ICT AND AGRICULTURE IN INDIA: A PERSPECTIVE FROM THE CASE STUDY BASED ON THE OSCAR PROJECT (OPEN SOURCE SIMPLE COMPUTER FOR AGRICULTURE IN RURAL AREAS)

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Abstract - Information and Communication Technologies (ICTs) have contributed in one way or the other to many transformations in contemporary society. The contexts and the impacts of such transformations are particularly significant for developing societies like India. The relevance of new computing technologies and their effective implementation in developing countries is widely debated, both at policy and community level. Needless to say, FOSS (Free Open Source Software) has encouraged the participation of civil society, creating potential for developing specific information technology tools. In this context, the OSCAR-project (Open Source Simple Computer for Agriculture in Rural Areas) is an initiative from European and South Asian Institutions to assist decision making in agriculture. OSCAR developed a weed identification system for the major weed species in rice-wheat cropping systems of the Indo-Gangetic Plains (IGPs) covering Pakistan, India, Nepal and Bangladesh. An integral part of the OSCAR-project is its applicability to three categories of potential users: farmers, extension officers, and, scientists and students in agricultural sciences. OSCAR was evaluated through extensive interactions with farmer groups, extension personnel, IT specialists, NGO and UN staff, government officials, scientific researchers and PhD students in various disciplines and MSc students from various programs in all the four IGP countries. The experience from OSCAR is helpful in understanding the larger contexts and the impact of ICT interventions in an interdisciplinary framework.

Keywords - Agriculture; ICTs; Society; Knowledge; Interdisciplinarity.

Résumé – Les technologies de l’information et de la communication (TIC) ont contribué d’une manière ou d’une autre à de nombreuses transformations de la société contemporaine. Les contextes et les impacts de ces transformations sont particulièrement significatifs pour des sociétés en développement comme l’Inde. La pertinence des nouvelles technologies informatiques et leur application...
effective dans les pays en voie de développement est largement débattue tant au niveau politique que communautaire. Inutile de dire que les logiciels libres (Free Open Source Software) ont encouragé la participation de la société civile, créant des potentiels pour développer des outils de communication spécifiques. Dans ce contexte, le projet OSCAR (Open Source Simple Computer for Agriculture in Rural Areas) est une initiative d’institutions européennes et asiatiques pour aider à la prise de décision en matière agricole. OSCAR permet une identification de la majorité des espèces de mauvaises herbes présentes dans les plantations de riz et de blé cultivés dans la plaine indo-gangétique (IGP) couvrant le Pakistan, l'Inde, le Népal et le Bangladesh. Une partie intégrante du projet OSCAR est son applicabilité aux 3 catégories d'utilisateurs potentiels : les agriculteurs, les ingénieurs agronomes et les scientifiques et étudiants en sciences agricoles. OSCAR a été évalué à travers des interactions intensives entre groupes d'agriculteurs, de techniciens agricoles, de spécialistes des technologies, de personnels d'ONG et de l'ONU, de responsables gouvernementaux, de chercheurs et de doctorants de différentes disciplines et d'étudiants en masters de divers programmes sur les 4 pays indo-gangétiqus. L'expérience d'OSCAR est utile pour comprendre des contextes plus larges et l'impact des TIC dans un cadre interdisciplinaire.

**Mots-clés** - Agriculture; TIC; Société; Savoir; Interdisciplinarité.

**INTRODUCTION**

Today, in journalistic, official as well as popular rhetoric, ICTs are widely perceived to be problem solvers, particularly in developing societies. Governments and the press alike address livelihood problems that the vast majority of people face in terms of mere technological solutions. Such solutions are frequently devised based on this technological reductionist approach. The most common example we witness, in this regard, is the provision of market information to farmers without taking into account the farmer's ability to wait and negotiate in different markets, or his immediate social context, factoring issues like indebtedness. Another example is one of Hewlett Packard’s i-community programme as part of its e-inclusion initiative in the rural areas of the state of Andhra Pradesh in southern India, where the absence of basic amenities and fundamental issues like healthcare were to be addressed by technological fixes from HP through its community information centers (Schwittay, 2008).

