER 4

LifeLines: livelihood solutions through mobile technology in India

S. M. Haider Rizvi

Even after rapid advancements in the industrial growths of nations, agriculture remains the largest single contributor to livelihoods in many economies (International Fund for Agricultural Development, 2001; Food and Agriculture Organization, International Fund for Agricultural Development and World Food Programme, 2002), and the role of agriculture acts as a multiplier because of the contributions of agro industry in employment creation and income generation (UN Commission on Sustainable Development, 2008). India presents one of the contrasting settings where 58.4% of the population depends on agriculture for its livelihoods (National Portal of India 2010) yet productivity has been declining. The situation is compounded in socially, culturally and economically backward regions such as Mewat. LifeLines, a mobile-based advisory service for farmers, succeeded in bringing improvements in agricultural practices with new inputs and increases in produce. Interestingly, the use of LifeLines services by the farmers not only established evidence for the role of ICTs in improvement of rural livelihoods but also highlighted the areas where more work is required to effectively satisfy farmer information needs. This chapter discusses the possibilities of replicating a LifeLines type of intervention in relation to areas that need further improvement such as 'delivery of services', 'flow of communication' and 'enrichments of technology'.

Introduction

The importance and potential of information communication and technologies (ICTs) have been established in every walk of life. The access to and usage of ICTs have been varied with the advances in ICTs; the 'digital divide' has become more prominent. People having access to ICTs are applying technology with innovation and making progress. The poor neither have access to ICTs nor get the benefit of their applications, especially in rural areas which are inhabited by about 72% of India's 1.1 billion people. They are unaware of applications and are compelled to follow traditional methods and approaches. In the words of former UN Secretary-General Kofi Annan, 'The new information and communication technologies are among the driving forces of globalization; they are bringing people together, and bringing decision-makers unprecedented

new tools for development. At the same time, however, there is real danger that the world's poor will be excluded from the emerging knowledge based economies'.[1]

Agriculture is an important sector which could have benefited a lot from the applications of ICTs, especially in bringing changes to the socio-economic conditions of the poor in the backward regions of developing countries. Agriculture is the major source of livelihood for the rural poor; most of them depend on rain-fed agriculture and fragile forests for their livelihoods. Farmers in rural areas have to deal with failed crops and animal illness frequently and, due to limited communication facilities, solutions to their problems remain out of reach (World Bank, 2009). In India, there are conflicting scenarios as the country is progressing rapidly with a GDP growth rate of 7.2% but only -0.2% growth rate for agriculture, forestry and fishing sectors (Economic Survey, Government of India, 2009–10). But efforts to improve the agriculture sector, it seems, are not in accord with the requirements. Therefore, now, there is increasing policy thrust in developing countries to arrest declining agricultural productivity thereby leading to reduction in poverty and stress on the environment.

The issues involved here are complex as land holdings are small, often fragmented, with low productivity and poor connection with extension services. Farmers lack basic literacy to understand new technologies and desperately need skills and support for production, processing and marketing. Traditional agriculture extension systems are weak and lack adequate manpower to effectively support farmers at their doorsteps (Madhvani et al., 2010). Agriculture experts often have low incentives to go to villages and are largely located in urban settings. Poor villagers find it hard to travel long distances to avail extension support due to their poor economic status and extremely poor transport network. They need timely knowledge support right in their villages as per their convenience. Knowledge intermediaries are often required who are local and proactively articulating problems using participatory communication methods.

There are obvious barriers of languages and cultural differences between input providers and the beneficiaries leading to top–down one-way communication failing to achieve the intended purposes of benefiting the farmers and communities at large (Chapman et al., 2003).

Context of the study

The chapter is based on the assessment of impacts of a telephone-/mobile-based information system, LifeLines, under the broader area of ICTRL interventions and presents an interesting case of the involvement of various stakeholders not only in the deployments of technology for the poor but also in its execution and evaluation. The protagonists of the interventions and their roles in the running of LifeLines services are summarized as follows:

The intervention area: community, and the intermediary organization

The Institute of Rural Research and Development (IRRAD) of S. M. Sehgal Foundation, Gurgaon, in India, works for the empowerment of the rural poor community in Mewat district of Haryana through an integrated sustainable development model to enable them to participate in their own development. IRRAD's income enhancement programme builds awareness of new technologies and modern agricultural practices as well as training the farmers in its adoption techniques (Figure 4.1).

To support its communities, IRRAD, in collaboration with One World South Asia, started implementing LifeLines services in 2009. It was realized that the community relies on traditional indigenous practices and was not using the facilities and services of ICTs so the challenges would be to not only create access to ICTs in the region but also to enable them to realize its importance and integrate it in their lives.

The technology and the collaborators

LifeLines is a telephone-based agro-advisory service to give technical expertise on a one-to-one basis for agricultural practices, seeds, market situation,

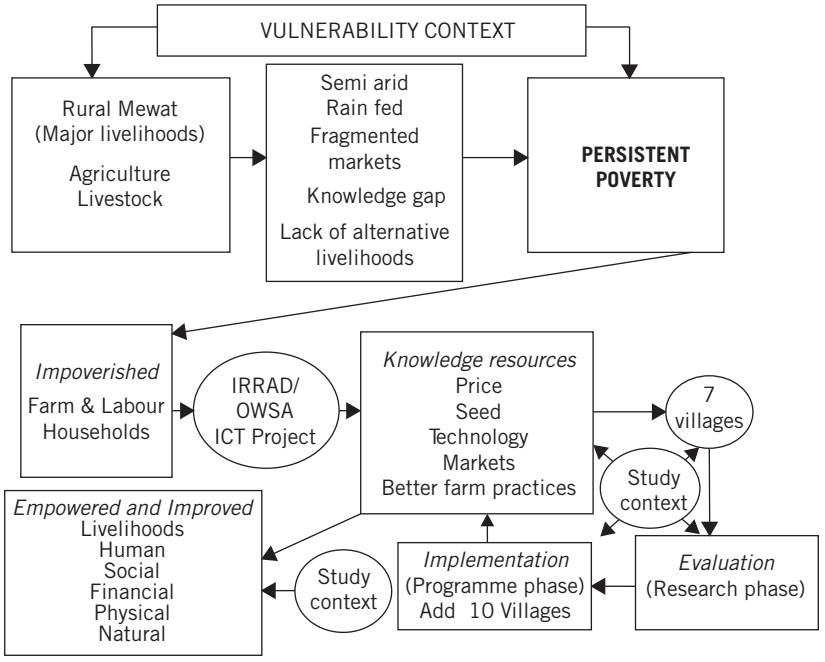

Figure 4.1 IRRAD's sustainable livelihoods model

prices and other allied activities. LifeLines was initiated in September 2006 by OneWorld in collaboration with British Telecom and CISCO and reaches out to rural communities in 53 districts across four states of India with information services in agriculture as well as the education sector.

The working of LifeLines system might be summarized as, 'to use the service, the user dials the designated LifeLines number using a landline or mobile phone. The call first reaches the interactive voice response (IVR) system of the service where the user is assisted by a voice menu to register his/her query. The query asked by the user is stored as a voice clip in the LifeLines' database server. At the backend, a knowledge worker (KW), responsible for processing the queries, logs in to the application through the web interface and views all the queries that have been registered in the system. Answers to these queries are first looked up in the system's FAQ database by the KW. If available in the database, the required answer is attached to the query in the form of a voice clip; otherwise the query is forwarded by the KW to the relevant experts for answer. Once the query is answered by the expert, the LifeLines application alerts the KW. The KW then retrieves the answer from the expert and saves it as a voice clip in the FAQ database. This answer is then played back when the user calls the service for the answer to his query. The user can also retrieve the answer in text format from his/her village information centre. Furthermore, the system also allows the users to send photographs along with their queries for the experts' opinion. For instance, 'farmers can send pictures of their crops and cattle when they ask queries. For this a mobile with appropriate functionality would be needed' (LifeLines, 2010). In IRRAD, LifeLines was operationalized with the help of the mobile phones of village champions (VCs) and *kisan mitras* (KMs) or farmer's friends who are full-time staff of IRRAD stationed in intervention villages. Given that areas such as Mewat have poor penetration of landline phones, mobile phones are a more feasible medium of information exchange. The LifeLines service was in operation for about a year in 14 of IRRAD's intervention villages in Mewat in October 2009 (IDRC, 2009).

The evaluator of impacts

The author of this chapter was the independent evaluator assessing the use of LifeLines in the lives of users. The study was conducted to assess the feasibility of such an intervention for livelihood enhancement of the poorest in Mewat, in terms of who has access to it and how their livelihoods improved in relation to their socio-economic conditions.

Research questions addressed

This research addressed the question: 'whether, and under which conditions, improved access to information and knowledge facilitated by LifeLines

can enhance the individual and collective capabilities of the poor to better improve their livelihoods?' The roles of information and knowledge for the empowerment of marginalized groups have been analysed.

In attempting to answer the above, the study looked into the following questions:

- What are the constraints faced by farmers in accessing information?
- What are the specific end-user information requirements of farming communities, taking into account gender differences and social patterns?
- What are the key livelihood constraints in the research area?
- What are the direct impacts of LifeLines as a mobile-based information delivery mechanism vis-a-vis livelihood improvement with regard to social, human, financial, physical and natural capitals?
- How has LifeLines benefited the intervention community by building knowledge partnerships between the research and scientific community and the local community-based organizations and civil society groups?
- Is there a need for strategic refinement/improvement of the technology and process model to improve its efficacy and impact? If yes, what would be the broad contours of these refinements?
- Do LifeLines services have the potential to scale up?

Methodology

The study attempted to understand the influence of LifeLines by comparing intervention and control group experiences which were collected through sample surveys complemented by participatory rural appraisal (PRA) tools such as focus group discussions. These corresponded with local socio-cultural conditions of the region and people. Details of the different elements of the methodology follow.

Hypothesis

Refined access to information through LifeLines leads to livelihood enhancements of the poorest and marginalized in Mewat.

Research design

An *ex-post facto* research design has been used in the study to evaluate the impacts of LifeLines services in the lives of farmers. Besides studying the impacts on the beneficiaries of the LifeLines services, a control group with similar socio-economic conditions has also been studied in similar dimensions to delineate the actual impacts of LifeLines services.

Variables

The variables in the study were of three kinds. The independent variables consisted of village, family income, caste, gender, crop, vulnerabilities and information sector (e.g. agriculture, health, education, livelihoods), etc. The dependent variables included perceptions of LifeLines services, accessibility of information, constraints in accessing information, importance of information, use of information in livelihoods areas, etc. The extraneous variables were other ICT interventions in the area in general and livelihoods promotions in particular, government schemes/programmes, resources and inputs from other agencies – GO, NGO, civil society, the individual and family innovations and efforts.

Tool preparation and pilot testing

A questionnaire in the local language was developed to quantitatively capture the information against the objectives of the study. To supplement the quantitative data PRA techniques such as focus groups, diagramming exercises, matrixes and timelines were used. Quantitative and qualitative tools were piloted on the intervention respondents to understand applicability and relevance. Necessary amendments were made based on the pilot testing of the tools.

Sampling

The research has been conducted in 10 villages of three blocks inhabited by LifeLines beneficiaries. The sampling for the study was the total number of beneficiaries who used the LifeLines services. Hence 145 respondents formed the intervention group. To see the impacts of LifeLines, an equal number of respondents who did not use LifeLines in these 10 villages, were selected as a control group for the study. For analysis purposes, only 107 beneficiaries could be retained from the intervention group because of incomplete data.

Data collection and analyses

To capture the impacts of LifeLines, quantitative and qualitative data were collected. Quantitative data were analysed using statistical methods.

It was collected by organizing PRA exercises with the users of LifeLines services in the villages. The data generated through PRA exercises were analysed through content analysis in relations to the impact areas.

Findings

A total of 10 villages from three blocks were covered in the study having intervention and control group respondents. In the intervention group about 19% of respondents belonged to the below poverty line[2] category compared to 23% in the control group. The average family income in the intervention and

control groups were Rs 116,673 and Rs 85,007 (US$2,639 and US$1,923 per year approximately), respectively. The expenditures were mainly incurred in buying agriculture inputs and on social occasions that were followed by feasting in both the intervention and control groups. The findings of the study are discussed in the following sections.

The usage of LifeLines began with the realization of the importance of timely information for agriculture practices. Overall, there was an increase in the yearly income of the farmers after they received information through LifeLines services. The annual average income of users of LifeLines was about 37% more than the control group. For 67% of the intervention group there was an increase in savings and earnings because of increased productivity and disease control. Increase in produce was the most immediate and visible benefit to the farmers. This restored their confidence in agriculture as a livelihood by increasing their knowledge about new agricultural practices, technology, seed, fertilizers, etc. and had a positive impact on their health (73%). Almost all farmers in the intervention group used LifeLines services (97%). Some 93% were in favour of the continuation of LifeLines.

Awareness about IRRAD work

The KMs/VCs played major roles in spreading awareness of IRRAD's work. More than 98% of the beneficiaries were aware of IRRAD's work to provide information about seeds, toilets, soakpits, soil treatment, water conservation, running sewing centres, education, health centres, dam construction and making school boundaries, etc.

Interestingly, 82% respondents in the control villages were also aware of IRRAD and the LifeLines service.

Usage of LifeLines and the response time

Of the intervention group only 20% reported that they used the services once a week, 25% said that that they used it once a month, 16% used it once in 3 months, 7% used it only twice in a year. Four persons out of 107 respondents admitted that they never asked any questions whereas about 14% said that they used the services when needed.

The majority of the respondents (72%) said that it took 1 to 2 days to receive a response to queries; about 13% said that it took about a week and 11% even said that they did not get any response to their queries (Figure 4.2).

Impact on farmers' livelihoods

LifeLines services played important roles in the promotion of farmers' livelihoods. Farmers reported that information received through LifeLines services improved the soil quality. About 72% agreed that it led to increased productivity

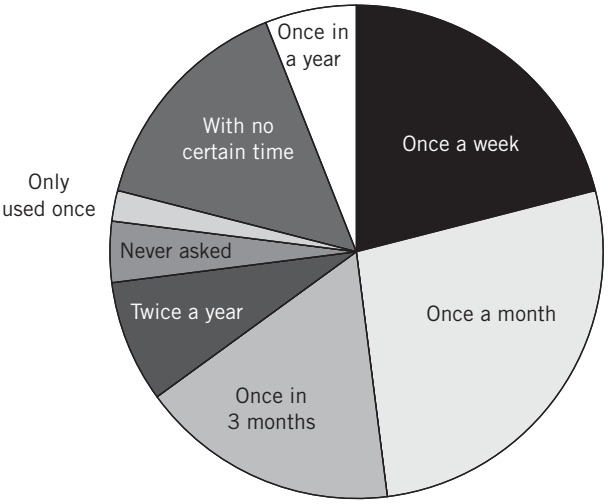

Figure 4.2 Usage of LifeLines

with an annual average increase of 2.86 quintal for the majority of the respondents in the intervention group. About 67% said that there was increase in savings and earnings because of increased productivity and disease control as a result of LifeLines services. A decrease in savings was reported by 24% of respondents in the control group. Loans were decreased by 31% of the intervention respondents. The control group, in contrast, reported little reduction (5%) in borrowing due to failed crops, decreased production, spending on social occasions, crop diseases, no work, increased expenses, etc.

Similar trends were found in the expenditure of farmers. In the intervention villages the inputs received as a result of LifeLines helped to decrease expenditure for 27% of respondents. It seems that the decrease in expenditure was enough to allow investment in physical assets such as houses, tractors, bore-wells, land, buffaloes, camels, etc.

Significantly, more respondents in the intervention group (73%) said that LifeLines positively impacted on health (only 15% in the control group reported improved health). The areas highlighted by the beneficiaries were: better nutrition (57%), increase in income (48%) and decreased visits to doctors for treatment of family members and livestock (45%), followed by increased work productivity and the ability to perform domestic chores (26%). These were not noticeable in the control group.

Bringing changes in education and skills

There was a positive change in education reported by 56% of the respondents in the intervention group but only 29% in the control group. The areas where changes were expressed by the intervention group were: increased knowledge

about new agricultural practices, technology, seed, fertilizers, etc., sending children to school, sending children to better schools and for higher studies/college. In skill enhancements LifeLines helped in learning a trade (40%) and diversified livelihoods (43%).

Building intra-village social relations and increasing inter village networking

LifeLines services played a prominent role in building social networking that resulted in increased mutual trust and support between fellow farmers and *kisan mitras*, collective participation in village economic and social activities and increased co-operation among fellow farmers. Inter-village networking such as with agriculturalists/farmers (46% of the intervention group and 8% of control group), was notably improved by LifeLines.

Queries for LifeLines services

The findings revealed that people in the intervention group asked questions using LifeLines services in varied areas such as on agricultural inputs in general (30%), prices, seeds, agricultural produce (43%), information about the seeds (60%), new agricultural technology (48%), crop and animal diseases and control (68%), marketing of agricultural produce (28%), etc. Only 8% of the control group sought such information (Figure 4.3).

Accessibility of information and their impacts

The respondents were found satisfied with LifeLines in terms of accessibility of services, its timeliness and the performances of service providers, etc. Some

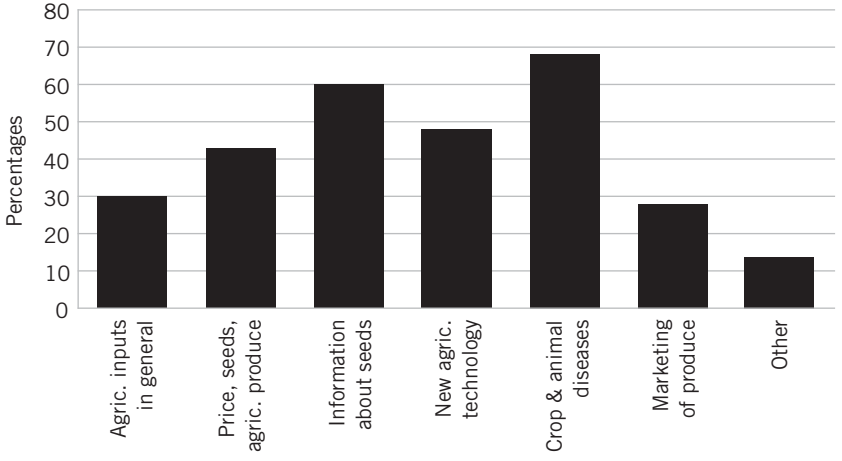

Figure 4.3 Nature of queries for LifeLines

86% of respondents agreed that the LifeLines services were easily available to them. Almost a similar number of people (83%) agreed that they were able to access the services when they were most needed. Farmers were not hesitant in asking questions from the KMs/VCs (75%) and were happy and satisfied with them (85%). Only 8% said that they were hesitant in asking questions.

Farmers' perceptions about LifeLines technology and its continuance

On the usefulness of LifeLines services, the results revealed that 15% of the beneficiaries said that it was very useful. A sizeable number (43%) said that it was useful, 30% said that it was somewhat useful and only 5% said that it was not at all useful (Figure 4.4).

When asked about continuity of the services 93% of respondents said that they were in favour of its continuance. In the qualitative exercises farmers said in unison, 'Earlier we used to practise agriculture with traditional methods but after LifeLines we came to know many new things and are hopeful towards agriculture'.

Improvements in LifeLines services – farmers' suggestions

The LifeLines users suggested ways to improve the existing technology as follows:

- The queries must be answered soon and in a proper manner – the time taken in responding to queries posed by farmers and getting useful and locally relevant information were lingering concerns of the farmers. These two things reflected again and again in various aspects on LifeLines, e.g. concerns, suggestions for improvements, etc.

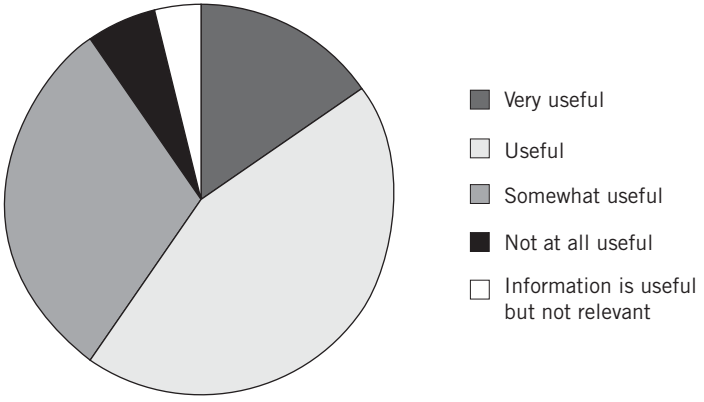

Figure 4.4 Usefulness of LifeLines

- LifeLines takes more than 24 hours to give a reply : getting a reply at the same time would be better.
- Receiving this information from a person who can inform every farmer door to door is preferable.
- The answers should be given on SMS through mobile phones so that it costs the farmers less.
- Good information should be given about seeds and fertilizers.
- The inputs on disease control, fertilizers and pesticides should take account of their local availability.

Use of LifeLines services by control group in future

The control group respondents admitted that they had problems with agriculture and livestock. About 88% of farmers in the control group wished to use services such as LifeLines to provide better information about agriculture and livestock rearing, crop disease treatment and animal diseases treatment (Table 4.1).

Conclusions

The findings suggest that the impact of LifeLines has been encouraging if seen in relation to the prevailing socio-economic conditions of the region. In the given time frame of one year, developing familiarity with LifeLines, its access and use can be regarded as the key to success. The technology was found very relevant in the given socio-economic conditions of the people and the region. The queries posed and inputs provided through LifeLines were diverse and covered aspects such as insect, pest and disease management, new varieties of crops, seeds and fertilizers, etc. It has supported the relevance and needs of such a technology/service in region. The discussion of impacts by the beneficiaries during the qualitative assessment of LifeLines has further confirmed the roles of ICT applications in agriculture.

LifeLines leading positive change

The intervention group has used the services (97%), in various degrees, offered through LifeLines and were willing to use it in future too, as 93% were in favour of the continuation of LifeLines. They reported significant positive changes in their lives because of LifeLines. The structural arrangement of getting the technology to the people has been found very satisfactory. The availability of KMs/VCs has been a big boost to people.

