BACKGROUND PAPER: ICTS FOR AGRICULTURAL DEVELOPMENT. AN EXERCISE IN INTERDISCIPLINARITY

By Rico Lie

ABSTRACT

This paper focuses on a concrete, non-mainstream example of bringing ICTs to rural agricultural areas. In elaborating on this example of 'ICT for Development' (ICT4D), it tries to provide insights into the integration of the natural sciences, the technical communication sciences and the social sciences in a project called: Open Source Simple Computer for Agriculture in Rural Areas (OSCAR). The objective of the OSCAR project is to initiate cooperation between European and South Asian Institutions with the view to learn about appropriate applications of ICTs in rural agricultural areas. More specific the project is envisioned to the development of a decision making tool for weed identification and control that will address the issue of the declining agricultural productivity in South Asia. In the end, the long-term objective is to contribute to the betterment of rice and wheat productivity in the Indo-Gangetic Plains by improving decision-making capacities in crop management with an emphasis on weed management and control. The Indo-Gangetic Plains (IGP) form an important region for South Asia as it provides the natural resources for rice-wheat cropping systems.

The partners in OSCAR are: Centre Coopération Internationale Recherche Agronomique pour le Développement (CIRAD) from France, French Institute of Pondicherry (IFP) from India, Rice-Wheat Consortium for the Indo-Gangetic Plains (RWC) from India, and Wageningen University (WU) from The Netherlands. The project is co-funded by the European Commission under the ASIA@IT&C programme.

INTRODUCTION

New Information and Communication Technologies (ICTs) and development seem to have found each other and merged into a new field, which is often called 'ICTs for Development' (ICT4D). These new ICTs include computers, internet and email, but also mobile phones. In a sense history seems to be repeating itself as again communication technology is in the center of the discussions on development. In the '60s and '70s we had a similar focus on the role of the mass media. Television was thought to play a decisive role in bringing about social change in rural and remote areas. For instance in 1964 in American Samoa, the teachers were simply kicked out of the classrooms and replaced by television sets (see Schramm, et.al., 1981). At that time, the small unincorporated territory of the United States of America had the largest educational television station in the world. In India, the Satellite Instructional Television Experiment (SITE) project, which started in 1975, aimed to reach 2,400 villages in 20 districts with satellite television

broadcasts (Agrawal, 1985). The basic idea was to broadcast synchronized agricultural, health, nutrition and family planning messages to the rural farmer.

Despite these and other failures in achieving meaningful change through means of mass communication technologies, many international organizations involved in development and change now again incorporate a perspective on the use of the new ICTs in their activities. Many initiatives can be identified. Just to name a few:

- InfoDev, the Information and Development Program of the World Bank published many documents on the topic (http://www.infodev.org);
- UNCTAD monitored ICT changes around the world (UNCTAD, 2003);
- UNESCO and the ITU, who have a mandate for communications issues at UN level, paid a lot of attention to the potentials of the new ICTs (http://www.unesco.org; http://www.itu.int/home). Both agencies are also involved in the World Summit of the Information Society (WSIS), bringing together all stakeholders involved in the so-called 'digital revolution'.

Examples outside UN circles are also manifold and for instance to be found among the activities of development organizations such as the International Institute for Communication and Development (IICD). The launch of the new Indian Journal I4D, which grew within the years 2003 and 2004 from nothing to a leading monthly magazine on ICTs in development, is also a good example of the growing interest in ICT4D issues.

Not only these multi-sectorial organizations show a concern with the possibilities of these new ICTs, but also more specific organizations involved in agricultural development turned to this field. The Technical Centre for Agricultural and Rural Cooperation (CTA) has been very active through the organization of the ICT Observatory "ICTs – Transforming Agricultural Extension?" in 2003 (see http://www.cta.int and Engelhard, 2003) and already produced the report "Information Revolutions" in 2001. The organization continues to monitor the developments of ICT4D (http://ictupdate.cta.int). CGIAR now has a special program called the ICT-Knowledge Management Program (http://ictkm.cgiar.org/index.html). FAO and FES reviewed combined radio and internet projects in a report edited by Bruce Girard (Girard, 2003), and so on….