Indeed, the potential applications of ICT in today's globalised world go far beyond international trade and associated economic dimensions. They urge integration of the developing societies into what is felicitously termed the information, or even knowledge, society. Also widely prevalent in this vision is the assumption that ICTs bring in efficiency, and therefore economic prosperity. As Robert Wade has aptly put it: “Area A is rich, integrated into market relationships, and has a lot of telephones; area B is poorer, less integrated into market relationships, and has fewer telephones; therefore, a telephone rollout will make B richer and more integrated”. (Wade, 2000: 449–50). In short, the potential application of ICTs to the problems of developing
societies seemingly manifold, the current discourse in this regard has tended to be overly reductionist, isolating the technological realm from its socio-political contexts.

This paper describes an exercise using an information and communication technology tool in the agricultural sector. The example taken here is a project entitled: “Open Source Simple Computer for Agriculture in Rural Areas” (OSCAR – www.oscarasia.org). The objective of the OSCAR project was to initiate cooperation between European and South Asian institutions to learn about appropriate applications of ICTs in rural agricultural areas. More specifically the project aimed to develop a decision making tool for weed identification and control that addressed the issue of declining agricultural productivity in the Indo-Gangetic Plains which cover parts of Pakistan, India, Nepal and Bangladesh. The experiences from the OSCAR project concerning application development process, its relevance to the envisaged target groups of the project viz. the farmers, the extension workers and the students and researchers would help to understand the dynamics of ICT interventions in a predominantly agrarian context.

THEORETICAL FRAMEWORK

In recent decades, the debate on developmentalism, and the power of technology to shape people’s lives has had a powerful political presence in India, through social movements against big dams, to those against genetically modified seeds and pesticides, to name a few (see for example Shiva, 1991 and Roy, 2002). The debate is often polarized between the aggressive votaries of a bland developmentalism, and equally aggressive protests against it, that embody an often impractical and sweeping suspicion of technological benefits to development.

While this wider debate has taken place in the context of agriculture and ecological damage, its effects and insights are extremely relevant to the realm of ICTs. The digital divide discourse is not so different from arguments that favoured “techno fixes” in the form of mechanized farming and large capital infrastructure over local needs. The software “solution,” secondly, involves a mixed bag ranging from the need for particular languages such as English, to specific cognitive frameworks and cultural styles and, of course, intellectual property regimes, that continue to raise the spectre of knowledge monopolies and imperialism. Finally, as Pieterse has argued, the concept of “Humanware”, a third digital divide, that turns the spotlight back on to basic issues of human development and education, and therefore questions of inequality. “Yes, education is a leveller if it is available and if it comes with other reforms-land reform, social provisions, etc.” (Pieterse, 2005).

So a debate over the importance of ICTs and local innovations to the project of the country’s development are even more relevant and urgent today. But with respect to social impact of ICTs we see only a handful of success stories instead of an in-depth analysis of such a large scale phenomenon across the world. There has been
little attempt to go beyond the anecdotal narratives of successes of some principal initiatives. Substantial, in-depth studies of the impact of ICT are critical, but are conspicuously absent. As Sreekumar et al have aptly noted, impressionistic reports of employment creation in villages have not been backed up by studies on the labour absorption capabilities of rural ICT. Anecdotes on increases in productivity and efficiency due to ICT use have yet to be empirically corroborated. Critical studies on the distribution across caste, class or other social hierarchies, have not accompanied declarations about the empowerment of the poor. (Sreekumar et al, 2008).

Here, one finds very interesting and relevant the recent scholarship on unequal power relations of contemporary developmental discourse. This has helped the debate on the development and use of ICT in the context of developing societies as one of the prime areas for critically examining such a discourse. It has pointed out that approaches to the relationship between technology and society tend to oscillate between technological determinism, where technology has an almost magic effect on peoples’ lives and actions, and a thoroughly relativist, and constructivist position where no clear path could be visualized for concrete action. (Thompson 2004: 104).

As this scholarship has emphasized, it is critical to place the debate on ICTs and development within the two larger fields of technology-society relations, and development discourse. Only by getting a more empirically nuanced understanding of how the ground-level application of specific ICTs works with users and initiatives, can we understand how meaningful they can be to developing societies.