Roles of intermediary institution for adoption of new technology

IRRAD had a meaningful presence in Mewat and this facilitated the smooth introduction and use of LifeLines. But the administrative, logistic, financial

Table 4.1 The intervention and control groups – differences at a glance

Variable	*Intervention group*	*Control group*
1. Age		
Maximum	72	84
Minimum	15	19
Average	41	45
2. Sex		
Male	101 (94%)	136 (94%)
Female	06 (06%)	09 (06%)
3. Poverty status		
APL	87 (81%)	112 (77%)
BPL	14 (19%)	33 (23%)
4. Educational status		
Literate	81/107	73/145
Illiterate	26/107	72/145
5. Awareness about IRRAD work		
Yes	105/107	119/145
No	02/107	26/145
6. Average annual income		
Farmer	Rs 99,426	Rs 80,979
Family	Rs 116,673	Rs 85,007
7. Average annual expenditure		
Farmer		
Family	Rs 115,725	Rs 82,937
8. Awareness of similar services		
Yes	04/107	04/145
No	83/107	125/145
9. Use of similar services		
Yes	02/107	00/145
No	04/107	44/145
10. Agreement of respondents on the increase of agriculture produce in last one year	72%	11%
11. Increase in savings	67%	19%
12. Decrease in loan borrowing	29%	3.5%
13. Increase in earnings	67%	21%

and programmatic dependence on IRRAD might hamper the development of a business model for the sustainability of LifeLines.

The visible impacts

Almost three quarters (72%) of the users of LifeLines reported increase in their income because of the services they used. The increase in income was further supported by the fact that the control group was deprived of the services and 57% of these respondents said that there was a decrease in their earnings in the last year. The average annual incomes of the intervention (Rs 115,725/US$2,617) and control groups (Rs 85,007/US$1,923) differed significantly. The absence of a LifeLines kind of service was felt very severely by the control group as 88% expressed the wish to use them.

The positive impacts of LifeLines services in the intervention group on soil health (61%), savings (70%), increase in earnings (70%), decrease in loan borrowings (30%), decrease in expenditure (28%), etc. was expressed by respondents. In the control group, the results on these parameters were poor which helped to confirm the role of LifeLines to bring these changes in the lives of farmers. The impacts of the LifeLines services on education, skill enhancements and building intra-village social relations and increasing inter-village networking were also seen. The holistic approach taken by LifeLines appears to have benefited farmers in ways that go beyond their agricultural needs.

Access and usefulness of LifeLines

There were no issues with the accessibility of LifeLines services as 83% got the services with ease when they needed it. The beneficiaries were found satisfied with the roles of KM/VCs (85%) and became comfortable in asking questions without any hesitation (75%). The perceptions of beneficiaries on the usefulness of LifeLines services were not the same across the board. The majority (95%) felt the service was useful, in varied degrees. Closer analysis gives rise to the need to further strengthen the reach, accessibility, capacity building of KMs/VCs, delivery of services, quality and usefulness of responses/inputs, etc. The response time for the queries might have been amongst the possible reasons for less frequent use of LifeLines. Ideally there could have been more reliance on LifeLines because most of the respondents in both groups were neither aware nor using other similar services.

Gaps between queries posed and responses made

The suggestions made for the improvement of LifeLines services by the users clearly indicate the limitations in the existing services. The time taken in responding to the queries was too long. In most cases the responses to the queries took more than 24 hours. There were occasions, e.g. diseases in the

plants, when the farmers need solutions to rectify the problems immediately or in a desired time frame otherwise the crops might go to waste. The farmers suggested a 24-hour response time.

The other major concern expressed by the farmers was the 'externalities' of the inputs made. It was revealed that sometimes the medicines and pesticides suggested for controlling the diseases were not available in local markets. The language and experience of the local intermediaries, i.e. the KMs/VCs were not always the same as the experts. Unaware of local context, the experts sometimes made suggestions that were not found to be applicable in local conditions.

Interestingly, the users of LifeLines elsewhere, in particular in the Bundelkhand region of India, spoke very highly about the LifeLines services and the areas highlighted here were not found as concerns for them. This suggests the importance of context and knowledge of the local area. Alternatively it may be because of the chance factors that the queries posed by Bundelkhand farmers were answered in the frequently asked questions (FAQs) whereas the queries posed by IRRAD farmers were not available in the FAQs.

Impact on rural livelihoods

One thing which very clearly emerged from the study was that use of technology increased the realization of its importance. Farmers received the services with enthusiasm and found them relevant. They reported an annual average increase of 2.86 quintals in produce and it helped in restoration of their confidence in agriculture as a profession. The farmers were motivated to cultivate and sell cash crops especially vegetables as the inputs received through LifeLines helped them in growing vegetables and earning more than previously. The increase in produce helped them to increase both earnings and savings. They were in a better position to buy machinery for agriculture, create some assets, and there was a substantial decrease in borrowing.

Evidences for ICTRL research

The LifeLines project in Mewat has shown that ICT interventions with poor and marginalized farmers can have positive effects on livelihoods if due care of their needs and contexts are taken into account. The findings of the research might lead to academic, research and practitioner communities building on these.

Overcoming structural, cultural and institutional barriers for equal access of ICTs to rural communities

IRRAD has developed a good structural arrangement in the intervention area by deploying human resources at the grassroots. The model applied for LifeLines interventions facilitated equal access to technology for community members

and farmers because the holders of the technology were locally recruited and trained youths acting as KMs/VCs (farmers' friend). So, anybody having any query could very easily register their queries.

Enhancing local capacities and knowledge networks

Prior to the advent of LifeLines, the farmers were using their own traditional knowledge in agriculture. At the most they used to go to the fertilizer and pesticide shops to ask about new fertilizers or pesticides to use on their farm. With LifeLines, farmers were exposed to external knowledge centres and resources to ask questions about their problems and to learn about new innovative practices happening elsewhere.

Sustainability of the LifeLines services

Although the farmers reported that the technology was helping them and as a result they were willing to pay the cost of running the service, it was more of an informal commitment of the farmers. The challenge was to work out a business model that would sustain LifeLines in the long run.

Recommendations

Speeding the information flow

One of the main general benefits of ICTs' application is to speed the flow of information. So, attention needs to be given to improve response times. LifeLines service users were not satisfied with the 'time taken in responding to the queries'. There were other ICT projects in India and elsewhere which have taken care of these problems by identifying and introducing strategic new roles in the process (Dearden and Rizvi, 2009).

Designing information services as per the community needs

The findings of the study supported the importance of customized knowledge to the beneficiaries. Having a database of the possible queries from an area was, generally, not serving the purpose. The value of information to a person or community depends on its optimum utilization and translating that into action. To make ICT interventions effective efforts should be made to make information available in time and appropriate to the intended beneficiaries. The systems should have a data on the context, e.g. the land plot details, the agro-climatic facts, history of crop practices and diseases and availability of inputs in local markets, etc., so that customized information could be provided as per the needs of the people in time. The role of timely and customized knowledge in agriculture cannot be compromized because information not coming in time is equal to 'no information'.

Bridging the communication gap

To share information via ICTs, communications between many stakeholders and actors needs to be completed. The stakeholders and actors have different backgrounds, training and experience: there are bound to be communication gaps. Information received from a particular source might not be understood in its wider context. The current study very forcefully highlighted the communication gap between farmers/KMs/VCs and experts. The need for mitigation between farmers and experts might be met by having a person available locally to bridge that gap. It would be a good idea to locally appoint an agriculture graduate/postgraduate as the advisor with basic training in ICTs. It would help not only in the availability of timely inputs but also in bridging the gap between the farmers and external experts to bring new knowledge.

Enriching technical features in LifeLines

The technologies developed and procured to enhance information should have the flexibility to accommodate the latest technological advancements. Given the advancements in areas of ICTs, the existing features related to telephonic advisory services in LifeLines seem to be limited. LifeLines should enhance its applications by adding multi-media features and introducing 3G applications to further increase the ease of use of the technology.

Management of technology and knowledge

In current practice there is heavy emphasis on the flow of information from the top, and in the process the knowledge available locally is not accommodated and disseminated for wider use. For example in LifeLines services the server is located in Mumbai without much access to local stakeholders. The project should think of having a local server to develop and manage the knowledge in the process. Currently, there is no scope for sharing the knowledge generated locally. There is a need to encourage two-way communications, thereby fostering greater ownership of the systems.

Building of capacities and scaling-up of LifeLines to non-IRRAD beneficiaries

ICTs should not be used in isolation. In the rural areas, ICT gadgets are treated as 'not to touch' objects and there are designated people to operate them. In LifeLines, deployment of KMs/VCs is working well to facilitate the farmers but there is a need to capacitate the KMs/VCs on ICT-related aspects as well. LifeLines had impacts on the non-users too. The respondents from the control group had shown a lot of interest in LifeLines services. In future scaling-up they could be considered as the beneficiaries.

Notes

1. UN Secretary-General's remarks in press briefing at FAO meeting, (2008) [online] http://www.reliefweb.int/rw/rwb.nsf/db900sid/EGUA-7FASWG
2. Below poverty line (BPL) is defined in terms of the calorie intake of people. As per the Government of India (GOI) parameters, poverty line for the urban areas is Rs 296 per month and for rural areas Rs 276 per month, i.e. people in India who earn less than Rs 10 per day. As per GOI, this amount will buy food equivalent to 2,200 calories per day, medically enough to prevent death.

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About the author

Dr S. M. Haider Rizvi is currently working with the Government of Madhya Pradesh's School of Good Governance and Policy Analysis, Bhopal as Director (Policy Analysis) in India. He has a doctorate in psychology and is a trained Participatory Development Action Researcher with 12 years of work experience with national and international organizations. He has worked extensively in the areas of participatory designing, HCI and ICTD.

CHAPTER 5

Connecting to work: non-agricultural livelihood opportunities for rural wage labour in Sri Lanka

Amila Balasuriya and Nilakshi de Silva

This chapter sets out an evaluation methodology to understand and assess the impact of ICT on rural livelihoods – specifically of wage workers. In Sri Lanka, poverty is associated with reliance on wage work with studies showing that households are more likely to be poor when household members are engaged in casual employment, in elementary occupations, often in the informal sector. These livelihood activities are characterized by underemployment rather than outright unemployment, and lack of information about work opportunities is thought to be contributing to this phenomenon. A group often neglected in policy circles, interventions targeting wage workers usually take the form of support for entrepreneurial activities, with limited impacts.

The chapter focuses on action research piloting a communication model – a job agency for wage work in rural areas, which matches demand and supply for agricultural as well as non-agricultural work, and describes the research methodology adopted to monitor impacts. The research approach was designed with both learning and proving objectives and has generated interesting results. While the project is still on-going, early results have implications for designing and implementing ICT projects targeting the rural poor, as well as structuring research to monitor and evaluate the impact of ICT projects on rural livelihoods. Findings are reported in terms of impacts on the community and also in terms of the wider applicability of the methodology of impact assessment using a control group.

Introduction

This chapter sets out an evaluation methodology to understand and assess the impact of ICT on rural livelihoods – specifically of wage workers. It is based on action research which is being implemented in Yatiyanthota, Sri Lanka, testing an ICT-based communication model to match demand and supply for wage labour. Wage workers are often the largest group among the productive poor in rural areas but policymakers often find it difficult to design suitable interventions to address their specific needs. The chapter aims to highlight the learning from implementing an ICT-based livelihood intervention for wage workers as well as the learning from testing a research methodology which combines

both learning and exploratory objectives with proving and impact assessment objectives, to generate systematic, useful and rigorous data.

Background

The research problem

In Sri Lanka, poverty is mainly a rural phenomenon. Data on consumption poverty in Sri Lanka shows that rural areas account for 82% of the poor in the country and the decline in rural poverty is slower than that seen in the urban sector. There is also a link between agricultural livelihoods and poverty as spatial analysis of poverty shows that the areas with the highest concentration of poor are also areas with a high proportion of the population engaged in agriculture. In terms of employment categories, close to 50% of employment is provided by wage work in the informal sector, which is associated with insecurity and low returns (Department of Census and Statistics, 2008). Not surprisingly, the rural poor are more dependent on casual wage work, be it agricultural or non-agricultural. Among agricultural households, almost 40% of the household income of the poorest group comes from casual wage labour. Of this an estimated 24% comes from agricultural wage work, and 15% comes from non-agricultural wage work (World Bank, 2003). Poverty among casual employees is higher than all other categories of employment, and is estimated to be about 24%, compared to 14% among self employed persons (Gunawardena, 2004).

Poverty in Sri Lanka is also associated with under-, rather than unemployment. The Department of Census and Statistics estimates that for every 100 unemployed adults in the country, there are 135 working adults who are under-employed (Ministry of Labour Relations and Manpower et al., 2009). Among household heads in Sri Lanka, under-employment, or working for fewer days per week than one would like to or working below one's skills/qualifications,[1] is more common than outright unemployment.[2] This phenomenon is more prevalent among less-educated workers engaged in the informal sector in occupations related to, for example, agriculture and fisheries (World Bank, 2007: 23). These activities are also highly seasonal, which also aggravate the problem of under-employment.

The action research, which is the focus of this chapter, is based on the hypothesis that some aspects of rural under-employment are due to lack of information, rather than lack of demand for labour. While formal sector employment opportunities are advertised and promoted through employment bureaus, there are no such channels in existence for casual wage work which is mainly found through informal networks. Accordingly, the intervention group for the research are poor and vulnerable households among the rural population who are reliant on wage employment, and whose incomes are constrained by under-employment. Because they are working mainly in daily employment, they have no security of employment and compared to formal and salaried employment, have very low returns on their effort. These households are also

poor in terms of human capital as they are usually less educated and have few marketable skills, which further increase their vulnerability and limit their livelihood opportunities. Employment is currently found through informal networks and migration to urban centres, or seasonal migration by agricultural labour. But because they are not connected, both physically and in terms of information with potential employers, they are forced to look for employment within a limited space, with correspondingly limited success.

Because the project is based on the hypothesis of an information and communication bottleneck, the ICT intervention involved using (mobile) telephony services to obtain information about available labour as well as available demand. Sri Lanka has very good telecom penetration rates; the country's population of under 20 million have more than 3 million fixed line telephones and close to 14 million mobile phone subscribers. The estimated mobile penetration is 68.21% of the population (Central Bank of Sri Lanka, 2009). However, specialists in the field feel[3] that there is substantial under utilization of the facilities for household livelihood activities.

The ICT intervention

The action research tested a communication model – specifically a job bank for casual wage work in rural areas – focusing on matching demand and supply for agricultural as well as non-agricultural wage work. The project sought to increase the quality (i.e., the nature of the work) as well as quantity (i.e., days employed) of households reliant on wage labour. The use of ICT was expected to help reduce the costs of accessing the service, both in terms of time and money, for the users as well as impact on the effectiveness of the intervention. The project involves setting up a database and related communication system to match the supply of rural labour with demand. The relevant worker and potential employer were connected through their (mobile) telephones. The employment found was mainly short term, ranging for example from half a day to weed a home garden to 15 days for road construction work. Because penetration of telephony services is quite high in Sri Lanka, the initiative did not include providing mobile phones to the poor. Available data suggests that most poor households have access to a mobile, wireless or fixed line telephone either within their household, or within their immediate neighbourhood which can be used as the primary contact method.

The project is being implemented by Berendina Development Services (BDS), which has more than 15 years of presence in the intervention area and is a trusted source of information in the communities. The intervention group was informed of the initiative through several methods: BDS conducted household visits and village level meetings to provide information about the new initiative and how to access the service provided. These activities were supported by a localized advertising campaign, using posters and handbills, which were displayed at natural points of congregation and information exchange

in the village, such as popular tea shops, bus stands, government administration offices, community centres and religious places. Interested persons were requested to register with the BDS by providing basic information such as their skills, work preferences and how they would like to be contacted, based on a format developed for this purpose. At the same time, BDS also solicited potential employers in the area, including firms and households, who may be requiring skilled, semiskilled and unskilled labour for daily paid and other short-term work. Using a computerized database of potential employees, BDS then started to carry out the necessary matching to inform suitable workers of work availability as and when they arose. IT expertise was used to develop a web-based database which is easy to use and capable of efficiently processing the information and matching prospective employer needs with the available rural labour. The project staff also follows up with the employers and employees after the work has been completed, to obtain feedback for M&E and project improvement purposes.

Research methodology

The specific objective of the action research therefore was to test the applicability of an ICT intervention to increase the livelihood options available to rural poor households. The key research questions were: (i) is information a bottleneck for improving livelihood among rural labour? and (ii) what is the impact of the proposed ICT intervention in improving the livelihood outcomes among the rural poor?

The research framework was designed to enable both 'learning' and 'proving' objectives. The learning objective is expected to be achieved through the use of qualitative data collection, which includes open-ended, exploratory questions in all the data collection tools (household surveys, key person interview scripts and case studies). In addition, these questions are expected to increase the internal validity of the data collection tool as well as the accuracy of the quantitative data collected.

The proving objective was aimed to be achieved through the sample selection (generalizablity) and the construction of the counterfactual (attribution). Data was collected from a stratified random sample of 60 households which are representative of the intervention population – workers in the Yatiyanthota DS division who feel that they are under-employed and who would like more and better work opportunities. The sample was drawn from all the people who register for the programme (that is people who self-identify that they are under-employed) and includes those who were matched with potential employees during the intervention and those who were not successfully matched. Sample stratification levels include age, gender, location and skill levels. A rolling baseline was used to counter the slow project start up with 50% of the sample workers interviewed in December 2009 and the remaining 50% interviewed in March 2010.

Because establishing the counterfactual – that is, the likely situation in the absence of the intervention – is key to understanding impact, several counterfactual scenarios were tracked. These try to understand the likely situation of the intervention households in the absence of the intervention. The first method compares the household situation before the intervention and after as follows:

$$\text{Gross effect} = \left(\frac{\sum_{i=1}^{n} (X_{i_{t+1}} - X_{i_t})}{n} \right),$$

where X_i is the individual/household,
t is the information at the baseline and
$t+1$ is the information at 8 months later.

This quantitative analysis was supported by qualitative discussions held with households regarding what activities they would have engaged in if they had not accepted work opportunities provided by the intervention.

However, because this data could be biased due to a number of unknowns (such as the general development of the area, etc), these two methods of constructing the counterfactual may not be fully reliable or accurate. To provide more credible and rigorous impact data, a control group of 60 households was also identified in the neighbouring Bulathkohupitiya DS division, to understand the project counterfactual and isolate project impact as follows:
where

$$\text{Net effect} = \left(\frac{\sum_{i=1}^{n} (X_{i_{t+1}} - X_{i_t})}{n} \right) - \left(\frac{\sum_{i=1}^{n} (Y_{i_{t+1}} - Y_{i_t})}{n} \right),$$

X_i is the individual/household in the intervention group
Y_i is the individual/household in the control group
t is the information at the baseline
$t+1$ is the information at 8 months later.

A different area in Yatiyanthota itself was initially selected as the control group, where the intervention was not going to be implemented but early indications that it would be difficult to prevent contamination of the control group led to the decision to select the control from the neighbouring DS division. In Bulathkohupitiya, data was also collected from a stratified random sample of households who were selected in the same manner as the sample drawn from the intervention location.

The variables on which data was collected followed the sustainable livelihoods framework (SLF) on which the research framework is based. The impacts of the intervention are being tracked via changes to the four capitals of financial, human, social and physical.[4] The variables tracked relate to financial

capital such as changes in wages, income and income sources and stability of income sources, savings and debt; human capital such as changes in skills, experience and training; social capital such as changes in networks, especially vertical networks, relationships with previous networks, especially those affected by changes caused via project intervention; and physical capital such as changes in livelihood assets, household assets and housing conditions. Both quantitative and qualitative data were collected (Table 5.1).

Table 5.1 Profile data for intervention and control groups

Characteristic	*Intervention (%)*	*Control (%)*
	Gender	
Male	98	98
Female	2	2
	Age group	
<40 years	52	42
40–60 years	41	53
>60 years	7	4
Don't know	0	2
	Primary occupation	
Wage labour	35	62
Agricultural wage labour	2	13
Masonry	35	18
Carpentry	13	7
Self-employment	6	0
Other	6	0
Unemployed	4	0
	Education level	
Never been to school	0	4
Primary (1–5 years) only	19	35
Secondary (6–10 years) only	54	38
Up to O/L	22	22
O/L or higher	6	2
	$n = 55$	$n = 56$

Source: CEPA Baseline Survey, 2010

This chapter discusses the findings of implementing the intervention for a period of 10 months in the Yatiyanthota DS Division, Kegalle District. The project got off to a slow start, and registration of 250 employees (50% of the overall target) was reached in February 2010, well into the fifth month of implementation. The reasons for the slow start are symptomatic of the constraints poor people face when using ICT to move out of poverty. Because both the project staff, and the intervention group, was not very familiar with the manner in which the ICT tools such as the computerized database were to be used in this project, these were often treated with mistrust. Initially, the project staff found it easier to make job matches manually and the database was more of a constraint than a help. There were also difficulties in finding and retaining staff with computer skills to carry out the database operations. The reason why people mistrust ICT however is due largely to the unreliability of ICT infrastructure in the Yatiyanthota area, coupled with its extreme weather conditions. Electricity supply is erratic and frequent power outages undermined the integrity of the database on multiple occasions before a separate generator and UPS was purchased. Before such remedial measures were taken, the project staff were confounded when job requests came while the database computer was down, which contributed to their preference for manual matching. The database was also affected by virus attacks due to unsecure sharing of USB drives among the project staff. Because of insufficient IT expertise locally in Yatiyanthota, in most of these situations the IT consultant in Colombo had to provide support to restore the database operations.

As a result of these constraints and delays, baseline data was collected in two rounds as employees were being registered. Approximately 8 months after the first tranche of baseline data was collected, evaluation data was collected from the same tranche of the intervention and control groups, which comprise 50% of the sample. Evaluation data was collected from this smaller sample because the project is still ongoing, and has not been implemented long enough to show substantial impacts. Accordingly, the results discussed below are indicative of likely impacts, rather than conclusive. Data analysis was done via mixed methods, and due to the size of the sample, statistical analysis was restricted to descriptive statistics.