OSCAR – THE APPROACH

The OSCAR project was not primarily a research project. It was a project, established to create an interdisciplinary space of learning. In this space of learning, it brought four different technical and social disciplinary perspectives together. On the technical side we can distinguish three kinds of scientific perspectives: 1.) the technical science perspective of weed identification; 2.) the information and communication technology (ICT) science perspective (hardware and infrastructure oriented), and; 3.) the technical science perspective of developing software applications (content oriented). The first perspective is a natural science technology perspective and the second and third perspectives are information and communication science perspectives. The fourth perspective is a social science, communication perspective.

The nature of the problem statements and the formulation of research questions and objectives are intrinsic to the respective scientific perspectives. Problem definitions in the natural sciences are grounded in epistemologies that do not involve human subjectivities. The relationship between the researcher and the researched is a subject-object relationship; whereas in the social sciences it is a subject-subject relationship (see e.g Lie, 2003: 3-5). A biological science identifies and formulates a
problem statement at a biological technical level, which means that a project stays within the biological world and does not enter a human social world.

A research project that is framed from a social science perspective would start as follows. First, a human, social problem is identified. This problem can be formulated from within the domains of the different social science perspectives. Thus, the problem could be seen as having primarily an economic nature, a socio-cultural nature or a political nature. Most of the times these natures are interrelated, but the problem is firmly grounded in human life. In OSCAR, the human problem was formulated that the production of agricultural products has been decreasing over the past decade in the IGP area in Pakistan, India, Nepal and Bangladesh. Consequently, farmers and their families and other dependencies have growing difficulties with sustaining their livelihoods. This is a human problem, asking for research and in the end, solutions. OSCAR is not primarily a social science project. It is an interdisciplinary project, but grounded in a biological science of species identification. The formulation of the problem statement from a biological perspective lies in species identification and control. The associated question is: “What is the best way to identify weed species?”, and once we know the specific species, “What is the best way to control them?” The project tries to bring these two disciplinary problem formulations and related questions together. In doing this, OSCAR has tried to address these questions by developing an open source ICT application to identify weeds and to suggest appropriate control measures and test the appropriateness of such an application to the needs of the different target groups in the IGP region.

While explaining the working of this application among its users constitutes a focus for this paper, the problem it has chosen to address however is that how far a particular ICT can be localized? To what extent can that particular ICT could be malleable enough, allowing itself to be localized, given the “real-external” constraints of access to the very products of technology, say the computer as a device, to the intended end-users, say the farmers? Does the problem lie in the relevance of the technology in itself to the perceived “local context”, or does it lie in the way the technology limits the very process of conceptualization of the problem? In other words, how far can the end-user factor himself into the way he is conceived as an user in the creation of an ICT aimed at his empowerment? Conceptualization and localization related issues are generic to any technology development and diffusion process. But in the case of ICTs, they assume complexity because of the very claims that ICTs make in being more democratic (open source applications), flexible, user-centered in the way they can be ‘developed’, which very often is the source of attraction of ICT to solve developmental problems today. This paper is then a modest attempt to capture certain facets of this complexity.

In this attempt, the paper will rely on the conceptualization and localization related experience of OSCAR, the project that is under review here. This would make it a case study based analysis, where in the methods adopted by OSCAR to assess itself vis-à-vis their stated objectives would be the guiding frame for the issues that
this paper seeks to raise. It needs to be mentioned here that within the purview of the project, user group discussion and focus group interviews in the field area of the implementation of OSCAR have primarily guided the authors to understand the impact of the project, which is discussed in detail below. This also brings up an additional problem related to ICT application centered interventions – what would be credible forms of assessment? Would it be the perceived ‘relevance’ of the end user or would it be a higher level of ‘flexibility’ that a particular component of ICT (ex. software/language flexibility, accessible device) could realize through its localization?