Research results and findings

By 30 August 2010, 536 employees had registered with the job matching service. The profile of the intervention group shows that those who register for the project are mainly males (96%), in the age group between 20 and 40 years (52%), and mainly those with less than 10 years of education (59%). These characteristics are in line with available literature and statistics about those who are under-employed (see Ministry of Labour Relations and Manpower et al., 2009), and also confirm that the project is reaching the intended intervention group. Registered workers are mainly engaged in wage work (including in the

agricultural sector) which is the primary occupation of 44% of the employees registered for the project. Other occupations include masonry (30%), carpentry (15%) and self-employment (4%), which indicates that under-employment is prevalent even among skilled workers. Only 4% of the registered employees are unemployed.

Information as a bottleneck for improving livelihoods

One of the main hypothesis of the action research is that lack of information about potential work opportunities is preventing casual wage workers from working more days per month or working in better paying jobs that match their skills. The research findings suggest that the previously limited sources and modes of obtaining information which were available to the intervention population have widened over the project period.

For example, at baseline most employees relied on a single source of information to find work. The most commonly used source of information was networks of friends and family, followed by persons working in the same livelihood and those in the same livelihood but with higher status, including the employer. Some also go to places where work is available. The project attempted to directly widen vertical links – that is, with potential employers, and also indirectly widen horizontal links – that is, with more persons engaged in similar livelihoods. Employees were linked with potential employers and encouraged to contact each other directly on future work opportunities. The evaluation found that just over half of the intervention group had been linked with potential employers on at least one occasion through the project, which appears to have had some results; at baseline, just 18% of the intervention group said they obtain information about work opportunities through vertical networks, compared to 50% just 8 months later. Among the control group, there is a less widespread increase, going from 16% at baseline to 25% 8 months later.

The importance of the telephone, as a mode of obtaining work-related information has also increased. Access to own phones (either mobile or at home) among the intervention group is on the rise, and has increased from 82% to over 90% during the past 8 months. At the baseline, less than 60% of the intervention group stated that they use the telephone to find work, and messages brought in person was the most frequent mode in which information was obtained regarding work opportunities. Those who were already using the telephone to find work tend to be younger, and more educated. Eight months later, 77% said that they get work-related information over the telephone compared to 33% among the control group.

While there is increased familiarity and recognition of the convenience of using the telephone, the intervention population was initially unconvinced by the centrality of the telephone for the success of the project. During project implementation, a substantial number of registered workers could not be contacted when suitable job opportunities arose because the contact numbers they

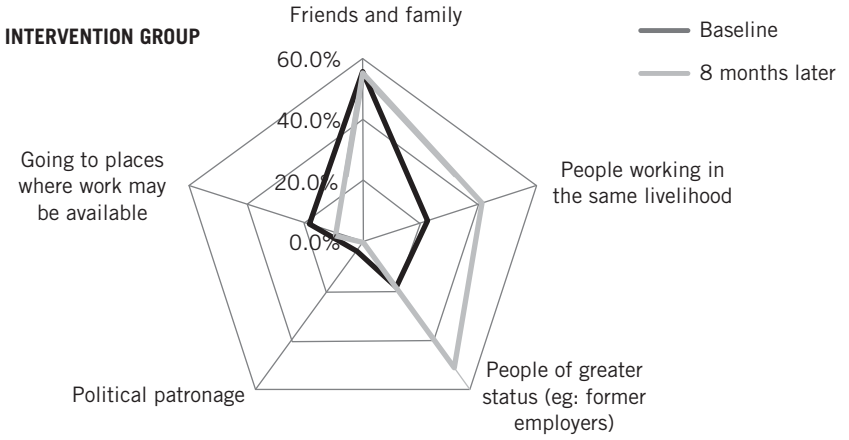

Figure 5.1 (a) Sources of information about work opportunities. Intervention group

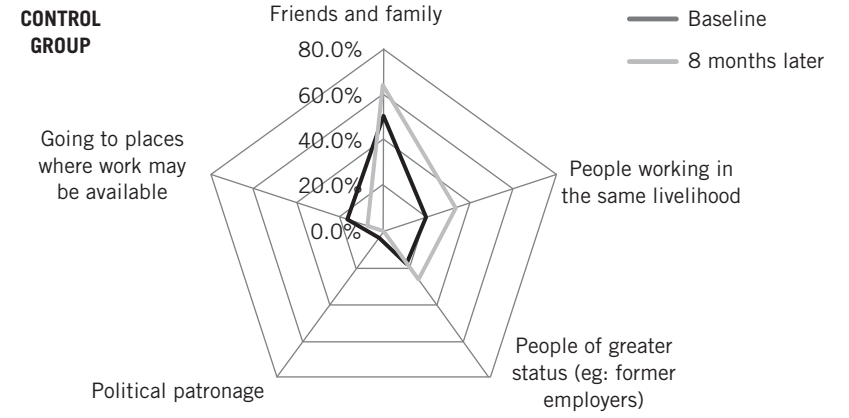

Figure 5.1 (b) Sources of information about work opportunities. Control group

had provided at registration – just a few months before – were no longer functioning. Close to 30% of the population said that they had changed their phone number during the past 6–8 months, with sharing of phones and numbers among family members, particularly those living away, being a common occurrence. The availability of cheap SIM cards due to fierce competition among the mobile service providers has led to people holding multiple SIMs, or progressing through several SIMs over a short period of time, which makes it harder to contact them via the telephone. Many of these people value the phone mainly for keeping in touch with family and friends who are informed of changes in their contact details. They also value the calling out function rather than being contacted themselves, and are yet to feel the need for and value of having a regular and reliable contact number for livelihood related purposes.

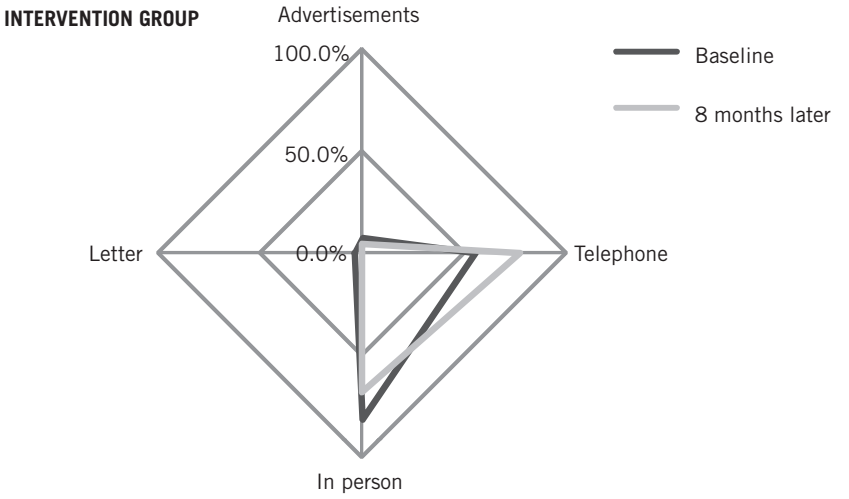

Figure 5.2 (a) Modes through which information is obtained

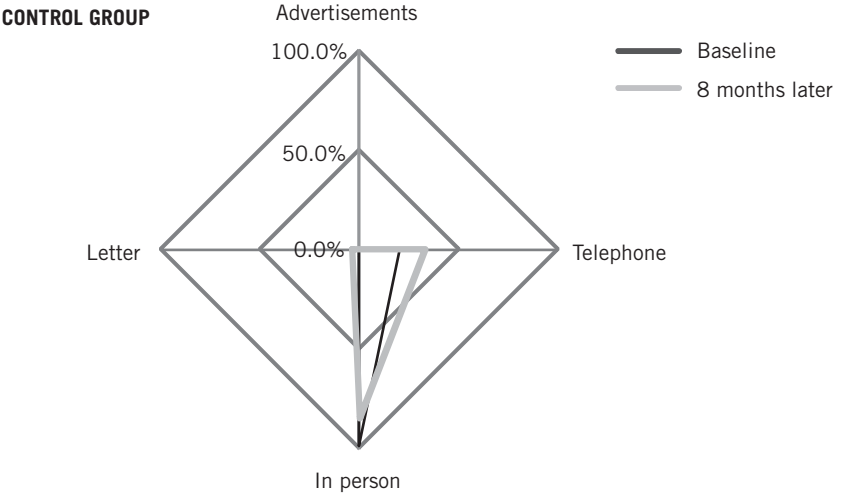

Figure 5.2 (b) Modes through which information is obtained

The apparent reluctance to use the phone to make business calls is also reflected in the number of workers who registered for the phone-based job matching, but then turned up at the project office looking for work. As one worker explained, it was easy to walk to the office – a matter of a mere 2 kms, especially when there was no credit on his phone. While he is directly constrained by the lack of funds in his prepaid phone, this reluctance is also due to perceptions of high costs of calling out. Most workers are either unaware or

uncertain about how much a call will cost them, which all contribute to this apparent preference to incur time and effort costs out of proportion to the cost of a phone call among the poor households. Overall, the obvious benefits of using the phone to obtain livelihood-related information has to be weighed against cost and trust issues relating to sharing the contact details with a wide and unknown group of potential employers.

The nature of the work carried out by wage workers also precludes their access to a telephone during the day time, when they are engaged in work. For example, tree cutters or toddy tappers often leave the phone in a safe place when they are engaged in work. Many occupations, such as carpentry, are accompanied by the use of loud machinery, and the ringing of a phone often goes ignored. Also many parts of Yatiyanthota are covered by one mobile operator or another, while there are still a few pockets where there is no mobile phone coverage at all. In addition, due to low prevalence of phones with local language fonts among the intervention population, some workers do not realize that they have had a missed call, or do not realize the call is from the job agency, and all except a small few actually call back to inquire the reason for the call. Also, due to low usage of local language phones, SMS functions are very rarely used among the intervention population.

Lack of information, however, may not be the only constraint to more work among wage employees. Among the intervention group, while 54% have been provided information about job opportunities on at least one occasion by the job bank, only 5% have actually worked on jobs found through the job bank. This suggests that there are other reasons, not only lack of information, for their under-employment. These include planning problems, such as insufficient notice (as most employers want workers either right away or within a day or two) and already having work when the message is received, as well as issues of distance, pay and work conditions, which do not match the workers' preferences.

The main threat to a successful intervention appears to come from the inability of ICT tools to overcome the issue of trust, which is critical in the informal sector. Because of the uncertainty associated with informal work, and wage work in particular, households prefer to obtain information about work opportunities through trusted sources. While the employers may receive information regarding work and employers through the telephone, most feel that this link is not adequate to make a decision about whether to take on the work because the trust element – that exists when they get information through friends, known persons, etc – is not present in this mode of information. One worker noted that 'a phone is important as it can be used in emergencies. With regard to work, new work cannot be discussed on the phone, you can only fix a time to meet to discuss. The payments, etc. can never be discussed on the phone. A phone can be used only once you get to know the person'. They would prefer to meet the employer and/or visit the place where the work will be carried out before making a decision. Over the project period, however,

some changes in attitudes were seen, with more openness to act on information received over the phone from a previously unknown source.

Likely impacts

By 30 August 2010, the project had received 145 requests for workers. Out of these, employers and employees were able to reach an agreement on pay and other conditions, and work was actually carried out in 121 cases. As the project implementation progresses, the number of successful matches also increases exponentially.

Given the relatively small number of workers who report having actually worked on jobs found through the project, the likelihood of seeing significant direct benefits in the intervention group – at this early stage of the project, is low. However, despite limited evidence of direct benefits, the research finds that there are positive changes in the intervention group compared to their situation at baseline, as well as compared to the control group. These changes suggest that the project may be having a positive impact through indirect means, such as by enlarging networks of potential employers and helping to familiarize workers with the use of the telephone to obtain work-related information.

For example, in relation to *financial capital*, there is an increase in the amount of pay received by wage workers, compared to that received one year ago. Nominal wages have increased over the year by about 6.38%. In the context of 5% year on year inflation to August 2010 however the real increase is about 1.2%. Among workers too, this increase is attributed to wages adjusting to the increasing cost of living, rather than an increasing recognition of the value of labour. However, if that were the case a similar increase should be seen among the control group but no such increase can be seen. In fact wages have decreased by 10.14% and the real decrease is even larger, at 12.84%. These developments suggest that in the intervention area, daily wages have increased which cannot be attributable to area or country-wide inflation.

The increase in wages is further accompanied by an increase in the *amount of work available*. Twelve months ago, the average number of hours worked per week ranged from 25 to 48 hours. This has increased to between 25 and 56 hours. While this difference is not statistically significant, qualitative data suggests that among workers there is a general perception of increased availability of work. Also, there is an increased tendency among the intervention group to take up permanent work, usually by travelling outside Yatiyanthota, or travel outside Yatiyanthota for wage work, which is not seen among the control group.

There is very little change in relation to *access to credit and savings* among the intervention group, but where there has been a substantial increase in pay, the excess amounts have been used to purchase household items, such as televisions, crockery, clocks, etc. While there is little new investment in livelihood assets such as tools, there is some tendency to acquire new telecommunications

tools, particularly among those who frequently or for prolonged periods travel outside their area for work, and need to stay in touch with their families. This also reflects on the ever increasing availability of cheap phones in Sri Lanka.

As noted, *social networks* with people who can provide employment opportunities is also showing an increase. Both vertical and horizontal links have increased with about 50% noting that their vertical networks have increased over time. The use of the phone has contributed to such increases in social networks, as people are now able to maintain a larger network than before. Among certain types of skilled workers, such as skilled carpenters and masons, there is an increased tendency to explicitly rely on telephone-based contacts to generate work opportunities.

This reflects a natural change, as more people realize the efficiency gains from using the phone to physically travelling to places, in relation to their work. While some increase in capital, particularly financial, physical and social, can be seen among the intervention group in comparison to before, as well as the control group, the attribution to the project is not definitive. However, as noted above, lack of direct attribution may be misleading. The awareness of the project concept alone can have a capacity-building effect, as more and more people become open to the idea of using the phone to find work. For example, qualitative data suggests that there is greater willingness to share contact details with an increasing network of social contacts. Almost 100% said they know when there has been a missed call, but only a few had programmed the BDS number into their phones, the majority having to refer to notebooks and other sources to identify the telephone number. One respondent noted that 'messages about work are increasingly coming via the phone. Compared to before, foremen (*baas*) call through the phone to inform about work and work opportunities'.

Among women, however, the project has had little impact. At the mid-term review of the project, only 2% of registered workers were found to be women, and increased efforts have since been made to obtain greater female participation. Women appear to be more reluctant to share contact details with unknown persons or people outside of their family and friend networks, whereas men are better placed to benefit from such interventions. Among unmarried women in particular, there is a general aversion to sharing contact details with unrelated males (including the project staff). The type of work women wage workers are seeking is also different to men; many are more interested in work that is very close to their homes so that they can balance their household responsibilities with their livelihood activities. These women find work such as rubber tapping through existing local networks and are unlikely to be benefited by the project. Compared to men, many of the women who register are low skilled and are mainly looking for domestic work in higher income households. These results are in line with experiences in other countries where gender imbalances are often seen in ICT interventions (Hafkin and Huyer, 2002). The project needs to adapt to these social contexts if it is to have an impact on under employment among female wage workers.

Conclusions and future research directions

The action research was implemented for a relatively short period of time but has generated substantial learning. There are two main areas of learning; first in relation to the impact of the specific intervention reported on; and second in terms of the methodology. Using a control group and an intervention group has shown how impact assessment evidence can be collected in a systematic manner. This approach has wide applicability.

Improving possibilities to connect, ICTs help expand social networks

For example, the profile of the workers who have requested to be registered for this service indicates that under employment is prevalent among wage workers. Work is mainly found through informal means, with almost no reliance on newspaper advertisements or formal vacancy announcements. As a result they are reliant on their limited networks of family, friends and former employers to generate information about work opportunities. The project aims to familiarize workers with using ICT to access and maintain a larger network of information sources on livelihood opportunities. To this end, it has matched about 54% of the population at least once with a potential employer, and encourages both employers and employees to contact each other directly in future. The process of using the telephone to inform about work, contacting previously unknown potential employers over the phone, etc., appears to have helped workers to become used to the idea of finding work using the telephone. Among the intervention group, both vertical and horizontal networks have increased by a much larger margin than seen in the control group. The use of the phone has contributed to such increases in social networks, as people are now able to maintain a larger network than before. Among certain types of skilled workers, such as skilled carpenters and masons, there is an increased tendency to explicitly rely on telephone-based contacts to generate work opportunities.

Better access to employment information positively affects livelihoods of the poor

Through such indirect means, the project appears to be having a positive impact on livelihoods, though longer implementation would be required to confirm the magnitude of such impacts. Among the intervention group, there is an increase in the amount of pay, which is not seen among the control group. A similar significant change in the hours worked cannot be observed, however, which suggests that the workers may be using their access to more information about work opportunities to improve the quality rather than the quantity of work they do. Project implementation over a longer period and further rounds of data collection are needed however to validate the causal linkages between the project activities and changes in the five capitals of the intervention population.

Policies suited for the poor are needed for them to effectively use ICT tools

The project has also provided substantial learning about adapting ICT interventions to suit the needs of the rural poor. For example, the research highlighted several constraints to workers using ICT such as lack of awareness about using simple phone functions (such as SMS) and inability to always carry the phone with them due to the nature of their work and so on. In addition there are other constraints such as inadequate infrastructure, particularly telephone coverage and regular supply of electricity, all of which are linked to their poverty characteristics, as the poor are likely to live in more remote areas, have less education and work outdoors under difficult work conditions. The constraints and the manner in which the project overcame these challenges have important implications in shaping ICT policy for rural development. For example, policies focused on internet, rather than phone-based ICT interventions, are likely to be largely out of reach for this intervention group; several ICT interventions are in place to provide increasing amounts of information via more and more sophisticated means to the poor, when groups such as wage workers, are constrained due to lack of awareness from using the basic functions of a simple phone.

People's experiences with ICT tools is helping to evolve their use as a source of information

The most critical constraint derives from the inability of ICT tools to overcome the trust element as households who rely on informal work are wary of work opportunities which do not come to them via a trusted source. While this is likely to remain an issue, the project is showing that attitudes are changing; while workers remain reluctant to come to an agreement to work over the phone, they are showing an increasing openness to act on information received over the phone, by making arrangements to visit the work place and discuss terms in a face-to-face meeting. As one worker noted:

> 'One of the most important things relating to the decision to work at some place is who I work for and the place *(wedapole thathwaya)*. There are some people I can't get along with. If I am asked to work in a new place, I don't go there to work in the morning; I go during the day and check it out. Then if it is ok only I go to work'.

The use of mixed methods is particularly relevant in studying the links between ICTs and livelihoods

Many of the constraints to using ICT and potential causal linkages between ICT and livelihoods of wage workers were not entirely anticipated, and were revealed due to the research methodology adopted. The research design was strongly grounded in the twin objectives of 'learning' and 'proving'.

The learning objective was supported by using the sustainable livelihoods framework (SLF) which emphasizes understanding the vulnerability context of the intervention group. The other critical element of the research design is data collection in several rounds including at the baseline and as implementation progresses, which helps to identify change as well as possible causal linkages. The use of mixed methods which incorporate collecting data on quantifiable indicators as well as open-ended qualitative questions also helped to identify issues, such as constraints to using ICT due to the nature of wage work. The proving objective was supported by using the SLF, which promotes data collection on multiple dimensions through the emphasis on the five capitals. Finally, the identification of the control group helps to differentiate gross impacts, and natural change, from the net impacts or project-specific impacts. In this research, the net effects suggests that indirect impacts of the project – accelerating the familiarization and use of ICT to get livelihood information – may be as or more important than the direct benefit of more work opportunities provided to workers through the job bank.

The project is still ongoing and a full impact evaluation is planned at the end of one year after the baseline data was collected. Given the learning so far, it is hoped that the research would generate interesting findings about using ICTs to improve the livelihoods of the rural poor.

Notes

1. The Department of Census and Statistics (DCS) defines a person as underemployed if he or she has worked less than 35 hours per week in the main occupation and is prepared and available to do more work, if offered (Ministry of Labour Relations and Manpower et al., 2009: 15).
2. Unemployment, on the other hand, is commonly seen among youth.
3. ICT and livelihood-related presentations and discussions. However, there is little rigorous research currently available on this topic.
4. Given the nature of the project, impacts on natural capital are unlikely.

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About the authors

Amila S. Balasuriya has a Bachelor of Science degree from the University of Peradeniya, Sri Lanka, and is currently working towards his master's degree from the same university. He is a junior professional at the Centre for Poverty Analysis (CEPA).

Nilakshi M. de Silva has a Bachelor of Arts (Social Sciences) Honours degree from Monash University, Australia, and a Masters in Public Affairs from the Woodrow Wilson School of Public and International Affairs, Princeton University, USA. She is a senior professional with the Centre for Poverty Analysis (CEPA).

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CHAPTER 6

Impact assessment of the e-AGRIKultura project: Philippines

Erniel B. Barrios, Joseph Ryan G. Lansangan and John Carlo P. Daquis

This chapter investigates the link between ICT and rural livelihood expansion in the context of the sustainable livelihood framework. Using two sets of agrarian reform communities (beneficiaries and non-beneficiaries of e-AGRIKultura project), we found evidence of a positive association between ICT, livelihood and income. There is greater appreciation of the value of information among beneficiaries compared to non-beneficiaries. While income for non-beneficiaries has increased due to another development intervention, because they appreciate information less, there is a potential threat in sustaining income gains. The ICT project is successful in converting rural communities to have a more progressive viewpoint on the role of ICT in providing information to enhance their livelihood assets. Considering the present endowments available to the rural households, they are better off with the ICT project with significant impact in increasing farm incomes as it facilitates expansion of rural livelihood, thereby increasing non-farm incomes as well.

While there is a growing realization of the role of ICT among rural households, more extensive advocacy campaigns and investments are necessary to ensure that information can be usefully accessed by all the potential stakeholders. Community organizations can be used to develop sustainability plans and act as a conduit in empowering rural communities. Local governments should play a vital role in ICTs supporting livelihoods through policies that will facilitate operation of private businesses, thereby forming catalysts of public–private partnerships.

Introduction

Rural households in the Philippines are the most marginalized since more than two thirds of the poor are located in rural areas and a majority of the rural households are dependent on agriculture for livelihood (Barrios, 2007). Farming is the most vulnerable livelihood due to its dependence on weather. Market access also contributes to the vulnerability of farmers since their produce should be properly stored if it cannot be distributed immediately to the consumers. In the Philippines where rural infrastructure still requires further investments, the farmers easily suffer losses since production areas and the marketplace are often unconnected.

The thrust of rural sector agencies in the Philippines (Department of Agriculture, Department of Agrarian Reform and Department of Environment and Natural Resources) is to achieve sustainable development through the modernization of agriculture, transforming rural communities into viable rural enterprises thereby expanding livelihood opportunities, and stewardship and rehabilitation of natural resources. In the process various strategies had been adopted, and most recently, the use of ICT has been piloted in some areas.

Rural livelihood and development

Rigg (2005) postulated that there is a changing landscape in the rural areas of Southeast Asia. Households still depend on agriculture but now have other sources of livelihoods. As accessibility infrastructure gradually improves, the previously isolated rural Southeast Asia is experiencing more non-farm activities. There is a gradual reversal of rural livelihood migration, expected to intensify as greater delocalization of livelihood is expected. Farmers become more informed of modern technologies and high-value crops and the government needs a paradigm shift where farmers are no longer peasants but rather agrarian entrepreneurs. The Philippine Comprehensive Agrarian Reform Program implemented in 1989 posits that agrarian reform beneficiaries, treated as members of the communities (not as individuals), can benefit optimally when these communities are transformed into rural enterprises, empowered to participate and implement marketing contracts, and are into demand-driven agricultural production. As farming systems become more efficient, excess labour would relocate to another sector where their skills would be most appropriate, facilitated through the expansion of rural livelihood and employment opportunities, e.g., through private–public partnership.

How is rural diversification initiated? The framework of public–private partnership is an important element. Narrod et al. (2009) presented case studies on public–private partnerships and collective action in high-value fruit and vegetable supply chains. The role of institutional support was noted in facilitating a small landholder's capability in coping with stringent food safety standards. It was further noted that selling in markets with food safety standards requires considerable market knowledge where ICT can play a significant role.

Market access is the most challenging bottleneck for the development of small landholders. The small volume produced makes it very difficult if not impossible for small landholders to negotiate and enter into contract with market players, e.g., traders. Opportunities for them to raise their incomes will open only if they are able to compete in the market (Markelova et al., 2009). Collective action can help address the inefficiencies, coordination problems and barriers to market access (Hellin et al., 2009).

Huallachain (2007) noted that the regional economic performance has been affected by the acceleration in the transition to a knowledge-based economy. In this, ICTs have come to play an important role in making information

available and accessible to a large number of people. In the context of rural communities, 'blending' of ICT with more traditional modes of communication (e.g., radio and telephone) is proposed to be useful (James, 2005). Such blending guarantees an inclusive outcome, ensuring this is not limited to a small subgroup within the community.

Even if ICT is theoretically effective in supporting rural development, the benefits can be optimized only if there is a sound sustainability infrastructure. Moreover, the community-oriented factors, intertwined with the social, political, cultural and economic factors, will induce effective and efficient implementation of rural ICT projects (Pade et al., 2009). With the harmony of these factors, sustainability of ICT projects are ensured, thereby maximizing the rural development benefits.

The research problem and objectives of the study

The planning of the e-AGRIKultura (ICT) project started in June 2004 but was implemented only in February 2005 for some sites and in 2006 for the others. It was intended to be pilot tested in six provinces, three in Central Philippines (Aklan, Bohol and Northern Samar) and three in Southern Philippines (Misamis Occidental, Agusan del Sur and Surigao del Norte). This study was conducted in February 2010 where in each province, the cooperative beneficiary of the ICT project was visited and 50 members were included as respondents. From a nearby cooperative comparable to the project beneficiaries, not covered by e-AGRIKultura, 25 members were included as respondents to serve as the control group.

The main goal of e-AGRIKultura is faster access to information on agricultural and farming technologies through the internet and optical media. Connectivity to the internet allowed farmers to research on agricultural and farming advancements and practices. In relation to another project promoting the use of ICTs, called Pinoy Farmers Internet, members of the cooperative were trained to access the site and gain new information such as modern techniques in farming, information on how to address crop diseases, which fertilizer and pesticide to use, which seeds to plant and how to optimize the yield of crops. Besides the information site, members were also given a list of other agricultural and farming information sites.

Replication of the project to other sites would require a tremendous amount of justification considering the huge amount of investment required to implement this information delivery mechanism to the farmers in the electronic platform. Also, since this is the first intervention of its kind targeted at agrarian communities, there was an element of trial and error rather than adopting empirically tested best practices.

This study documents the lessons learned from the project and elucidates the role of ICT in facilitating rural livelihood expansion (RLE) with e-AGRIKultura as an illustration. It shows how ICT complements the evolution of more diverse

rural livelihoods that could eventually reduce farmers' vulnerability due to over dependence on agriculture. Specifically, the following research questions were investigated:

- What are the e-AGRIKultura project components related to ICT? Were the intended goals for these components realized?
- Is it possible for ICT to complement/facilitate the expansion of rural livelihood?
- How much of a contribution to increasing rural livelihoods can ICT generate?

Methodology

Framework

With development as the ultimate goal, the sustainable livelihoods framework (SLF) (Chapter 1, p. 6) was proposed as a framework for studying the impact of ICT interventions. The sustainable livelihoods approach is a way of thinking about the objectives, scope and priorities for development activities (Serrat, 2008). The sustainable livelihoods approach guides the identification of the action plans that need to be prioritized to ensure attainment of the development goal.

SLF assesses the interplay between livelihood assets (human capital, natural capital, social capital, financial capital and physical capital) and households' influence and access as this is affected by external factors causing vulnerability to the households while policies and institutions providing the safety nets. Using a perception survey, Mohapatra and Suar (2008) developed a scale that included constructs/dimensions of livelihood sustainability and used this to assess whether technological capital influences sustainable livelihood of people in a watershed area.

This study modified the SLF to be more suitable in the rural Philippine setting. Barrios (2007) proposed the interplay of various economic, social and environmental factors towards improvement in the well-being of rural communities. Furthermore, Barrios (2008) proposed a model that characterized the dynamics of rural development highlighting RLE outside the farm. Following this methodology, the study focused on the six pilot areas where e-AGRIKultura was implemented.

Research design

The study used a quantitative research design in a quasi-intervention setting. Since there are no baseline studies in the pilot areas, some control groups (sites not covered by e-AGRIKultura) are identified to provide a benchmark upon which the initial impact was measured. Sample survey was used to collect information from the project beneficiaries, complemented with key informant interviews with project implementers.

While measurable final outcomes are a desirable yardstick of how much impact a project or intervention has made, the intermediate process can be examined through participatory approaches using measurements based on perceptions (Appleton and Booth, 2005). Desired development interventions can hardly be realized if the interventions beneficiaries' perceptions are not congruent with those of the implementers (Kottak, 1991). Perceptions can serve two purposes: as a proxy indicator of potential rural development outcome and as a source of information on how the sense of ownership can be advocated to move towards sustainability of these projects (Barrios, 2008). Thus, along with some factual information on the respondents, scales were included in the questionnaire to assess impact.

From each of the six provinces data was collected from 50 members of the cooperatives who accessed e-AGRIKultura services, and from 25 members of the cooperatives that did not benefit from the project. Members of the cooperative can be the household head, spouse of the head, a beneficiary of the agrarian reform programme, or a household member engaged in farming activities. A total of 450 respondents were enumerated in the study.

In assessing the data from project sites and the non-project sites, the contribution of ICT was computed using selection models (estimation of treatment effects) (Heckman, 1979) accounting for the bias induced by non-random assignment of the respondents to the treatment groups. The treatment groups are the beneficiaries and non-beneficiaries. The advantage/disadvantage of the treatment groups could have been compounded by superior endowments to start with which is evident in the average incomes being higher in the study areas that were not covered by e-AGRIKultura than those which were covered under this project (see Table 6.1). Hence, the model adjusts the manifested effect of the treatment accounting for such factors that could possibly cause bias. There is a large amount of literature on the use of selection models in estimating the effect of an intervention on development outcomes. For example, Frisvold et al. (1988) used selection models in estimating the effect of sanitation and living conditions on the health and welfare of agricultural workers.

Table 6.1 Income by sources (in PhP)

	Total		*ICT project sites*		*Non-ICT project sites*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Total annual income	65,327	358,390	61,797	431,609	72,387	114,703
Annual income from farming activities	47,881	356,656	44,468	430,503	54,706	106,484
Annual income from non-farm activities	42,037	115,127	39,732	130,214	46,649	76,705
Total area harvested (hectares)	1.34	1.761	1.11	1.516	1.64	2.006

Source: Survey of 450 respondents
US$1 = 44 PhP

Results and discussion

For the purpose of this study farm income is defined as any proceeds from production activities related to crop production and/or livestock raising within the farm cultivated by the household. Non-farm income includes all proceeds from economic activities outside any farm, e.g. value-adding activities, micro-enterprises or employment/provision of services in economic activities not connected with the farm.

Over half of the households in the e-AGRIKultura sites reported that the main employment of the head was related to farming, fishery or forestry. In the non-ICT project sites, more household heads (over 75%) were engaged in activities related to farming, fishery or forestry. While the numbers were still very small, the proportion of entrepreneurs or self-employed household heads in ICT project sites was double the proportion in the non-ICT project sites. Apart from the household heads, the household members in ICT project sites were engaged in non-farming activities, while in sites not covered by e-AGRIKultura they were engaged in farming activities. This is initial evidence that households in the non-ICT project sites are still mainly dependent on farming, but those covered by e-AGRIKultura have more options other than farming, possibly an early indication of livelihood expansion.

The average incomes from different sources are summarized in Table 6.1. Income in sites covered by e-AGRIKultura was lower than that in the non-ICT project sites. The higher farm and non-farm income in non-ICT project sites can be attributed to some integrated development intervention projects funded by the Asian Development Bank (ADB), The World Bank and the Belgian government, implemented way ahead of the e-AGRIKultura project. Unfortunately, both the ICT and the non-ICT project sites are still typical pictures of rural poverty since the total income for both groups are lower than the 2006 poverty threshold of PhP 72,876 (US$1,656) for the ICT project sites (household size being 4.82) and PhP 77,995 (US$1,773) for the non-ICT project sites (household size being 5.18). One interesting feature of the income data though, is that income from non-farming activities was a significant proportion of the total income, indicating diversity of livelihood opportunities among residents in agrarian reform communities (ARC).

Perceptions of living conditions

Of the 18 items in the living conditions scale (see Appendix 1), the two groups have comparable perceptions on seven items, including utilities, income and food sufficiency, availability of jobs and overall ratings of living conditions in the community. However, the respondents from the ICT project sites have significantly better perceptions of the concerns related to education access and quality, regularity of income, training on livelihood and improvement of transportation. All these items pertain to better endowments that can facilitate the realization of benefits from ICT. This could mean that the beneficiaries

in the e-AGRIKultura sites are indeed ready in the mobilization of ICT as an instrument towards livelihood expansion, and subsequently, achievement of development goals.

Perceptions of ICT

Table 6.2 summarizes the perceived availability, necessity, access, satisfaction and effectiveness of various ICT infrastructure, ICT services and training among the respondents from the two sites. The majority of the respondents in e-AGRIKultura sites believe that infrastructure, services and training are available (70–95%). The internet is the least available infrastructure; information on farming technologies is the most available ICT service, while information on processing of local products and information on market of processed commodities are the least available. All respondents agreed that these are needed but those who actually accessed the infrastructure and services were fewer than those who were aware of their availability. This means that either some beneficiaries were not aware of the benefits from ICT or that there was inadequate technical know-how for them to access the benefits of ICT. Those who accessed these services unanimously reported satisfaction and agreed that they were indeed effective.

In comparison to the e-AGRIKultura users, a low proportion (13–43%) of the non-ICT project beneficiaries reported that these ICT facilities, services and training were available except in the case of cellphones (74%). Just like in ICT-project sites, the internet was the least available facility, and information on processing of local products and information on market of processed commodities were the least available services. While they believe these were not available in their communities, they think that these were needed. The proportion who reported to have accessed ICT services was lower than those who reported that they were available. However, those who accessed these services were satisfied and reported that they were effective.

The stakeholders in the ICT project sites show greater appreciation of the value of information as compared to those in the non-ICT project sites. This can be easily linked to their access to and use of information centres established under e-AGRIKultura. Almost all respondents from the ICT project sites were aware of the availability and necessity of the information centre leading to their realization regarding the importance of the information on farming technologies, sources of production inputs, market of commodities, prices of commodities, procurement of local products/raw materials for value-adding, market of processed commodities and other employment outside the farm. In the non-ICT project sites, while there was better income level as a result of other development intervention projects, they had lesser appreciation of the information that could potentially contribute in sustaining initial gains in the income they had already realized.

Table 6.2 Use of ICT and ICT services

	e-AGRIKultura sites					*Non e-AGRIKultura sites*				
	Available	*Needed*	*Accessed*	*Satisfied*	*Effective*	*Available*	*Needed*	*Accessed*	*Satisfied*	*Effective*
ICT infrastructure computers	93.90	95.60	67.20	95.10	96.10	31.00	72.20	17.50	70.00	78.90
Telephone/cellphone	93.50	96.90	83.80	98.70	99.10	74.70	88.10	78.40	98.90	98.90
Internet	70.90	89.80	46.80	93.60	96.70	13.10	68.60	7.40	50.00	50.00
Information centre	91.20	95.60	75.80	96.60	99.00	22.20	80.70	24.00	96.60	96.60
ICT and other services										
Info on farming technologies	92.90	96.90	72.20	95.40	95.80	43.20	89.40	36.00	91.50	91.30
Info on sources of production inputs	88.70	94.50	65.80	96.00	96.50	41.70	89.90	35.30	100.00	100.00
Info on market of commodities	85.40	93.50	61.10	93.90	95.00	39.30	87.90	31.60	85.40	82.50
Info on prices of commodities	84.20	94.20	61.70	96.40	94.50	36.10	85.10	29.30	86.50	86.10
Info on procurement of local produce/ raw materials	76.90	93.50	53.00	95.80	97.20	21.90	83.10	17.90	82.60	82.60
Info on market of procured commodities	77.10	93.10	52.60	96.40	97.10	26.00	80.90	18.50	91.70	91.70
Info on employment outside the farm	85.60	95.90	60.40	96.30	98.10	35.40	81.40	24.20	92.00	92.00
Training on ICT equipment	78.80	94.90	58.60	92.50	94.90	19.20	78.30	13.00	100.00	100.00
Training on information uses/benefits	80.30	95.90	59.40	95.00	98.70	28.30	87.10	20.90	95.70	95.70

Table 6.3 Perceptions of the purpose of ICT

	e-AGRIKultura				*Non-e-AGRIKultura*			
Purpose of ICT	*Perceived*	*Feasible*	*Realized*	*Sustainable*	*Perceived*	*Feasible*	*Realized*	*Sustainable*
ICT can increase farm productivity	97.9	94.5	93.3	92.9	57.9	93.9	63.2	85.4
ICT can increase farm income	96.1	94.1	92.2	92.6	60	87.1	63	84.2
ICT can help expand livelihood	95.8	92.9	91.2	91.6	55.9	93.8	62.5	82.5
ICT can contribute in starting business	94.8	92.8	93.3	93.9	57.9	96.9	63.2	87.8

Table 6.3 indicates that almost all respondents from ICT project sites perceived that ICT could increase farm productivity, could increase farm income, could help expand livelihood and could contribute in starting up a business. A similar proportion agreed that ICTs could help achieve all these: they were feasible, actually realizable and could be sustainable. In non-ICT project sites, the perception was not as promising as there is only a little more than half who think so. While they indicated these were feasible, they were more pessimistic as to whether these could be realizable or sustainable. This implies that if ICT was to be introduced in replication sites, some preparatory work might be needed to advocate with communities, initial investments to experiment with different modalities to tailor-fit the service design to the environmental realities (physical, social and economic conditions), and actual experience on ICT facilitating access to information that they can experience.

An 18-item scale (Appendix 2) was also created to assess their perceptions on various facets of ICT such as purpose, capability, availability, access and other issues surrounding ICT implementation. The respondents from ICT project sites were in stronger agreement on these items than those in the non-ICT project sites. After three years of project implementation, perceptions of the stakeholders on issues around ICTs had improved significantly. Thus, the ICT project has already made some initial impact through the changing perspectives of rural stakeholders on the use of ICT and to enhance livelihood.

It is very important for the stakeholders to appreciate and experience the value of the information accessed from the information centre that was integrated into the e-AGRIKultura components. Counterfactual simulation suggests that non-farm income can be higher by 54% among those who believed that an information centre was needed than those who believed otherwise. Furthermore, farm income could be 64% higher among those who value the

importance of an information centre relative to those who believe otherwise. This means that an information centre that is considered a necessity by the stakeholders can help increase income irrespective of whether it comes from farm or non-farm sources, consistent with the SLF, i.e., expansion of rural livelihood assets.

Discussions

We used two scales (Living Conditions; and ICT and Livelihood, see Appendix 1 and 2) that incorporate the typical indicators monitored in the SLF; these are subsequently aggregated into indices. Income is significantly correlated with both the living condition index and ICT and livelihood index. Non-farm income is even more significantly correlated with living condition index and ICT and livelihood index. This is clear evidence of the positive association between ICT, livelihood and non-farm income, and validates the usefulness of perception scales as proxy indicators of quantifiable development outcomes such as income. ICT facilitates the expansion of livelihood opportunities among the rural households by improving both farm and non-farm incomes and subsequently alleviating the dependence of rural households from farming. While farming remains the major livelihood (as should be the case in the context of food security), alternatives are available that can mitigate their economic vulnerability and farming itself becomes more income generating. This is expected as e-AGRIKultura primarily provides agriculture and farm-related information leading to an upward movement in farm incomes.

Selection models were fitted for outcome indicators, counterfactual simulations were also made to assess the expected outcomes given the endowments currently available among the beneficiaries/non-beneficiaries of the e-AGRIKultura project. Total household income was significantly influenced by the living condition index (an aggregate of various constructs of the living conditions reported by the households and the indicators of the SLF). The effect of ICT intervention on total income could be optimized if there were more employment opportunities available to various members of the benefiting households leading to the contribution of non-farm employment in income-generation. Given the current characteristics of the beneficiaries and non-beneficiaries of the ICT project, provision of the ICT project can generate an expected income of PhP 161,202 (US$3,664) for the households. On the other hand, without the ICT project, the expected income is only PhP 118,552 (US$2,694). ICT within the SLF can best contribute to total income if there is complementary expansion in employment opportunities, more specifically, for livelihood outside the farm contributing to total income. Provision of information related to these may support this process.

With the project, the expected household farm income was PhP 93,030 (US$2,114). Without the project, farm income was only at PhP 52,919 (US$1,203). This can be explained by the fact that the centre provides

information mostly related to agriculture. For the non-farm activities, the expected income among beneficiaries of the ICT-project was at PhP 52,494 (US$1,193). Without the project, expected household non-farm income was higher at PhP 66,332 (US$1,508). This was so because, the non-project sites were covered by an integrated development project (also targeting expansion of non-farm livelihood) implemented way ahead of the e-AGRIKultura. Thus, non-project beneficiaries are better off in terms of non-farm income. This further suggests that provision of information related to non-farm activities may help improve these livelihood options for the households.

The counterfactual simulation for the living condition index pointed out a higher score of 57.68 and 53.63 percentage points in favour of the e-AGRIKultura project. Furthermore, ICT and livelihood index were at 88.76 in e-AGRIKultura sites, but only at 57.89 in the others. This points out to the important role of the ICT-project in opening/facilitating households to realize better livelihood opportunities.

ICTs and development

Physical viability of ICT is a crucial pre-condition to establish the ICT–development linkage, especially in rural areas. One prominent feature of rural Philippines is that communities are isolated due to the absence of accessibility infrastructure (Barrios, 2008). At the community level, physical infrastructure such as accessibility (roads), communication infrastructure, and electricity, among others are necessary. Further, what is also important is that the beneficiaries appreciate and recognize its potential contribution to their well-being. Their economic capabilities need to be in place or at least support services available. Household endowments such as an educated member, communication appliances, etc., should also be present. In the event that ICT could indeed stimulate the generation of livelihood activities, readily available economic support such as microfinance and enterprise development should be available. Social networks such as people's organization or cooperatives play an important role in advocacy, awareness and use of ICTs.

For any kind of technology, adoption can only be ensured once the stakeholders are aware of the dynamics in which this will work and how this can contribute to alleviating their conditions. And this might require some experience and experimentation of the community in the use of ICTs in accessing information and using it. Technology adoption leads to change in perceptions. As long as the potential benefit of ICT is understood, perceptions of the stakeholders could become more optimistic. Change in perception leads to further application of ICT and greater usage. These changes will empower the rural stakeholders and help develop a relative advantage in competing for access to production opportunities.