OSCAR – THE PROJECT AND THE FINDINGS

With rice-wheat cropping systems covering a total of 13.5 million hectares in Bangladesh, India, Nepal and Pakistan, the Indo-Gangetic Plains (IGP) is considered the breadbasket of South Asia and one of the most productive agricultural regions of the world. Extensive irrigation infrastructure, mechanization and easy access to production inputs and marketing and grain procurement services have contributed to an increase in the production of food grains in the region, in order to keep pace with the demand of rapidly increasing populations in the 70s and 80s. Along with a wider recognition of environmental issues arising from the intensive and sometimes excessive use of inputs, recent signs indicate a slowdown in the growth rates of production and productivity in this region. The main reasons are cited as land degradation and problems of increased incidence of pests, diseases, and weeds (P.K.Aggarwal et al, 2004). The long-term sustainability of these systems factoring in environmental and economic aspects is a major concern (Joshi et al, 2003). The project chose to focus on the aspects of weed identification and control since weeds are considered to be the one of the most detrimental factors hampering productivity.

The OSCAR project primarily aimed to develop an application to address one of the primary needs of farming, to identify the exact weed species and control measures which would function as a decision support system for three main target groups viz. the farmers, extension workers and students and researchers in agronomy. The technical core of the decision support system is a weed species identification system around which other aspects such as weed control measures, botanical descriptions and images were built.

The computer driven identification system, known as IDAO (IDentification Assisté pour Ordinateur) is a concept which allows users to identify botanical species in a non-traditional manner. It helps to overcome problems encountered in 1) identifying the species without its flowers or before it flowers 2) the use of dichotomous keys, which are widely used tools in the biological sciences to identify organisms by making sequences of decisions in a dichotomous way, and 3) the non-use of technical terms that are not understood by non-specialists.
The multi-media approach of the identification system helps to overcome these problems in the following way. First of all it uses sketches and images instead of technical nomenclature. It provides an easy way of navigating and dichotomous decision making based on visual comparison of characteristics of the actual species with the sketches. Thirdly, the software is multilingual and uses technical names, English names and indigenous names for the species.

The weed identification system contains a model plant species with different user selectable characters such as root, habit, leaves and flowers. Each character has a number of character states which are in turn selected by the user. Based on the user’s selection, the system displays the most appropriate match compared to the species available on the database. Once the weed species is identified the system displays information about its botanical characters, various control measures in different languages and also the relevant images of different parts of the identified species.

The OSCAR project implemented the decision support system for the weeds of IGP in different versions. They are 1) a Microsoft Windows version, 2) a Linux version, 3) a Simputer version and 4) online web based version. The Simputer invented, developed and produced in India is a handheld PDA-like computer device. By being inexpensive, portable, running on the open source operating system Linux, with network (including internet) and text-to-speech facilities, by being able to run on three AAA batteries, and by being robust, the original idea was that it could be capable of playing a role in closing the digital divide. The Simputer was intended to be ‘an access device for the masses’ (Manohar, 1998) and aimed at farming communities in rural areas. Though critiques have been skeptical about these intended target groups (McCollum, 2002; Noronha, 2003; and Ganapati, 2003), adoption of the application to Simputer was conceived to help diffusion. But during the course of the project, it was found that without widespread availability and proper support mechanisms and the higher costs compared to a traditional computer Simputers would not serve the purpose. Instead an online web based version was developed which at least would help diffusion to a wider audience though restricted by infrastructure in the rural areas.

Focussed interviews and group discussions were periodically held with the different target groups to assess the appropriateness of the application. The application in its various development stages was evaluated through extensive interactions with farmer groups, extension personnel, IT specialists, NGO and UN staff, government officials, scientific researchers and PhD students in various disciplines and MSc students from various programs in all the four IGP countries. Around 20 group discussions with farmers and students were conducted. After the group demonstration preference was given to individual testing of the application by the discussants. The individual testing of the application were followed by focussed interviews with target audiences focussing on three questions viz. a) whether the visual interface design is understandable, b) whether the navigation and the process of identification is clear and c) the appropriateness of the tool itself. The last question
was broken down into appropriate sub-questions based on the type of target audience. They are, How do you currently identify weed species? What tool for identification are you using now? Can you tell what the advantages are of using the OSCAR tool over using your current tool? Are these major advantages? Do you think the tool is an addition to your current tool or a replacement? Who do you think could be the end-users of this program? Why? What do you think about putting the software on a mobile computer so that you can take it into the field?