Sustainable access to information would positively affect livelihood expansion of rural households as knowledge and information become systemic

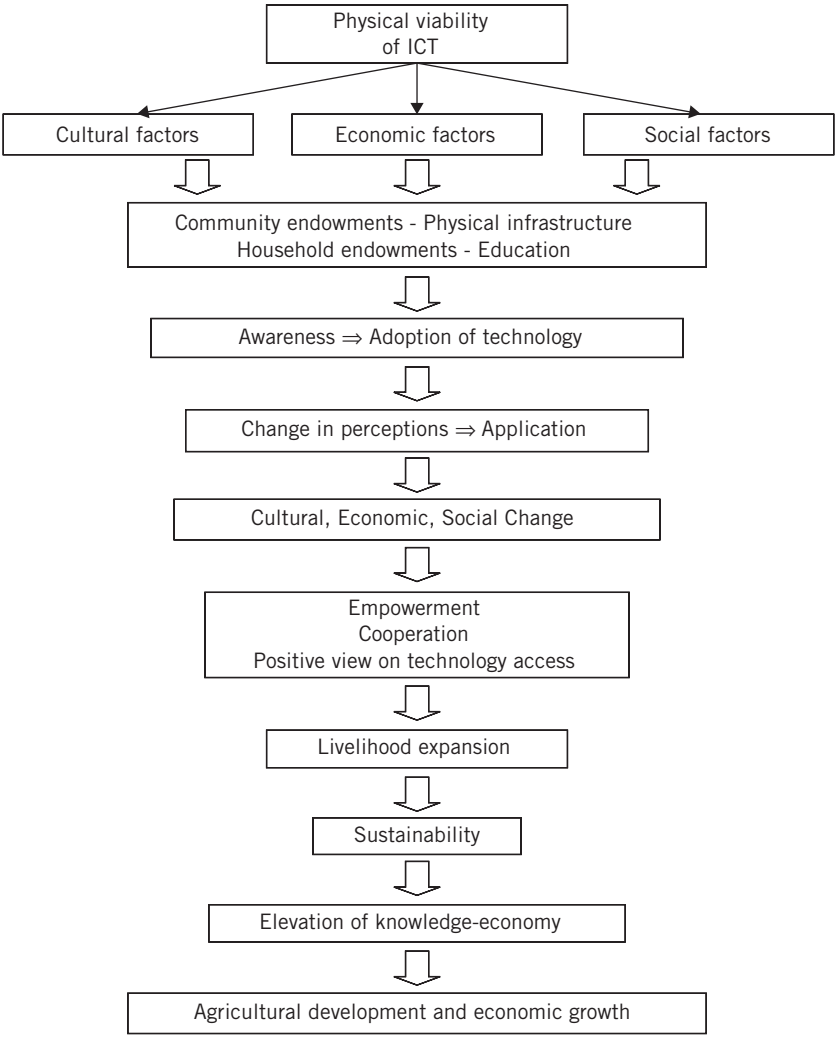

Figure 6.1 ICT and sustainable rural development framework

drivers of agriculture and eventually rural development. Figure 6.1 summarizes the dynamics in which ICT contributes in the SLF.

The role of ICT in expanding rural incomes can be divided into four phases. The first phase happens prior to the introduction of ICT. There is limited access to various factors of production, a constraint in economic production; hence, income is not necessarily generated at the frontier level. Non-farm livelihood sources are relatively scarce; hence, more farm income is generated than from non-farm sources. In the second phase, ICT may already be adopted, but possibly be limited only to other uses, e.g., social networking,

communication, etc. This is the stage when farmers are still getting familiar with the different facets of the ICT. Phase 2a is experienced by a group similar to the non-beneficiaries of the e-AGRIKultura project included in this study. While they may also go through the process of familiarization with ICT, income coming from farm and non-farm may already be pushed near the frontier level, this movement in income is not necessarily driven by ICT, but perhaps, by other integrated development interventions.

Phase 3 evolves into the actual utilization of the information accessed through ICT for its intended purpose. It is natural for the farmers to appreciate the value of agriculture-related information first. Improved farming practices and marketing information will push farm income towards frontier level. The non-farm income may or may not be elevated to the frontier level since farmers may not yet be optimizing the use of information. In the final phase, it is expected that there will be a spillover effect of information utilization from farm income-generation towards the generation of non-farm income. ICT will open a network between farmers and firms, and more employment opportunities will open up or perhaps value-adding activities by the farmers may increase. There will be reallocation of excess labour from agriculture as a result of the attainment of efficient production systems. At this point, ICT will ensure that continuous flow of information will necessarily provide a safety net for rural households to produce at the frontier level both from farm and non-farm sources. Those coming from Phase 2a will also pass through Phases 3 and 4, not to elevate income generation to the frontier level, but to sustain the levels achieved through other development interventions. In any case, access to information through ICT will facilitate the sustainable generation of income among rural households. These phases are summarized in Figure 6.2.

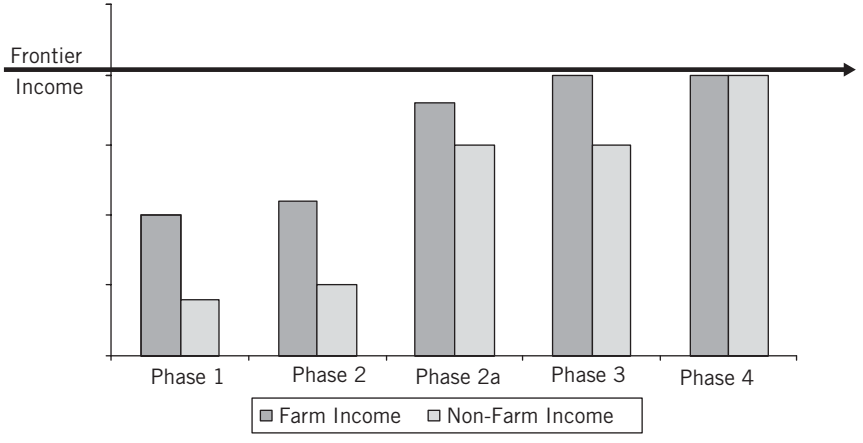

Figure 6.2 ICT and development timelines

Conclusions and recommendations

Using the SLF, this study assessed the linkage between ICT and RLE in the context of e-AGRIKultura. With expanded livelihood sources, vulnerability of rural communities can go down by reducing dependence on agriculture. Not only has farm income increased as a result of e-AGRIKultura, but has also increased diversity in livelihood opportunity as reflected in the rising income from non-farming activities through this intervention. The ICT project is also successful in converting the rural communities' viewpoint, on the role of ICT in enhancing their livelihood assets and opportunities available to them through better access to information, to a more progressive one.

Are rural communities ready for ICT? The physical and economic conditions of rural communities may not yet be fully ready to realize the complete potential of ICT, but the ICT project beneficiaries are indicating their willingness to learn and experience ICT as it facilitates livelihood expansion and eventually reduces economic vulnerability. There is however a need for an extensive advocacy campaigns to ensure that the potential stakeholders are aware of such benefits from ICT. Some basic training on access and utilization of ICT services will also equip the stakeholders with empowering tools in economic production.

There is an improving outlook in rural communities, especially those who have had some experience with using ICTs to access information, about their potential benefits for living conditions, rural development and livelihoods. While ICT may not yet be physically viable in certain communities, there are enough community and household endowments that can be tapped towards advocacy campaigns, social preparations and capacity building to push ICT as a viable conduit for livelihood expansion in rural areas.

Can ICT projects be sustainable in rural communities? The respondents all agreed that information is needed. However, there were fewer respondents who actually accessed the ICT infrastructure and services than those who were aware that these were available; implying that some beneficiaries were not aware of the benefits from ICT or that there was inadequate technical know-how for them to use ICT. Those who accessed these services unanimously reported satisfaction and agreed that these were indeed effective.

Almost all beneficiaries of e-AGRIKultura agreed that ICT could increase farm productivity, could increase farm income, could help expand livelihood and could contribute in starting a business. A similar proportion agreed that these purposes were feasible, actually realizable and sustainable. In non-ICT-project sites, the perception was not as promising. While they indicated these were feasible, they were more pessimistic as to whether these could be realizable or sustainable. This indicates a learning curve which users need to go through to fully appreciate and use ICTs to their benefit.

If an ICT project is to be replicated, advocacy on the purpose of ICT should be done ahead of any intervention. Community organization can be used in developing a strategy to promote sustainability, in developing the community into a rural enterprise and as a conduit in empowering rural communities.

With a substantial social preparation strategy, advocacy campaigns, tapping resources of local government and strengthening of community institutions (e.g. cooperatives), these rural communities are indeed ready for ICT as an instrument for livelihood expansion.

How should an ICT project be packaged? In the Philippine setting, segmentation of rural communities generated by the ARC launched by the Department of Agrarian Reform (DAR) can provide the basic building blocks for an ICT project. DAR aims to convert these communities into a viable rural enterprise by facilitating access of these communities to various economic and physical support services, strengthening of people's organizations, facilitating access to basic social services and linking the governance issues of people's organizations to the local government. ICTs can be integrated in the inherent development strategy of DAR to help communities to conduct their own assessment of the endowment available to them, needs assessment and planning for a strategy to implement this plan.

There is a need for further advocacy on the potential benefits from ICT especially among the most remote communities. However, ICT advocacy, intervention to mitigate the physical isolation of rural communities (e.g., farm to market roads), microenterprise development and microcredit access should be integrated for a more sustainable development. Thus, ICT as an integral component of a rural development strategy can best serve the purpose of supporting livelihoods improvement. On the policy side, the local government can contribute in terms of an environment that will facilitate and simplify entrance of the private investors in rural areas. Currently, there is no motivation for private ICT stakeholders to mobilize in rural areas since the business opportunity cannot be seen yet from official statistics. This is one area where the local government can play a very vital role.

There are several ways in which information can be shared with community members, e.g., visual presentation of information (physical or electronic). Interpretation and communication of information can be done using a media more appropriate for them, e.g. radio, television, SMS and MMS sent to experts for interactive consultation on agriculture and the like.

Policy implications. While there is existing legislation in the Philippines intended to pursue the synergies between ICT, agricultural development and rural development, there is a need to strengthen some of the implementation strategies of such programmes such as:

1. More defined implementation guidelines related to the National Information Network (NIN) feature of the Agriculture and Fisheries

Modernization Act (AFMA). NIN is a network linking all offices and levels of the Department of Agriculture, research institutions and local end-users. The goal of NIN is to provide easy access to information and marketing services related to agriculture and fisheries. The e-centre in the ICT project can be used as a model for NIN.

2. AFMA included a provision on taxation that should not deter growth of value adding (microenterprise development) but there is no explicit provision of how private investors can be encouraged to invest in rural areas. One problem cited as a bottleneck of the ICT project is the poor signal for connectivity. Incentives or complementary support from the local government can be introduced to encourage private investment such as for physical infrastructure for communication facilities.
3. AFMA also included provision of microcredit but there is a need to further institutionalize a national microcredit programme that will include not only credit at lower interest rates but also an advocacy campaign on the uses and functions of microcredit. While some rural households tend to access credit with excessively high interest rates, others include misusing microcredit funds.
4. Policy on the adoption of ARC (or other similar concepts) as a viable strategy in rural development. Government agencies working in rural areas still deliver the interventions as outright provision of support services that is not sustainable. The ARC approach aims to facilitate access instead of direct provisions of factors of production that will eventually translate rural communities into a viable enterprise.
5. More thorough rationalization of the integrated rural infrastructures programmes is needed. Rural infrastructure must be demand driven and match the needs of the communities. The communities must be involved in the identification of the kind of infrastructure they need. This will develop in them a sense of ownership that will facilitate the layout for sustainability strategies.
6. Inclusion of ICT in rural extension programmes.
7. Institutionalization of local government support, especially on policies that will serve as catalysts of public–private partnerships essential in technology projects.

Future research. This study provided empirical evidence on the dynamics in which ICT and rural development are linked in SLF. The non-beneficiaries included are actually beneficiaries of other integrated development interventions. It would be a valuable insight to come up with similar quasi-experimentation to include different kinds of integrated interventions with or without ICT and a true control group who were not exposed to any development intervention.

The learning curve is believed to increase as trial-and-error schemes from ICT interventions are becoming available to various stakeholders. Spatial

spillover is also unavoidable as information spreads quickly through technology adoption. It is imperative then to examine the space–time dynamics in which ICT and rural development are linked; greater knowledge can be generated that can potentially minimize randomness of the intervention approaches in the future.

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Appendix 6.1 Living condition scale

1. Housing unit is comfortable for the family.
2. Toilet is hygienic.
3. Cost of electricity is reasonable.
4. Water source is accessible.
5. Water is safe for drinking.
6. Water cost is reasonable.
7. School is more accessible now.
8. There is an improved quality of education.
9. Income is more regular.
10. Income is sufficient for household needs.
11. There are enough jobs available now.
12. There is enough training on possible livelihood.
13. There is enough training on new farming practices.
14. There is enough food for the family.
15. It is now easy to take a public transportation.
16. There is general feeling of satisfaction in the community.
17. I am content with the way our needs are met.
18. Our living conditions now are much better than 5 years ago.

Appendix 6.2 ICT and livelihood scale

1. Information on farming technology can be obtained from the internet.
2. Information on farming technology should be delivered by the extension worker/technician.
3. Information on farming technology can help improve productivity.
4. Information on marketing of produce can be obtained from the internet.
5. Information on marketing of produce should be delivered by extension workers.
6. Information on marketing (including transportation) of produce can increase income from the sale of the produce.
7. Information on market linkages can increase farm income.
8. Internet can provide information on livelihood opportunities within the farm.

9. Internet can provide information on livelihood opportunities outside the farm.
10. Internet can help in planning to start a small business.
11. ICTs are needed.
12. ICTs are useful.
13. I/family members have enough knowledge on the use of internet and computers.
14. I/family members have enough skills on the use of internet and computers.
15. I/family members are willing to be trained on the use of internet and computers.
16. I will support ICTs project.
17. I will contribute to maintaining ICTs project.
18. I believe ICTs project can contribute in rural livelihood.

About the authors

Erniel B. Barrios is Professor of Statistics at the University of the Philippines Diliman. His educational training was in statistics and he is actively contributing to the theory and issues related to computational statistics. His work on development studies focused on various strategies in monitoring and measuring rural and sustainable development, benefiting significantly from the quantitative methods derived from his work in statistics. He co-authored the development of an index of sustainable development for the Philippines and the index of sustainable agriculture in Southeast Asia. He also contributed on the use of perception scales in early impact monitoring of development projects.

Joseph Ryan G. Lansangan and **John Carlo P. Daquis** are Assistant Professors also at the University of the Philippines Diliman and are working alongside Professor Barrios on computational statistics and its applications.

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CHAPTER 7

Evaluation of a rural information project in Ningxia, China

Nie Fengying, Zhang Li, Bi Jieying, Liu Fujiang and Tian Xiaochao

This chapter focuses on the evaluation of ICT applications aimed at the promotion of sustainable livelihoods in rural communities. Based on the methodology of a sample survey, key informant interviews and focus group discussions, it sought to assess the impact of ICTs on livelihoods by applying the 'livelihoods framework'. The study was conducted in Ningxia Hui Autonomous Region in China where the government introduced a village information centre into every village. Analysis of the survey showed that the main overall impacts include capability building and the promotion of information awareness among farmers. The farmers (85%) reported that the project had made great contributions to the quality of life and development of the local economy and society. As for the promotion of farmers' livelihoods, the impact on human capital, financial capital and social capital are more obvious. It improves the livelihood of rural farmers of Ningxia mainly by strengthening human capital to increase financial capital through improved access to information on better agricultural practices and market information. The research also found that farmers are eager to gain access to technology and knowledge. In addition, it was observed that various individual factors influence the use of ICTs with different forms of use at the regional level having different impacts.

The study drew conclusions regarding the innovative institutional mechanism to link rural communities with promoting rural livelihoods. Impacts were observed on human, social and financial capital in rural communities. For instance, 72.9% of respondents had participated in distance learning and skill training initiatives while 69.3% earned more income. We further discuss appropriate ICT intervention, diversified financing mechanisms, enhancing human capacity building and exploring sustainable development. The approach in China of supplying rural information services as a public good is different from other countries in Asia and some suggestions are made for using the public sector to support market development.

Introduction

ICTs in China

The application of ICT in rural areas of China has been seen as an important task for pushing forward the construction of a 'Socialist New Countryside in China'.[1] It may contribute to the integrated development of urban and rural areas by providing information to farmers about agriculture in rural areas. ICT application in rural areas is thought to facilitate improved management and guide governments to improve services that would improve rural cultural and economic development and reduce the development gap between urban and rural areas. This chapter discusses an ICT intervention that was deployed between 2007 and 2008 in Ningxia Hui Autonomous Region (hereafter Ningxia), the first province with each village connected to the internet in China. The impact has been evaluated using survey-based data collected in 2010.

The approach to ICT implementation in China provides an interesting case study of the impact of ICT on rural livelihoods. The application of ICTs in rural areas is supported by a strong policy at various government levels during recent years. The Peoples' Government and the Commission of Communist Party of China (CPC) of Ningxia jointly issued the document (in February 2007) on constructing a central information platform by integrating information resources (Office of Leading Group of Information Technology Application in Ningxia (OLGITAN), 2008a). The document attached great importance to ICTs' application in rural Ningxia, and has contributed towards accelerating the development of rural ICTs' application. This helped enable the realization of rural development in Ningxia in China to use the ICT platform to catch up with more economically developed provinces. The experiences outlined here are relevant to the promotion of ICT in other provinces.

The Ningxia ICT project consisted of an internet protocol TV (IPTV) system, a comprehensive information service website for rural Ningxia, a call centre for agricultural farmers[2] in the rural areas of Ningxia and a village information centre (VIC) to campaign for rural development (Office of Leading Group of Information Technology Application in Ningxia (OLGITAN), 2008b). The comprehensive information website provides information on agriculture, markets, weather, financial instruments and health amongst other useful information. Call centres provide voice and video training on aspects such as agricultural technology and processes. The VIC provides facilities for the farmers to download and upload information on websites. The call centre, with support from the information network, is connected to each VIC using video technology. This makes face-to-face communication between experts and farmers possible. In the case of Ningxia one information network is being formed. This model is unique to the nation.

During the implementation of the project, the Ningxia Branch of China Telecom, General Bureau of Ningxia Broadcast and TV, and other related

departments including the West China Electronic Co. Ltd., coordinated with each other and constructed the rural comprehensive information service platform (consisting of three information technologies), including the network of rural comprehensive information service, the call centre for farmers of Ningxia, as well as the platform of rural IPTV during April–July of 2007. This paved the way for popularizing a high standard, multi-functional information service network at the village level. In July 2007, the leading office of rural ICTs application formulated a series of implementation procedures to guide and uniformly request for the construction and management of VIC across the region. Thus a model of rural information application was created in Ningxia. On completion of the project, 2,802 VICs had been established and each village had access to the internet and IPTV all over the region by 2008 (Zhang et al., 2009). Ningxia became the first province with each village connected to the internet in China.

Through the integration of three platforms (telecom, TV and internet), a new operational platform has been created. This initiative resulted in the integration of service items of portal, 10 application systems, real time play of IPTV system and video on demand, stock information and teletext. It also created a new pattern for information development and service, achieving the organic integration of network information resources and service functions at the village level. The impacts of this project on rural livelihood need to be evaluated to better understand the potential of ICTs and provide evidence for ICT practitioners. The ICTs application and its analysis will contribute towards the scaling up of other similar projects.

Area profile

The study area of Ningxia is located in Western China with a land area of 51,950 km^2. Rural population in the province is 3.37 million, which is 53.9% of the total population in 2009 (National Bureau of Statistics of China, 2010). In general, the ecological environment of Ningxia is relatively bad, bearing the characteristics of a dry climate and experiencing water shortages. The economic development of Ningxia is relatively slow and the regional GDP reached CNY 135.33 billion in 2009 (approximately US$19.9 billion), which is far behind the national average. The per capita annual net income of rural households was CNY 4048.33 (approximately US$ 595.3) in 2009 (ibid). Half of the counties are nationally defined key poverty counties with 168,000 poor people in 2008 (Survey Office of Ningxia, National Bureau of Statistics of China, 2009).

The introduction of ICTs was carried out in the period between 2007 and 2008. Our survey, discussed below, was conducted during 2010 in an effort to assess the impact. The selection of sample counties was made taking into consideration the level of local economic development, land area, population and agricultural production. The surveyed counties accounted for 60% of the

Map 1 Map of Ningxia

total counties in Ningxia. The geographic distribution of these counties covered the northern, central and southern regions, among which, the four counties of Yuanzhou, Longde, Pengyang and Tongxin are nationally defined as key poverty counties. The four counties of Zhongning, Lingwu, Helan and Pingluo are relatively developed counties, while the county of Hongsibu attracts migrants from poor mountainous counties.

Research objectives

The intervention for the 'Promotion of Sustainable Agricultural Livelihoods of the Rural Communities in Ningxia', China was supported as part of ENRAP's ICT4RL research initiative. The specific objective of the study is to evaluate the overall impact of the 'three-network' integration project on livelihoods of the rural communities in Ningxia and identify what causes these impacts.

Methodology

The evaluation of impacts of ICTs on livelihood development in this chapter will be analysed based on the sustainable livelihood development framework. A variety of research methods were used that included: a survey; the analysis of secondary data; document analysis; key informant interviews and focus group discussions with project stakeholders. The study first undertook a literature review to analyse the basic status of farmers' vulnerability and current livelihood strategies in rural Ningxia.

The sample survey was carried out on 628 households, in 54 villages in 24 townships of nine counties in Ningxia. Researchers advised local village leaders to identify households representing an average status in the village avoiding extremely poor and the extremely rich ones. Moreover, since out migration is common in the study area, household selection was constrained to choosing those who were still in the village. The researchers completed each household questionnaire via a face-to-face interview. They provided basic information, including information about gender, age, education level, occupations of household occupants and their opinion on the rural information project as well as their history of internet and computer use. This also included information about how their internet and computer use, if any, related to their livelihood activities. Information about the organizational context in which the rural information project operated was through key informant interviews with relevant personnel (mainly village leaders) as well as reviews of all project-related reports and other related papers. The public internet access site for rural information services was also assessed (http://www.nxnc.gov.cn; http://www.12346.gov.cn). Given the timing for the study, it was not possible to collect pre-project baseline data, and it was also not possible to define a control group as the whole province was covered by the ICT intervention before the study started. It was also difficult to identify a similar group in another province excluded from the ICT intervention. This is an important difference between this project and all the others reported in this book. Therefore, the study relied on the perceptions of farmers who had experienced project effects to a greater or lesser degree.

The average number of sample villages in each county is six – the number varied according to the situation. The average number of households in each village is 10. The interviewees included various dimensions of age, gender, nationality, education, occupation and poverty. Of them, 36.8% were women, 64.5% were aged between 30 and 49 years and 42% belonged to ethnic minority groups (such as Hui and Man). Regarding the education level, 50.8% graduated from junior middle school and only 8.3% were illiterate. Altogether, 60.9% were mainly engaged in agricultural activities, while 22.6% did part-time jobs. Nearly half of the interviewees thought they were still in poverty (Table 7.1).

Table 7.1 The characteristics of survey sample

Variables (%)			*Variables (%)*		
Gender	Female	36.8	Ethnicity	Han	58.0
	Male	63.2		Hui and other minority ethnic groups	42.0
Age	Younger than 29	17.9	Occupation	Mainly engaged in agricultural activities	60.9
	30–39	31.8		Mainly engaged as employees	22.6
	40–49	32.7		Mainly engaged in self-run business	8.8
	50–59	13.6		Others	7.7
	Older than 60	4.0			
Education	No schooling	8.3	Land scale	No land	8.4
	Elementary school	18.1		>5 mu (5 not included, below the same)	21.2
	Junior high school	50.8		5–10 mu	25.6
	Senior high school	16.2		10–15 mu	18.0
	Vocational and technology school	3.4		15–20 mu	10.4
				<20 mu	16.4
	College and university	3.2	Poverty	Yes	46.7

(1 mu = 0.067 ha)

Research results and findings

This section will divide the study results and findings into three sections: general findings, those represented under the livelihoods framework in human, social, and financial capital (see Chapter 1 for the diagram), and the factors affecting ICT use.

General findings

Building ICT infrastructure. The provincial government of Ningxia attached great importance to the ICT intervention and saw it as part of rural infrastructure construction. Due to the geographic location of various villages, the ICT providers used different ways to connect the internet to rural households, for example ADSL or Wimax, providing more options and facilitating easier access (Zhang et al., 2009). Because every village in Ningxia has established one or more information centre(s), farmers now have a new means of accessing information. They either search for information by themselves using the computer in the VIC or get help from messengers. Messengers are local leaders and other important persons within the community who provide training to farmers on how to use the ICT applications and are also responsible for providing important information to the community.

A Village information centre in Ningxia

Improving the quality of life. The TV, VIC, internet, village messenger and mobile messages are the main information sources attributable to the project. They account for 60% of the farmers' increased information access compared with traditional information access which focused mainly on the village leader, agricultural extension staff, radio, newspaper and magazines and others (Figure 7.1). The survey results showed that more than 82% of the respondents were aware of the ICT project (of which 38% knew a lot about it).

The respondents (85%) reported this project had made great contributions towards improving their quality of life and even towards the development of the local economy and society (Figure 7.2). They could now access more information via the internet; improve the production and marketing of agricultural products, increase income and enjoy time-shifted (record and play-back) TV programmes and movies delivered by VICs. Their physical and spiritual life had also improved. Those people reporting 'small' or 'no' impact were largely related to employment issues (non-agricultural workers) and age (for respondents over 40 years of age). They were not related to gender or ethnicity. Overall, the people felt the initiative had pushed the development of the economy and society forward.

Skill building. With the aim of improving the impact of and potential for rural ICTs in Ningxia, farmers need to be organized and learn how to use computers

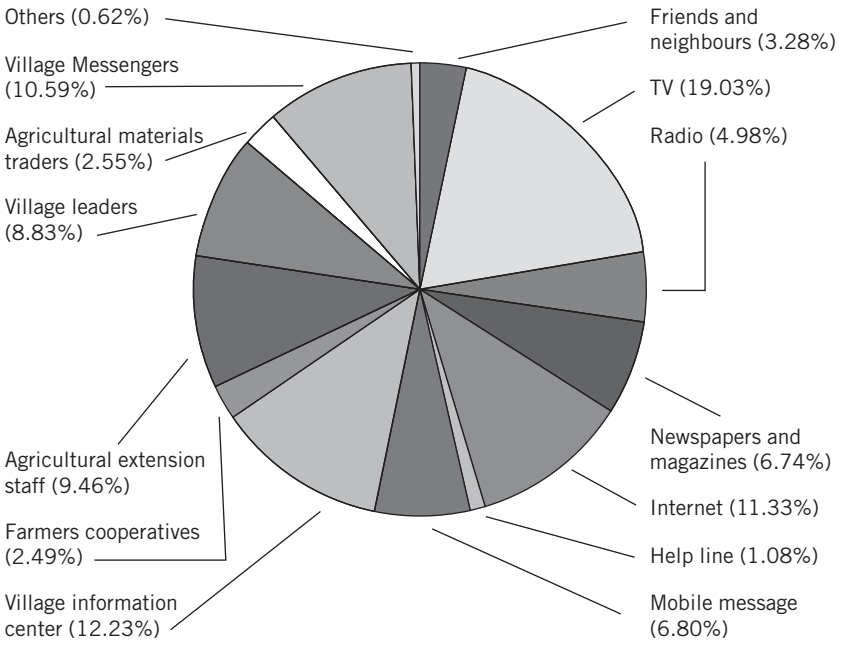

Figure 7.1 Increased information access

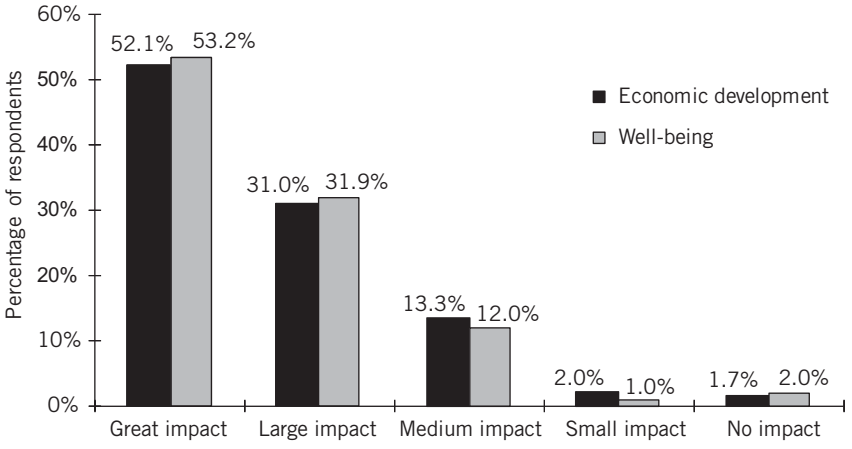

Figure 7.2 Farmers' perception of impact

to access more services. So far a lot of effort in information training has been made in rural Ningxia.

Trained messengers with higher education can help farmers access information. The survey data suggested that more than 60% of respondents had experience in using the internet, of which 71.1% had access to the internet

Computer skills training for farmers on the move: a bus goes from village to village, providing training courses

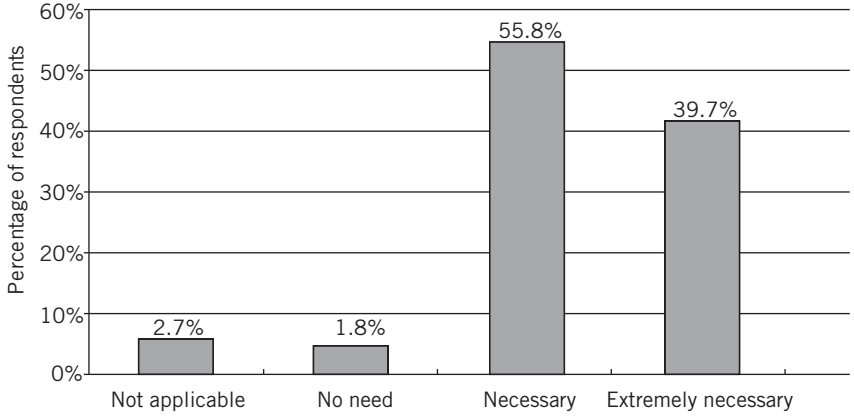

Figure 7.3 Attitude of farmers to ICT intervention

in VICs and 78% needed the help of messengers, while 22% could manage it by themselves. There was also 15.2% of them using the internet at home and 7.7% from an internet cafe.

Farmer inclination to use ICTs. The survey data also suggested that farmers had a strong willingness to use ICTs application for their livelihoods (Figure 7.3). The main purpose of their participation in ICT intervention was to gain access

to technology and knowledge, and promote economic activities. Thus, it can be concluded that the information awareness of farmers was promoted through the intervention. Of the 4.5% of respondents who thought ICT intervention was not applicable or not needed, 58.6% of them were from poor households, 33.3% of respondents had an education level of primary school or less and 20% of them were illiterate.

Human capital

Skills. The ICTs initiative helps to increase knowledge through distance education and skill training, while also providing users with a convenient means of searching for health information. Prior to the project, farmers were forced to either go to the township/county or wait for the extension service officer assigned at the township to visit their village to get the information. Due to the support of this project, 72.9% of respondents have participated in distance learning and skill training. This has enabled them to learn about crop planting and animal breeding techniques and other skills for various occupations such as driver, welder, computer operator, motor vehicle repairer, cooker, tiller, electronics engineer and straw weaver. The education and training functions of the project have helped farmers increase their agricultural income (by promoting output and quality) as well as obtain income through self-employment and also as migrant workers. For example, farmers are educated about how to use new technology for better farming practices. The respondents (63.5%) have developed large-scale animal raising operations and vegetable cultures in greenhouses. More than half of the respondents acknowledged that the project had provided opportunities for educating the farmers. Studies by Parkinson and Ramírez (2006) and Sey and Fellows (2009) support the above findings.

Health is also important for human capacity building. In rural areas, medical care and health promotion infrastructure is commonly limited, with expensive outside hospitals being the only available alternative. Meanwhile, the farmers lack health care information and knowledge. The implementation of the ICTs project has made it easier and more convenient for farmers to see a doctor through related hospital information searches, making an appointment to see the doctor in big cities, etc. According to the survey, 71.9% of respondents recognized that the project contributed to their health care. Moreover, 67.1% thought that this was mainly due to them being better able to understand and gain knowledge on health via the internet, which in turn greatly facilitated the promotion of their health.

Entertainment makes an important contribution to well-being. Entering into the information era, access to entertainment via the computer brings a new aspect to people's lives. According to the survey, 84.3% of the respondents recognized that they had more options for entertainment. At present, watching TV is still the main leisure activity in rural Ningxia. However, surfing the internet has become the second most popular leisure activity. In addition,

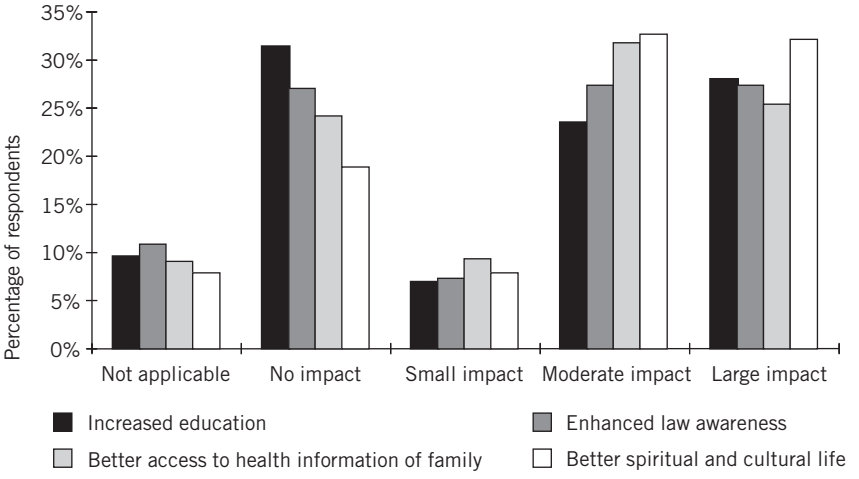

Figure 7.4 Impact on human capital

watching movies is becoming more and more popular due to related services delivered by the project. Due to the diversity of entertainment available, unhealthy habits such as gambling are eliminated (a habit which had been popular in the past).

In evaluating the impact on human capital, four indicators were used: increased education, enhanced law awareness, better family access to health information, better spiritual and cultural life which contribute to the formation of ethics including various recreational activities: reading books, watching TV programmes and movies, etc. From Figure 7.4, it can be seen that the information project made a greater contribution towards a better spiritual and cultural life. Secondly, it helped farmers have better access to health information for family members. Increased education is the key for human capacity building, but the impact on it is relatively small compared to other indicators of human capital.

Social capital

This project also facilitated the strengthening of social capital. It has firstly facilitated communication between family members. More than 60% of the respondents recognized that they now have more contact with family members than before. Households with children have been provided with better access to education facilities outside their village – it provided means for having internet chats/discussions and high-frequency communications. The project also provided a platform for village affairs management such as office automation (OA). Through the platform, the statistical reports (pertaining to agriculture, etc.) can be submitted to and accessed from government agencies via the internet so as

to reduce time and transportation costs. Meanwhile, officials in some villages used bulletin board services (BBS) and an online instant messaging system (QQ group) to distribute related government information. Due to more transparent policy information on the Web, farmers find it easier to learn about policies. As a result, farmers who are now equipped with more accurate information are willing to attend and participate in collective decision-making processes for their benefit. A significant number (57.9%) of respondents acknowledged this impact. More than 40% of surveyed farmers also thought that they could now communicate more smoothly with government departments. Therefore, government services were more effectively delivered to farmers. More than 50% of respondents reported that their participation in farmer cooperatives and management of village affairs was based on the ICT application.

Building new knowledge networks, agricultural cooperatives and networks of communication between community-based organizations and other support structures are impacts of the information project. For the farmers, sufficient trust to justify decisions was created predominantly through personal contact and, usually, a shared context and proximity to the information source. However, agricultural cooperatives can play a key role in organizing farmers to deal with market shocks. In Ningxia, some VICs are managed by agricultural cooperatives, through which important information is effectively delivered to farmers. As a sign of increased trust in the system, more and more farmers have shown willingness to join the cooperatives to access better agricultural practices and the market. The survey result showed that 50% of respondents have taken part in farmer cooperatives. Thus, the ICTs project has helped to establish new

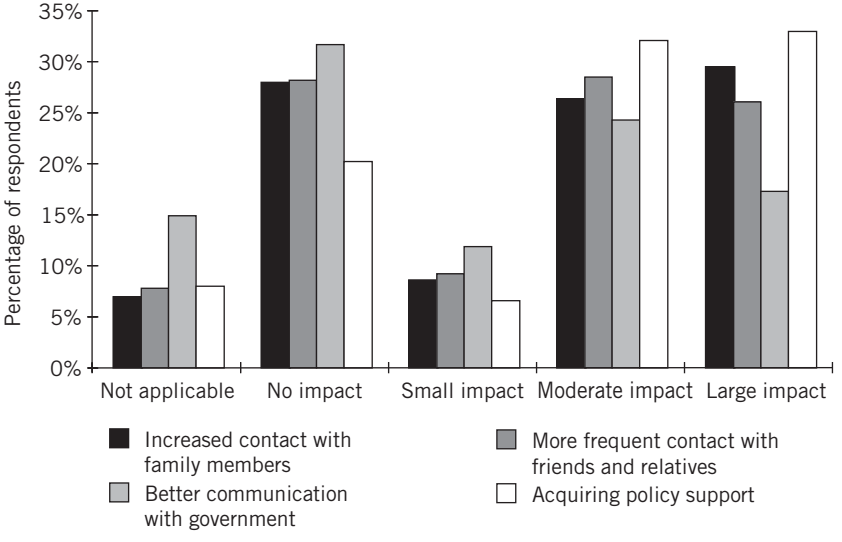

Figure 7.5 Impact on social capital

knowledge networks in local communities and support the promotion of social capital. It was also observed that increased knowledge access empowered farmers to take on more leadership roles and responsibilities in the communities.

In evaluating the impact on social capital, four indicators were adopted, including increased contact with family members, more frequent contact with friends and relatives, better communication with the government and acquiring policy support. From Figure 7.5 it can be seen that the largest impact was on acquiring policy support. For example, by access to the government's rural and agricultural support policies – such as agricultural subsidies, the Chinese Government's Consumer Electronics Subsidy Program to the countryside (The Ministry of Commerce and the Ministry of Industry and Information Technology (MC and MIIT), 2008) – and their implementation procedures, farmers can now gain timely benefits from it. The second was a contribution towards increased contact with family members. It made a relatively small contribution to better communication with the government.

Financial capital

Income is an important financial capital for farmers, which helps to achieve livelihood objectives. As a result of better farming practices from online agricultural advice and price information, farmers' income can be increased (Batchelor and Scott, 2001). A significant number (83.6%) of respondents recognized that their income increased through the information project. The main increase in income has come from planting due to the application of new cultivation techniques, promotion of the ability to control diseases and pests and the adjustment of planting structure. Although the study did not ask for farmers to declare their absolute increase in income, a study by Zhang et al. (2009) suggests that incomes rose by 100% (on a per capita basis, from sweet melon). In addition, it is also partly due to cost saving on chemicals and pesticides, increased sales and higher prices. Animal breeding ranks second, and the next is outside employment. Breeding income has increased mainly due to the application of new breeding techniques and increased disease control capabilities. For rural households, wage income is an important supplement. Depending on the skill training provided by the information project, farmers can find employment more easily. The survey data suggested that 69.3% of respondents who took part in skill training have earned more income.

Farmers have a habit of saving in rural China – savings is still a main means of financing for farmers in Ningxia. However, this project has made a contribution to providing other means of investment such as insurance, and in financial products such as funds and stocks, among which the insurance is more widely purchased by farmers. Based on the internet, farmers can now get timely financial information, and make online transactions for funds and stocks. The latter are however seldom used by farmers because of their limited income level. Through this project, the convenience of fund collection can be

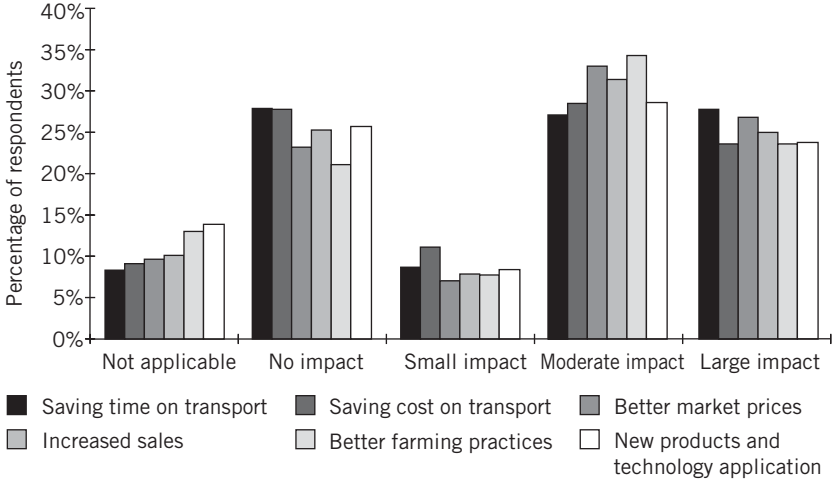

Figure 7.6 Impact on financial capital

provided to farmers. Rural banks and minor credit organizations are the main channels of fund collection for farmers. Through these, related information services which depend on the information project have been provided.

In addition, there is evidence that ICT has the potential to reduce the transaction costs associated with the exchange of information relevant to agricultural activity. ICT (primarily via the internet and telephone) can reduce the time (and hence costs) associated with receiving market information (such as prices) and the costs of conducting and agreeing to transactions. This also increased farmers' financial capital indirectly. More than half of the respondents claimed that time and transport costs were saved. The above findings were supported by Ramirez and Richardson's (2005) study.

In evaluating the degree of impact on financial capital, the following six indicators were adopted: saving time on transport, saving cost on transport, better market prices, increased sales, better farming practices, new products and technology application. From Figure 7.6, it can be seen that the largest impact lies in saving time on transport. Saving time on transport will reduce related costs (increased efficiency and time spent on other productive activities) and indirectly increases financial capital. There was also a large impact on better market prices and increased sales. If we consider the overall impact on financial capital, the measurement of six indicators showed that the influences and resulting differences are not obvious.

Vulnerability

The indicators of vulnerability used were articulated by intervention groups of farmers. Better response to natural disasters by timely access to weather

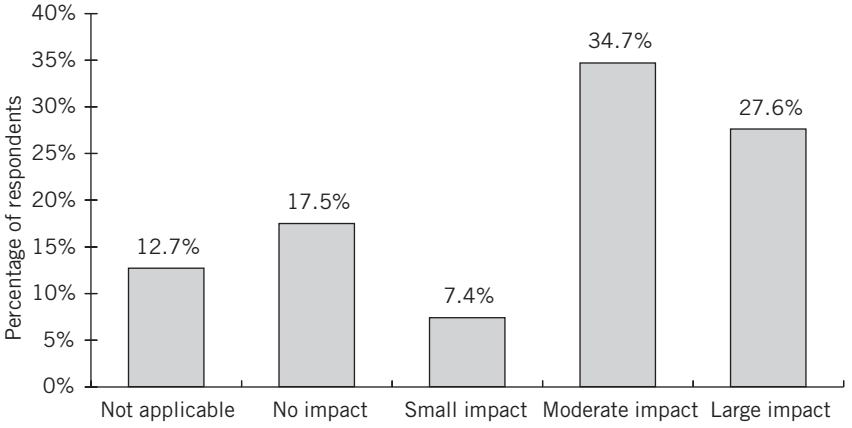

Figure 7.7 Impact on reducing vulnerability

information is used to reflect reduced ecological vulnerability. About 27.6% and 34.7% of respondents claimed that the project had large and moderate impacts in this area, respectively (Figure 7.7).

Factors influencing individuals' use of ICTs

The use of ICT varied among various groups according to gender, age, education, occupation, poor, etc. Education level is a key factor for the use of ICTs. Due to limited knowledge, the ability to use new technology varied among different groups. As the rural poor often have low levels of education, this restricts the wider delivery of services to them. It was shown that 80.6% of respondents having access to the internet had junior middle school and higher education. Due to the link between education level and age, the aged farmers are limited users of ICT-based services. The survey results showed that 63.8% of respondents who had access to the internet were aged between 30 and 49 (Figure 7.8). It should be pointed out that younger farmers, with high levels of education, tend to seek jobs and employment outside. When considering the age distribution of the sample, younger farmers were more inclined to use ICT.

Generally, rural women have low education levels. Therefore, women seldom use ICT-based services. The survey data presented the evidence that 64% of male respondents used the internet. The difference in use among different ethnic groups is not very obvious in Ningxia (Figure 7.9).