Based on this testing framework of the application about its appropriateness in both intrinsic and extrinsic aspects, a summary of the key findings of the study are presented as follows.

FARMERS IN THE INDO-GANGETIC PLAINS — current communication systems in place seem to work well as far as problems with weed identification are concerned. Priority issues for farmers, as far as weeds are concerned however lie with management and control and not their identification.

EXTENSION WORKERS (AT DIFFERENT LEVELS) — there seems to be no major problem in weed identification among extension officers. In a rare case, when an extension officer cannot identify a certain species, he turns to the scientists at national or university level for help. It seems therefore more logical to offer the software and database at this level. Computers are, in most countries, available from the regional/district level upwards. In most rural areas, there are no computers used in extensions services. The software and the database could be of relevance to in-service training.

STUDENTS AND SCIENTISTS — the software seems to be primarily an educational tool. It could find its relevance in school education, higher academic (agricultural) education (B.Sc, M.Sc and Ph.D levels) and in professional education in agriculture. It could also be relevant for in-service trainings at the level of 'teaching the teachers'. The free/open source nature of OSCAR generated a considerable interest among scientists and students. The freedom that the project allowed to customize the application reflecting their specific environment and needs was seen as lucrative. Specifically at the universities where both informatics and botanical skills are readily available together, this aspect was greatly appreciated.

Apart from these, the decision support system’s usage of a visual interface to the identification process was seen as a major advantage since it eliminates any prerequisite botanical knowledge about weed species, literacy issues and computer skills. If the farmers have a problem with a specific species that they do not know which happens very rarely though, the farmer turns to the extension officer and if the extension officer doesn’t know, he or she turns to the specialist at the National Agricultural Research Centre. Many people felt that the software would be useful for extension people and farmers, if issues on weed management and control are emphasized.
DISCUSSION AND CONCLUSION

To what extent does the application development process need to account for the specific, local, social contexts of end-users? What space do people, with urgent livelihood concerns of their own have, to participate in these interactions even as end-users? Boas et al have weighed the relative merits of technology transfer versus adoption and adaptation, and ground up innovation, when ICTs are applied to social and developmental initiatives. They show how boilerplate initiatives such as rural telecentres or computers in schools do not necessarily have the stated effect when these programs are initiated without completely taking into account the specific needs and concerns of the local contexts (Boas et al. 2005: 106).

Within a rural agrarian context, the OSCAR initiative assumed that the farmers do need information on weed identification and control. Conceived as a decision support system, the project could come up with interesting innovations like the use of IDAO in a non-specialist context and use of images of weeds. However, the intended end-user, the farmer - his problem was not that of weed identification but control, where concerned issues were availability of agricultural inputs at appropriate time and cost. The ICT intervention here, seemed to have fared better in the area of identification, which failed to attain relevance to the user. However, it did relate itself, by its technological innovation to the other users in the hierarchy – the extension officers and researchers. Here, we find how an intervention based on ICT had problems conceptually but still found its relevance to certain actors in the process of working itself out in the field. The process of development of the technology itself was highly limiting to the inclusion of the perspective of the farmer’s need, where as localization of the technology brought in additional problems like unaffordable devices, lack of electricity and communication infrastructure, including that of familiarity of the user with the device – which in effect is conceived to be the ‘problem solver’. However, in this case, the technology having gone through a process centered initiative did find itself useful to a limited group of users – extension officers and researchers, who were not necessarily constrained in terms of access and skills. This does point toward possibilities of a more process centered development process, albeit to highly specified group of users.

While external constraints have induced significant innovations in ICTs like cheaper devices and have brought in more legitimacy for alternative platforms for committed actors in the realm of technology development (like open source software), the very idea of ‘relevance’ still faces high levels of uncertainty, particularly in interventionist initiatives. These often cannot be relegated as familiar problems of conceptualization and localization. Because, at stake are probably the larger claims that ICTs have made in the very manner in which they seek to intervene in development, in developing societies. There, it would be a truism to say that problems are merely that of technology.
REFERENCES