It was also found that farmers mainly engaged in non-agricultural activities and with large-scale land tend to have more access to the internet (Figure 7.10). This is because villagers mainly engaged in non-agricultural activities have a greater understanding of ICTs. They are more apt to take up use of the internet for improving their livelihoods. Farmers with more land usually tend to produce high-value commercial crops which need more market information for

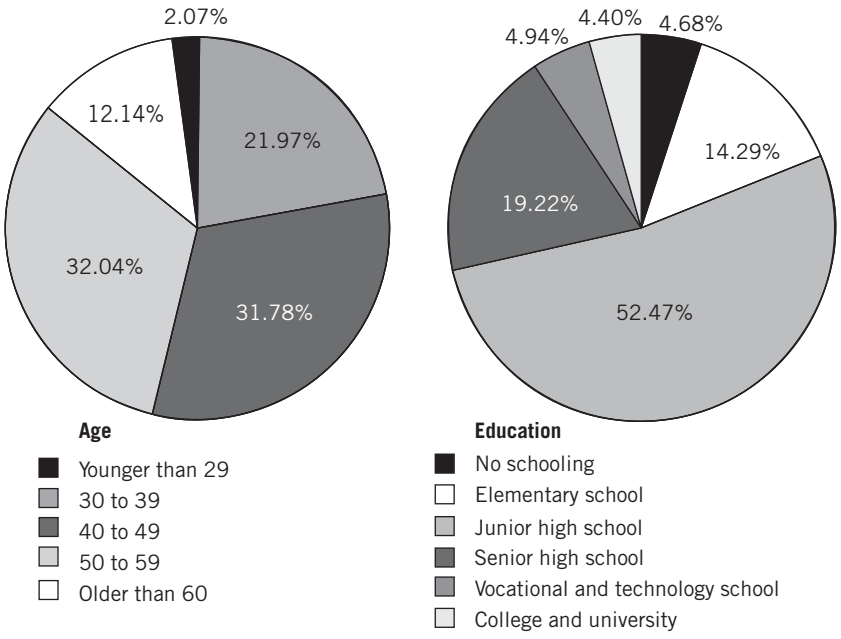

Figure 7.8 Age and education dimension of users

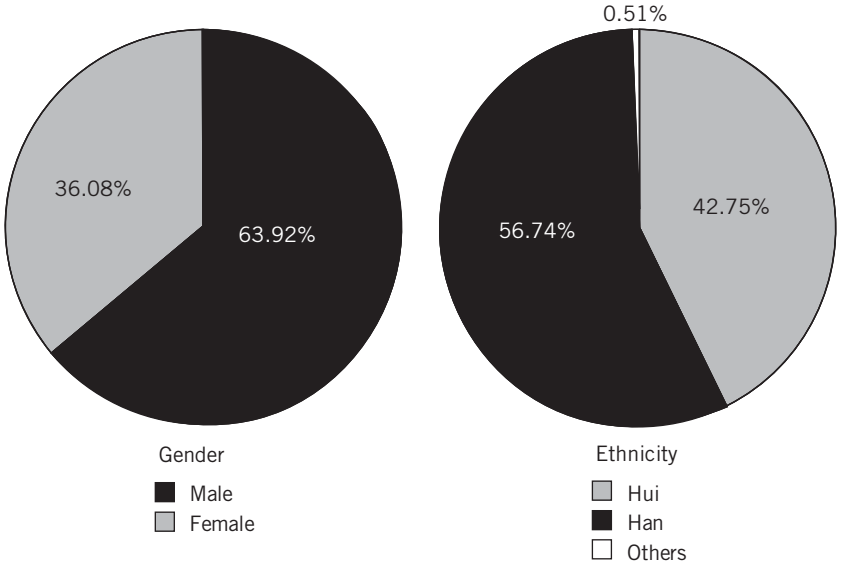

Figure 7.9 Gender and ethnic dimension of users

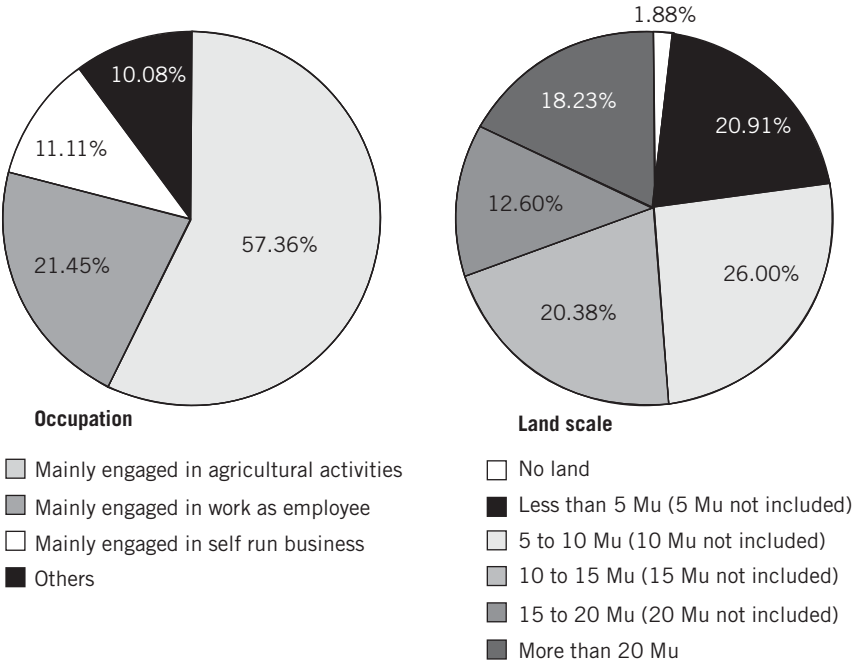

Figure 7.10 Profile of users (1 Mu = 0.067 ha)

the increased sales and prices. Therefore, they would like to use the internet for enhancing profit.

Correspondingly, the poor use few ICT services. The poor account for 42.2% of users, out of a sample which consists of 46.7% poor farmers. Although this ICT intervention provided access to information services for all farmers, the poor are disadvantaged by lack of funds, being prone to disease resulting in malnutrition and the lack of ability to work for a living.

Factors affecting regional level ICT use lead to various impacts

At the regional level the mechanisms are in place to ensure learning and information sharing based on the project. However, according to the statistics, the use of the information platform varied in the nine surveyed counties (Table 7.2).

The use of ICTs in Pingluo County ranked first out of all in the Autonomous Regions. This is due to three main reasons. Firstly, Pingluo has a more developed economy than all the other counties and this provides an opportunity for a wider uptake of the concept of ICT-based services. Secondly, the local government attaches more attention to the up-scaling of ICT-based services with a preferential policy of encouraging use of ICTs, such as providing subsidies

Table 7.2 The uses by surveyed counties

Rank	*County*	*Number of hits*	*Number of VICs*
1	Pingluo	2291	143
9	Zhongning	685	145
10	Tongxin	631	129
11	Yuanzhou	479	193
12	Lingwu	453	114
13	Longde	432	127
16	Pengyang	225	152
18	Helan	91	74
21	Hongsibu	52	49

Source: http:// www.12346.gov.cn

for farmers to purchase computers. Thirdly, a suitable market service pattern is adopted.

In Pingluo County, an e-business centre for agricultural products has been established. Agricultural products can be traded via this platform using published selling and buying information. In addition, the staff in the centre collect data on market prices and put these on the website. The messengers in each village can deliver this information to farmers in time. If the farmers think the price is acceptable, the staff in the centre can collect agricultural products in the field at the same price. Thus this cuts the farmers' transport costs. Under some circumstances, the centre also helps in searching other markets for higher prices via the internet. According to the statistics, the total trade value using the internet in Pingluo County was more than CNY 30 million (approximately US$4.4 million) in 2009 (previously there was none), the average market price increased from CNY 0.6 – 1.4 with a CNY 300 increase in farmers' income per capita (Ningxia Comprehensive Agricultural Information Website, 2009).

In Tongxin County, located in the central dry region, the VIC established relationships with enterprises which have a demand for labour. By providing relevant skilled training, the VIC coordinated with farmers' labour cooperatives and organized rural surplus labour to be employed in factories in the cities. Due to their increased skills the farmers' sustaining capability and living standards in urban areas were enhanced. In 2009, the number of employees in the county reached 60,500 with a wage income of CNY 220 million (approximately US$32.4 million). Wage incomes account for one third of the total income of rural households (Chinese Labour and Social Security Education (CLSSEN), 2009). Due to the difference in location, income-generating activity and so on, the livelihood strategy varied among regions thereby resulting in different impacts based on the various uses in different livelihood strategies.

Eagerness by farmers to gain technology and knowledge

As farmers' livelihoods concentrate on agricultural production, ICT interventions should focus on various sections of agricultural production. The internet connection of rural Ningxia has played an important role in delivering agriculture-related information services for agricultural production. The survey data suggested that the main aims of using the internet focused on acquiring technology information, knowledge learning and price information (Figure 7.11). Although the project also carried out other activities such as playing movies via VICs (amounting to over 8,000 times), the survey results indicated that this was less important for farmers. From the perception of farmers, 40.26% of respondents hoped to acquire technology and knowledge by using ICT-based services. So far, more than 6,000 internet-based training courses have been conducted for 100,000 farmers on various topics (Zhang et al., 2009). Thus, the project is helping enhance farmers' knowledge and capabilities.

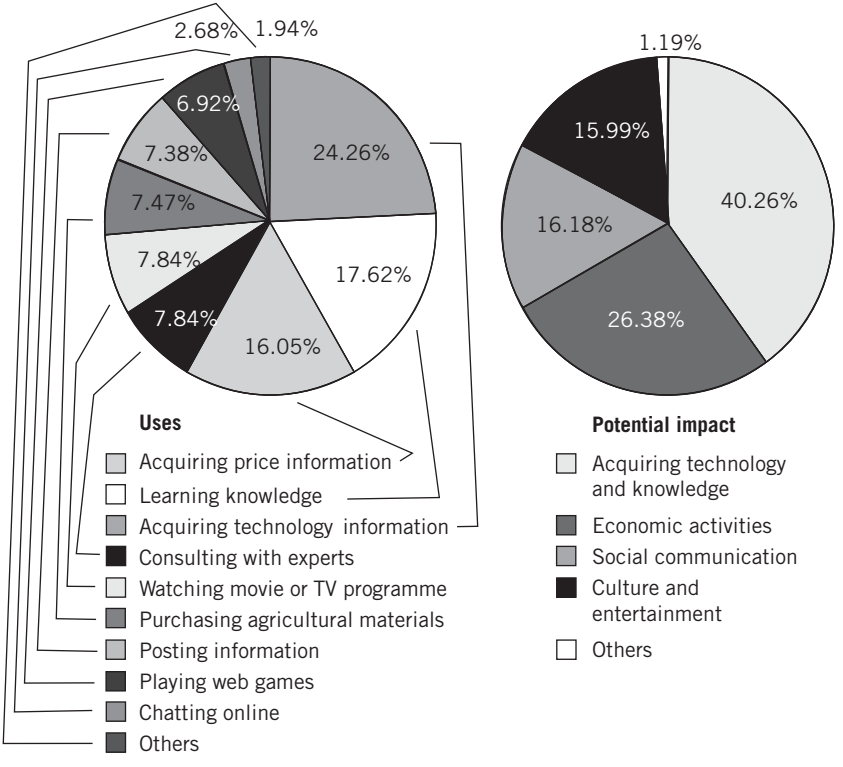

Figure 7.11 The uses and potential impacts of using ICTs for farmers

Conclusion

The study applied the livelihoods framework to identify the impacts of the rural information project on livelihood assets. Education, location and the type of income-generating activity were important differentiating factors in Ningxia. Based on the study findings it can be said that ICT application in Ningxia has had an impact on rural livelihoods. However, the potential of the project depends not only on financial assets but also on access to a broad range of other assets encompassing social, political and educational resources. All these resources are necessary for poverty reduction. Where ICT-based service is well used, it can be a supplement to, not a substitute for, existing information systems and technology extensions. In this respect farmers can be best served through the provision of affordable and accessible communication networks.

Innovative operating mechanisms are needed to link rural communities to information sources

There is a huge gap between information that resides in the agricultural sector and that which is known by rural communities. At a local level, multi-stakeholder mechanisms are important to make relevant information accessible to end users. Farmers increasingly want tailor made, quality answers to their questions. The online advisory service of a call centre in Ningxia enables farmers to get answers in real time. Services such as China Mobile Fetion (toll-free mobile text message service) are being piloted for use in selected villages of Ningxia. At the regional level, a mechanism is in place to ensure learning and information sharing among farmers. In this way, the rural information project plays an important role in knowledge sharing, bringing various stakeholders together and engaging in smooth policy implementation.

Over the past several decades information about technology has predominantly only been available to farmers via agricultural extension services and local governors in China. These data are often incomplete or not compatible with farmers' needs. Local knowledge on good practices and lessons learned about innovations is generally not captured. Presently, farmers can share information in a timely and appropriate format by using the ICT platform and the economies of scale can be realized. Internet and new video formats play an increased role in this regard.

ICTs help generate income and employment opportunities

The evaluation results indicated that 95% of respondents were generally satisfied with the information services delivered by this project, and were now more aware of the use of ICT. This provides a basis for a more substantial improvement of livelihood assets. Most farmers find themselves in a disadvantaged position when they face disease and pest problems as well as when

they have to deal with middlemen who buy their produce. More than 50% of respondents indicated that by accessing information through this project they benefited from enhanced empowerment, enabling them to acquire better input and sales prices. They also benefited from increased income by saving time and transport costs and increased sales (by gaining access to new markets and getting higher productivity due to improved production methods). While the direct impacts on financial capital can be measured, the impacts on human capital are harder to measure and value. It will take time before human capacity development yields economic benefits. The survey data suggested that 72.9% of respondents were empowered by increased employment opportunities due to the ICT-based training received through the project, and 69.3% experienced direct positive effects on their income. Through respondents' responses it was observed that the project contributed more to the building of human capital than to the impact on financial and social capital. In essence the project has improved the livelihood of rural farmers of Ningxia mainly by harnessing strengthened human capital to increase financial capital.

Diversified financing mechanism required to strengthen sustainability

A mechanism is required to encourage the private sector to provide ICT services and support. Lack of investment is often a major challenge faced by ICT application in rural areas. Although ICTs are mostly categorized as public goods, the provision of which is the responsibility of government, it is difficult to carry out long-term development depending only on government investment. Thus, enterprise investments in ICT application in rural areas should be mobilized to form a diversified financing mechanism and ICT infrastructure. Public and private sector service providers should be linked and support obtained from market-oriented private suppliers to reduce costs and provide more specific user-oriented services. For instance, as in Ningxia, the private sector can help provide training support as well as run VICs in collaboration with the government. The governments should play a key role in facilitating the marketing process by administrative, economic and legislative means, through which high-tech corporations, social intermediary organizations and other individuals are encouraged to participate in providing ICTs for rural areas. Diversified service charges will need to be introduced in order to guarantee the sustainability of the ICT platform which is presently provided to farmers free of cost by the government.

Generally, the sustainability of ICT intervention involves funding sources, information sources, a stable team of competent messengers and, more importantly, an 'upgrade' path for the facilities. The more valuable the information provided to users the greater the possibility of the long-term success of the project. Production, service, and trade-related information are the main types of information needed to meet farmers' demands. In this regard, the government might not play a decisive role and a market-oriented service mechanism

should be developed to better suit users' information needs and increase their use of the platform. Great importance should be attached to the cultivation of a talented team of information service providers. Apart from training messengers (and establishing an incentive and evaluation mechanism for them), support services should also be provided and farmers' cooperatives developed. This should be combined with the rural technical extension station and agro-businesses should have a strong link with farmers and large-scaled farms to provide information delivery and services. In this way more farmers can be encouraged to use ICTs for the promotion of livelihoods.

Enhanced use of ICT through capacity building of users

Some evidence suggests that the failure of ICT interventions was mostly related to lack of people's ability to use ICT. Although every person has an equal right to information access, the limited ability of individuals will lead to difference in the effectiveness of use. Promoting the ability of farmers to use ICT can improve the use of ICTs application in rural areas. As an ICT intervention also has potential impacts on human capital and social capital, there are interactive roles of promotion. Farmers' computer skills could be strengthened through training programmes for them. Integration of ICT interventions into other rural development projects to increase farmers' exposure to technology, improved training mechanisms among messengers to train farmers and provide information as well as changing the perceptions of farmers towards ICT by publicizing new technology trends and demonstrating their effects are some more ways of increasing farmers' skills and capabilities in ICT.

Notes

1. The national 11th Five-Year Plan (2006–10) referred to the campaign of portraying China's 'new countryside' as featuring 'advanced production, a well-to-do life, civilized folk ways, a neat look and democratic management'.
2. Ningxia call centre for farmers. Available from: http://www.12346.gov.cn

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About the authors

Professor Nie Fengying is working at the International Information Division in the Agricultural Information Institute of the Chinese Academy of Agricultural Sciences. Her research areas focus on food security and rural communication. She is currently involved in doing research that is funded by the UN on household food security in vulnerable communities in six counties of China.

Dr Zhang Li is an Associate Professor who works at the International Information Division in the Agricultural Information Institute of the Chinese Academy of Agricultural Sciences. Her research areas are agriculture information

analysis and management and she also works with the Ministry of Agriculture in China for information collection and analysis.

Ms Bi Jieying is a research assistant at the International Information Division in the Agricultural Information Institute of the Chinese Academy of Agricultural Sciences.

Liu Fujiang and **Tian Xiaochao** are students of Graduate School at the Chinese Academy of Agricultural Sciences.

CHAPTER 8

Beyond projects: making sense of the evidence

Jayantha Gunasekera and Ramona Miranda

What are the common findings across the six projects described and discussed in the previous chapters? What new evidence do we have to confirm both what we already knew and what we merely suspected? These and other key questions concerning the overall evidence presented in this book are discussed in this chapter. After a summary of the projects, the findings are presented within a sustainable livelihoods framework. Some emergent themes are then discussed.

The projects

The previous six chapters have presented a wealth of evidence about the impact of ICTs on rural livelihoods. The rich data revealed by each project is challenging to assimilate into a broad picture. The purpose of this chapter is to help the reader assimilate that strategic view of the evidence that arises from the projects. The conclusions provide the reader with a synthesis of the impact that ICTs can have on rural livelihoods. Beginning with a summary of the projects, the pertinent findings are presented within the sustainable livelihoods framework.

The research projects investigate strategies, processes, methods and technologies to support rural communication and knowledge networking, and develop recommendations for future activities. The projects aimed to foster a culture for knowledge sharing and learning amongst all the stakeholders of IFAD projects (see www.enrap.org).

The main focus was to ascertain how ICT can and does impact the lives of rural communities in Asia – particularly in relation to improving livelihoods by addressing various information and communication asymmetries in agricultural extension work. This was done with the implementation of new interventions as well as assessing the impacts of existing ones. The six projects under this research programme covered a range of ICT initiatives and geographies in Asia: China, the Philippines, India and Sri Lanka. To bring a focus to livelihoods the sustainable livelihoods framework (SLF) was used and it was felt that this could provide a rallying point of comparison for the whole research programme documented in this book.

Scoping studies were carried out initially in both South Asia and South East Asia to understand the status of the ICT uptake and the work already being carried out, and based on this the project was designed. *Practical Action* as the technical lead for this research brought in its strength in analysing the interventions from the livelihoods perspective, and focusing the individual research on the improvements to the livelihoods of the beneficiary communities, as opposed to customary focus of ICT for development projects on the ICT device and software itself. *Practical Action's* extensive experience in applying the disaster-resilient SLF (Ariyabandu and Bhatti, 2005), which is the SLF adjusted to also take into account increasing disaster risk, assisted in focusing the research. Seeing access to information as a means of enhancing the assets in improving livelihoods was an important element. Use of control groups in the research, so that a better level of attribution of the change seen could be made, was a key aspect of this research.

Each research study irrespective of whether they were action pilot research or post evaluations, had well-defined research questions and hypothesis. The methodologies comprised both qualitative and quantitative analytical tools. One of the unique qualities of this research study was that, every research study except the post evaluation of China's rural information project, used a control group to compare and strengthen the attribution of results of the ICT intervention. In the case of China, comparison was done with perception analysis on recall basis. Control groups in social sciences have long been used, but not extensively in ICT4D research.

The cross section of projects within this research included both new pilot action research (three studies) and evaluation of past interventions (three studies), providing a spectrum for analysis.

Findings in relation to the SLF

The lessons and findings of this research are synthesized and presented under the headings of impact on livelihoods assets, reduction of vulnerability and transformation of structures at par with the SLF.

Enhancement of livelihood assets

One of the fundamentals of livelihoods approach is related to the improvement of the assets in varied forms. This stems from the presupposition that 'no single category of assets on its own is sufficient to yield all the many and varied livelihood outcomes' (DFID, 2000).

Information and communication technology (ICT) can support livelihoods in several ways: by providing access to information needed by the poor in order to pursue their livelihood strategies; and by supplying information to inform the policies, institutions and processes that affect their livelihood options. For example, ICTs have an important role in poor people's livelihoods through

enhancing their access to a wide range of assets; these have been discussed by studies before (Duncombe, 2006) and some of them have been included in Table 8.1. The table shows that there has been significant improvement in all of the assets except that of natural capital. It must be noted, however, that some of the evidence is based on perception surveys (Chapters 6 and 7), while

Table 8.1 Perceived impacts on livelihood assets

The assets	*Link with livelihood improvement*[a,b]	*Evidence from the research*
1. Natural capital (natural resource stocks from which resource flows useful for livelihoods are derived)	*Improving access to information about availability and management of natural resources,* or through strengthening market access for agricultural products. *ICTs can also support early warning systems to reduce risk and vulnerability to natural disasters and food shortages.*	Improving of market access for produce were seen in Chapters 3, 4 and 6. Eliminating wastage of produce – Chapter 2.
2. Social capital (social resources on which people draw in pursuit of livelihoods i.e. relationships, membership of networks)	Strengthened connectivity and contact for geographically disparate households and social networks. Communications allow migrant workers to remain in touch with families and remit finances Community groups have access to e-governance and related information. Advice for life events – Telecentres and other public or semi public sources offer opportunities for getting advice and information re life events Linkages between farmers across villages and learning from each other. Collective action address the inefficiencies, coordination problems, and barriers to market access. *Intermediary and advocacy organizations to access information and provide a platform for advocacy initiatives.*	More contact with their families – Chapter 7. Farmers enabled to upload and download information to and from government agencies regarding agriculture, health and have improved knowledge of policies – Chapter 7. Building intra-village social relations and increasing inter village networking – Chapter 4 Increase in social networks - vertical and horizontal networks by a much larger margin than seen in the control group – Chapter 5. Farmers show interest in other information such as weather forecast, market price (spot, future and local mandis), availability of credit from formal financial institutions and on insurance schemes – Chapter 3. Increase in interactions with other traders; increased farmer interactions on livelihoods between farmer groups, relatives and neighbours – Chapter 2. Local facilitating institutions – Chapter 3.

Continued

Table 8.1 *Continued*

The assets	*Link with livelihood improvement*[a,b]	*Evidence from the research*
3. Human capital (skills, knowledge, ability to work, good health which enable people to pursue different livelihood strategies)	Distance learning through specialist broadcasts (satellite and internet), capacity building at community, government and organizational levels. Providing access to knowledge through agricultural extension. Learning through and with ICTs. Access to Health information services. New working skills – learning specific computer based skills, but also operating phones shops, etc.	Education, skill enhancements – Chapter 4. Distance learning and skill training initiatives – Chapter 7. People are in process of learning new methodologies in agriculture, learning of new innovative practices happening elsewhere – Chapter 4 Roles of motivators and facilitators recognised – Chapters 4 and 7. Farmers as well as other local people involved in the initiative, improved their awareness and skills in accessing ICT services – Chapter 7. Improved healthcare – Chapter 7. Improved decision making process – Chapter 2. Desired behavioral changes whereby they have begun to consider growing other higher value crops – Chapter 2.
4. Physical capital (basic infrastructure for the supply of energy, shelter, water, transport and communications, production equipment)	Access to information and communication technology Knowledge of basic rights to infrastructure and therefore enhanced ability to lobby utility providers. Reduction of transport needs through the use of ICTs. Access to improved production equipment through more extensive researching of products (through ICTs). *Enabling service providers to monitor access to local services.*	Access increased in three of the studies. But in all studies, the technology was begun to be perceived as an information service providing tool as well. Reduction in information asymmetry – Chapter 2. Reduction of transport costs – Chapter 7. Significantly better perceptions on the concerns related to education access and quality, regularity of income, training on livelihood, and improvement of transportation – Chapter 6. Some bought machinery for agriculture – Chapter 4.

Table 8.1 *Continued*

The assets	*Link with livelihood improvement*[a,b]	*Evidence from the research*
5. Financial capital (financial resources available which provide livelihood options e.g. savings, credit, remittances, pensions)	The increases in profit margins that result from increased access to improved information – e.g. ability to sell at best market prices, ability to sell beyond local market. Possible increased access to financial services. Increased remittances from migrant workers. *Improve the organizational effectiveness and reach of financial organizations. Mobile banking can enable greater access for the poor to banking facilities and provide a secure place for cash deposits including remittances.*	Reduction of transaction costs – Chapters 6 and 7. Improve their farming practices, receive better market prices, increase sales, and save time and transportation cost – Chapter 7. Skill training has also resulted in accessing more diverse means of investment such as insurance – Chapter 7. ICT can increase farm productivity, can increase farm income, can help expand livelihood, and can contribute in starting a business – Chapter 6. Increase in produce helped them in better earnings and savings – Chapter 4. Increase of net income by 15 per cent more than the control group – Chapter 3. Utilised price alerts to realize higher prices – Chapter 2. Drastic decrease in loan borrowings – Chapter 4.

[a] The *italicized* points are some potential impacts that could be improved by ICTs. However, these were either not addressed by the current research or there was no visible change.

[b] The key factors listed here are extracted from Batchelor and Scott (2001), Eldis website and evidence from the research.

some of the evidence is supported by observations and data that indicate or validate the improvements.

Of those listed above, some of the most salient are highlighted here. Farmers living in very remote areas sometimes have to travel to cities spending the whole day in search of advice, market prices and make deals with buyers. The e-AGRIKultura project in the Philippines (Chapter 6), the rural ICT project in China (Chapter 7) and the action pilot research on price transparency in Sri Lanka (Chapter 2) have collected evidence to conclude that ICTs can be utilized effectively to reduce the transaction cost by facilitating easy access to services and information. This saves money and time for farmers. Investing these savings on productive activities can bring multiple benefits to farmers, especially in building physical, financial and human capital.

The ability of ICT systems to diversify the livelihood opportunities for the rural poor has been observed. Balasuriya and de Silva's study in Sri Lanka (Chapter 5)

provides sufficient evidence to say that ICTs can reduce unemployment and underemployment by linking the demand with the supply of skilled labour in rural job markets. In China (Chapter 7) it was found that apart from the expected benefit the farmers have of being able to access technical information, ICT systems have also opened up avenues such as internet-based marketing (if not for farmers at least for those who operate the information systems from villages), having a direct positive impact on the sales of the farmers' produce. The evidence from the Philippines e-AGRIKultura evaluation (Chapter 6) shows that communities are willing to learn and utilize ICTs as it facilitates livelihood expansion, and thus the potential to enhance livelihoods.

Among the indirect benefits of these ICT initiatives were improved medical care, education and social networking. This shows the potential of ICT systems to improve accessibility to such services through enhanced connectivity. ICTs can shorten the distance between the rural communities and services that they cannot access (Chapters 4 and 7). Further, it was observed that ICT systems can also contribute towards improving communication between the communities and government departments which leads to increased access to government services and improved quality of services. This is mainly due to the ability of ICT to offer a wide range of administrative services and its ability to facilitate frequent contact with communities. Development of confidence and skills of communities to use ICTs also contributed to these positive changes. All these directly contribute to development of social and human assets.

Reducing vulnerability

Information plays an important role in reducing the vulnerabilities of livelihoods of rural communities as the majority of rural livelihoods are agriculture based. 'People's livelihoods and the wider availability of assets are fundamentally affected by critical trends as well as by shocks and seasonality – over which they have limited or no control' (Batchelor and Scott, 2001). ICTs cannot do much to assist the poor in reducing their vulnerability. However, there are two key enabling applications: a) an analytical role for information in assessing the vulnerability context; and b) a need to communicate that information to those who can act upon it (Duncombe, 2006). The research reported here falls into the latter category, referred to in Chapter 1 as functional applications.

In the arena of rural agricultural livelihoods, rural production systems are vulnerable to unexpected weather changes, changes in market dynamics and unexpected pest and disease attacks. Three of the six research studies in this initiative focused on the provision of forecasted information or information that enables the farmers to forecast. The LIRNEasia initiative in Sri Lanka (Chapter 2) provided daily market prices and on request price forecast information and the EKGAON Action Pilot research provided nutrient application

information (Chapter 3). In all these three cases farmers have been able to take timely decisions, especially on which crop to cultivate, what amount and when to apply nutrients, what preventive measures to take when facing future disease or pest attacks, when to harvest and what price to demand at a particular time. Thus, the ability of ICT systems to provide reliable and timely information can reduce the vulnerabilities of rural livelihoods. For example, assessing how seasonal or market fluctuations may impact upon livelihood outcomes by the service providers and then feeding that to the farmer for him to act upon reduces the impact of shocks and seasonality.

Another key area of vulnerability reduction is the reducing of isolation. Remoteness impacts heavily on the ability for service provision, and ICTs can help overcome this. Overcoming isolation through the absence of accessibility infrastructure was noted in the Philippines study (Chapter 6).

Diversification of livelihoods is another strategy to reduce vulnerability. Diversification was seen in different forms in this research, ranging from the expansion of livelihood opportunities among rural households, by improving both farm and non-farm incomes as in the Philippines case (Chapter 7), to a more limited diversification as in the diversifying of crops cultivated as mentioned in the LIRNEasia study (Chapter 2). However, as one study (Chapter 5) noted, the information alone is necessary but insufficient; actual opportunities for diversification, for example non-farm employment, need to exist.

It can be said that access to wider social networks that bring about stronger coping mechanisms and access to advocacy networks and government were also seen in many of the research studies. Better health care and access to all groups within society can also reduce the vulnerabilities of less-powerful segments such as women.

An area where there is potential but not quite reflected in this research is the enabling of the rural poor, especially farmers, to get climate data by communicating it to them as part of early warning systems that can protect against natural disasters or impacts of climate change on agriculture.

Transforming structures

Transforming structures and processes within the livelihoods framework are the institutions, organizations, policies and legislation that shape livelihoods (Batchelor and Scott, 2001). The relationship of farmers to the institutional framework (both formal and informal) surrounding the agricultural sector has a great bearing on their livelihoods. The government-led extension services have been one of the key features of rural livelihoods in the traditional system as these livelihoods are mainly provided by agriculture, livestock, fisheries, etc. However, there prevails a negative perception of the extension systems of developing countries (Qamar, 2005). This is the result of many limitations in the system. Lack of resources for the governments, lack of access to new

agricultural knowledge and mismatch of the institutional set-up are some of the key issues faced by the traditional extension systems.

Apart from the above, globalization, market liberalization, privatization, decentralization, focus on client participation on decision making, natural and man-made disasters, rural poverty, food insecurity and impact of climate change demand much more than ever; the traditional extension systems need extensive reform (Qamar, 2005).

The evidence from field research, especially the evaluation of China's rural information project (Chapter 7) and the e-AGRIKultura projects of the Philippines (Chapter 6), shows the potential of ICT systems to face the above challenges. In the case of China, village information centres (VICs) are managed by the agricultural bureau, science and technology department or by private sector agrochemical companies. In this case ICTs have been able to attract more players to agriculture extension. Facilities such as office automation and instant messaging systems provided by the rural communication project have been able to increase the interaction between the farming communities and government officials, and especially, agriculture expertise that was previously beyond their reach. In the case of both China and the Philippines (Chapters 6 and 7) the systems have also helped to improve two-way communications and communicate government plans and policies to the farmers and updated agricultural data from the field to policy makers at the governmental level.

The most common finding from all the research is that ICTs can complement rather than replace the traditional extension system by bringing in more value-added services, and giving solutions to other development issues. In transforming the structures there is also a need for substantial learning about adapting ICT interventions to suit the needs of the rural poor.

Making sense of the evidence

Value of information provided

There is substantial evidence to conclude that the adoption of ICT-based information systems by farmers depends on the reliability of the information source and how credible and worthy of trust it is. In many cases when the ICT system is introduced or operated by a credible organization, due to past experience of successful partnerships, the rate of adoption is high. In the case of both IRRAD and EKGAON studies (Chapters 3 and 4), farmers had positive working experiences with the agency that introduced or implemented the ICT system. This facilitated increased adoption rates.

Public versus private ICT initiatives

In many cases ICT inventions are supported either by government organizations or NGOs (Rainford, 2006; Kapadia, 2004), and essentially the services are subsidized. Given the context of high cost of initial capital and lack of ICT

infrastructure in rural areas, external investment can be justified to reduce the disparity between rural and urban communities' access to ICT services. A carefully designed business and investment model can be seen as an essential element in terms of sustainability of ICT systems for livelihood development. However, despite many ICT interventions successfully offering their services there is hardly any evidence to say that these experiences have generated enough lessons to formulate investment and business models for the purpose of replication in other similar rural contexts and areas. There are many good examples (Roldan and Due, 2008) around the world where the private sector has been very active in taking ICT services to rural areas, especially mobile phones. In this context some argue that the investment model for rural ICT infrastructure should be private sector driven (Hanna, 2009; Ruben et al., 2007). Others are of the view that it is unlikely that the private sector is willing to undertake such a long-term and high-risk investment of rural ICT infrastructure development. Alternatively, many are of the opinion that public funds can be used to develop ICT infrastructure in rural areas, attract ICT service providers and create competition to get the best for rural communities (Hanna, 2003). 'Can the governments of poor countries afford to make such investment?' and 'What priority will ICT infrastructure get in development agendas?' are two basic questions that need to be considered when making such recommendations. Many believe that the best option would be to embark on more private–public partnerships (Dhawan, 2005).

This prompts the need for the researchers to further analyse ICT systems to deliver livelihoods outcomes investment frameworks. Such analysis needs to consider not only immediate returns such as increased income, reduced costs and increased livelihood and market opportunities but also the ICT system's ability to attract external investment, and its ability to mobilize resources on rural infrastructure and services directly or indirectly linked to livelihoods.

The research studies have given some thought towards defining elements of sustainable business models to deliver ICT-based services to the rural poor. The marketability of information services can be increased by offering diversified information; such as technical information, market information, weather forecast information and even general news alerts.

Indirect cost recovery is another element that increases the sustainability of services. Instead of individually targeted services; service providers can approach the farmer through associations which facilitate the farmer association to recover the cost of services through a membership fee or other revenue-generation mechanisms.

Evidence from the price transparency study in Sri Lanka emits a strong positive signal regarding the viability and sustainability of partnering with an existing business organization. Building on existing infrastructure and existing ICT services would be considered as one of the best business models to introduce new services.

ICTs to complement traditional systems

Traditionally, agricultural extension services are provided by government mechanisms in most of the developing countries. These services are dysfunctional due to multiple reasons such as the lack of resources, vast geographic coverage and the lack of access to new knowledge by the extension officers. Given the context above can ICTs replace traditional agricultural extension services? This is an area that many researchers tend to explore as a solution to the above problem. The four action research studies are implemented quite independently from the government extension services leaving no evidence to prove or disprove the argument. However, evaluation studies in China and the Philippines show that rather than replacing them, there is a great potential for ICT-based systems to complement traditional agricultural extension services by providing solutions to the above problems. In both cases ICT systems have been able to build the capacities of the extension workforce, reduce the travel time and cost of extension services, offer value-added services and add alternative extension work force.[1]

Training in ICT use

Adoption of ICT systems by communities is based on several factors. The level of literacy and capacity to use ICT systems is one of the major factors that influence adoption. It is observed that where there was training, the rate and speed of adoption were high. This prompts the need to consider different levels of usage and adoption in different countries. Therefore, it is important to consider training as an essential element of ICT systems in the rural context and the need to incorporate training into the system.

Facilitating women's use of ICT services

Development experience around the world indicates that certain cultural practices are a hindrance to the participation of women in development activities. ICT use is no exception (European Commission, 2009), and it is reported that there is a very low percentage of women who come to community facilities to access ICT services in rural areas. This was seen in Chapter 7, where women, due to cultural reasons, came less to the village information centres. Lower education levels in women in rural settings was also seen as a contributory factor.

In some cases, an ICT-based livelihoods support system requires that their mobile phone numbers have to be shared (given out) in order to achieve the benefits of the systems. They will also frequently be contacted by unknown parties for business purposes. This is not accepted in some cultural contexts as illustrated in Chapter 5.

Therefore, it is essential to take into consideration the cultural contexts and particular barriers that women may face in accessing ICT services when designing ICT intervention at the village level. Taking measures to ensure the

privacy of women's contact details and devising ways of introducing trusted and transparent intermediaries to facilitate interaction between women and prospective business partners should be explored further. Attempts at addressing this aspect emerged in the study in China (Chapter 7). It is also important to devise mechanisms to take the ICT service an extra mile to reach women who have limited opportunities to travel away from the vicinity of their houses or villages for various reasons.

Limited opportunities for ICT use?

The studies have observed that the usage of ICTs is higher among farmers who have bigger plots of farming land. The researchers have argued that this is because they have opportunities to use ICTs compared to farmers having smaller plots of land. This poses a serious threat to the objective of utilizing ICTs to eradicate poverty and improve livelihoods of the most marginalized. This prompts the need for more integrated development where ICT is combined with other development plans, often referred to as mainstreaming.

Diversity of users

More often ICT-based agricultural information systems have to cater to diverse agro-ecological characteristics covering large geographical areas to achieve its economies of scale. This means that the system has to cater to diverse agricultural needs (farming techniques, cropping patterns, diseases and pests), socio-economic contexts and different educational levels. In certain cases, for example in India, there is also diversity in the use of language even if the language is the same. This ground reality causes a challenge for a centrally managed information delivery system to update its databases with local content. The evaluation of the 'LifeLine System' reveals that if not all, some of the prescriptions recommended by the ICT system for treating cattle are not available in the local market. The reason behind this is: the experts who develop the prescription database come from one region and the application of this medicine is in another region. The same study also revealed that the communities find it difficult to understand the accent of the voice messages in which they receive the advice. Again the reason is the same, regional diversity; the use of language in the region the database was built is different from the use of language (mainly accent) in the region it was used.

Up to what level local knowledge can be captured and updated frequently and how to get the participation of local knowledge providers in achieving this task is something that needs to be researched further. Use of local knowledge networks to capture local knowledge and decentralized databases are some of the options that can be explored.

On the one hand increasing the geographic coverage and agro-ecological diversity is healthy for the sustainability of the ICT system in terms of the

business. On the other, meeting the diversity through a central ICT system is challenging and may not be cost effective. Establishing a balance is essential for providing accessibility and economies of scale.

Human interface in ICT

There are many barriers faced by rural communities when trying to access ICTs from remote locations. These can be economic, social, cultural, gender and skill related. Sometimes, user friendliness (e.g. some farmers did not like voice recording answers) also affects the extent to which the ICT systems are adopted. In most of the cases in this research there is a common element that has contributed to the success of the ICT system; a human interface between the community and the database. Some of the good examples are the '*kisan mitras'* in the LifeLine system in India and the 'messenger' in the rural ICT project in China which has impacted on the use of ICT by communities and the increasing benefits. The additional benefit of having a human interface is the ability to interpret information into useful advice. It is important to note therefore the influential role human interface can make in transforming the technology-based information system into a user-friendly information and advice service.

Helping to adapt to climate change

Vulnerability of rural agriculture to impacts of climate change is currently at the centre of development discussions. Given ICTs' ability to provide technological solutions to agricultural problems the authors believe that ICTs can be effectively utilized to tackle climate change vulnerabilities. ICTs can make learning from the experiences of other farmers, regions and countries faster than before. Information on crop varieties and farming techniques that can withstand extreme weather conditions, measures to reduce impacts of seasonal variations on crops, etc. can be used to tackle climate change issues. It will be beneficial to explore further along these lines to make sure rural livelihoods are adaptive to climate change impacts.

Learning curve in the use of ICTs and ICT-based services

The research highlighted a learning curve in the use of ICTs and ICT-based services, which indicates that the speed with which one can expect an impact on livelihoods will change over time. The learning curve also relates to the supply side actors in ICTs and ICT-based services. One can expect that as people who demand and actors who supply learn from the experience of working in rural areas, the livelihood changes will be much faster and more visible in future. This idea has been illustrated in Chapter 1 (Figure 1.4).

Evidence from Chapters 2, 3 and 4 tends to suggest that customization is key to successful uptake by the rural farmer.

Influence of ICTs on village power structures

The research projects reveal important lessons on the social power structure and its links to ICTs. It revealed that the benefits of ICTs are more approachable by the powerful or families comparatively with better wealth in the rural set-up due to their influence on the initial setting up of ICT systems and accessing ICT-based services.

However, experience also shows that ICTs have been able to empower weaker segments of rural society to explore solutions for their livelihood and development issues. The experience from China shows how empowerment through ICTs can create new leadership in rural areas.

One of the key findings of the research is that ICTs have the potential to greatly reduce farmers' transaction costs.

Future research directions

The research carried out in the six studies presented and the seventh, which is still continuing and not presented as a chapter here, provides us with substantial food for thought. On the one hand, the research has provided some evidence and some positive indications of the possible positive impacts of ICTs on livelihoods. On the other, many of the findings are based on perceptions of the users, and as such there is a need for continued study to concretize the evidence.

There is a lot to be gained from the continued assessment of the interventions begun, and the ones that have been in existence for some time that this research has looked at. This is one of the fundamental future activities suggested.

In addition, some aspects that should be researched are outlined in the following sub-sections.

Understanding how ICTs can influence/be used to influence policies

More often the ICT systems are introduced to address one particular aspect of rural development with no reference to other development priorities and issues. These systems can bring the expected changes and impacts at the intended geographical locations. But it is learnt that ICT systems, being an integral part of the development agenda, can easily influence the policies and facilitate achieving broader development goals and widen for reapplication of successful experiences. The e-AGRIKultura project where ICT was an integral part of the agricultural reforms policy has been able to bring valuable insights to the planners and policy makers. The process of project experience creating impacts on the policy level is continuing and closely following the latter impacts would be of interest to the researchers.

Deciding to shift to ICT

When ICT-based agro-advisory services are introduced, there are some early adopters who start utilizing it effectively while there are some late adopters and laggards who continue to use the same channels they used before. According to Balasuriya and de Silva in Chapter 5 this may vary based on the farmers' trust in the service providers based on previous agro-advisory services as well as on the strength of marketing and promotion campaigns, etc. However, in this research the factors behind the farmers' decision to shift from the conventional information sources to ICT-based services are not clear. It would be interesting to know on what basis the early adopters, late adopters and laggards make their decisions to shift from the current information sources to ICT-based services.

Conclusion

The research has provided substantial evidence to say that ICTs can be effectively used to address the issues of rural livelihood development. Facilitating access to useful information by rural farmers, effective communication between the farmers, markets, service providers and policy makers, strengthening linkages between stakeholders, creating transparency among market stakeholders, early warning on weather and diseases, and developing institutional and individual capacities are some of the areas ICTs can directly impact.

The experiences reported here should help to influence the development of ICT policies and interventions. There are some successful models of delivering ICTs for rural livelihood development and some evidence about what works less well.

Note

1. In China, village level youth act as the human interface between the farmers and the ICT system to provide advice based on what they learn from the system.

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About the authors

Jayantha Gunasekera has 13 years of experience in development in particular, enterprise development in the sectors of agriculture, agro-processing, fisheries and rural energy services. During his career he has conducted research on microenterprise models that suit different rural agriculture and agro-processing contexts, women-based enterprises, impacts of ICTs on rural livelihoods and post-crises livelihood development. Jayantha has been instrumental in setting up a social enterprise; Rural Enterprise Network, to promote agricultural and agro-processing microenterprises. He was a member of the team that conducted the global research; 'Enhancing the Livelihoods of the Rural Poor through ICT' for World Bank and led the Sri Lanka component of the research.

Ramona Miranda has over ten years' of experience working as a communications specialist with Practical Action South Asia, and years of media experience in print, audio and online media. She has completed academic studies as a Masters student in communication at the Ohio State University, as well as several training programmes covering gender and disaster management. Ramona has also been involved in developing many of the information material and knowledge products that Practical Action South Asia has produced in the past 10 years. Her areas of expertise are knowledge management, disaster risk reduction, gender and ICT for development. She serves as the focal point for the regional work on Responding to New Technologies work and in this capacity she has been involved in the ENRAP research project on ICT for rural livelihoods.

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