This renewed interest in ICTs for (agricultural) development is remarkable and triggers the question: "What is the difference between the classic mass media attempts and the 'new' attempts to use ICTs as instruments for bringing about change?" The first thing that seems to be different relates to the shift in paradigmatic thinking about change and development in general and the role of ICTs in development in particular. This change is often framed under the heading 'from modernization to multiplicity' (see for instance Servaes, 1999). The new paradigm emphasizes non-linear bottom-up perspectives and local cultural relevance. The second thing that seems to be different and is more specific is that the new ICTs, such as internet and mobile phones are not only and primarily used to reach the masses as the mass media were supposed to do. The new ICTs can also cater for small and specific audiences, which opens up possibilities for sharing more relevant and even tailor made information. As the mass media mainly aimed at national development, the new ICTs can also be appropriate instruments for aiming at local, community levels. We have also learned that the implementation of any technology needs to be participatory and sustainable in its very nature. Although difficult to implement, the new ICTs have the potential of becoming a more democratic medium than traditional media such as national television that is often operating in a national power driven environment. So, an important difference between then and now seems to lie in the possibilities of the technology itself. The possibilities of the ICTs have changed towards more flexibility as it is related to speed, convergence of media forms, interactivity and specificity (see Lie, 2003a for more information).

Also in the area of 'agricultural extension systems' or 'agricultural knowledge and information systems' (AKIS) (see for instance Röling, 2004), one of the changes taking place is the integration of new information and communication technologies. The mainstream focus of bringing ICTs to rural areas seems to be lying on (multi-purpose) telecentres or information kiosks as they are called in India. Two mainstream ICTs in the debates seem to be the use of the internet (including email) and the use of mobile phones, although mobile phones seem to get far less attention. Besides these two 'new' ICTs, radio remains one of the most important communication and information technologies for rural areas. But also the overall paradigmatic thinking about agricultural extension has changed. We no longer think in terms of 'adoption and diffusion of innovations', but talk about 'agricultural knowledge and information systems', emphasizing social learning and negotiation, participation and interactivity, the sharing—in stead of transmissions—of all kinds of knowledges, knowledge markets and networks and continuous change (see for instance Leeuwis, 2004). Within this paradigm shift from 'extension' to 'communication for change' in the agricultural sector, there is also a growing recognition of the importance of cooperation and integration of the natural sciences and the social sciences, in our case the communication sciences. Without intrinsic transdisciplinary cooperation, ICTs would only have a limited chance of being successful in an appropriate and sustainable way.

OPEN SOURCE SIMPLE COMPUTER FOR AGRICULTURE IN RURAL AREAS (OSCAR)

This paper focuses on a concrete, non-mainstream example of bringing ICTs to rural agricultural areas. In elaborating on this example of—what is now generally referred to as—*'ICT for Development'* (ICT4D), it tries to provide insights into the integration of the natural sciences, the technical communication sciences and the social sciences in a project called: Open Source Simple Computer for Agriculture in Rural Areas (OSCAR)[2]. The objective of the OSCAR project is to initiate cooperation between European and South Asian institutions with the view to learn about appropriate applications of ICTs in rural agricultural areas. More specific the project is envisioned to the development of a decision making tool for weed identification and control that will address the issue of the declining agricultural productivity in South Asia. In the end, the long-term objective is to contribute to the betterment of rice and wheat productivity in the Indo-Gangetic Plains by improving decision-making capacities in crop management with an emphasis on weed management and control. The Indo-Gangetic Plains (IGP) form an important region for South Asia as it provides the natural resources for rice-wheat cropping systems.

In order to produce the decision-making tool, the project will build on existing software for species identification. This software, called IDAO, is developed by the Centre Coopération Internationale Recherche Agronomique pour le Développement (CIRAD) in Monpellier, France in cooperation with the Institut Français de Pondichéry (IFP) in India. This tool has been developed for training purposes and for assisting non-botanists in processes of species identification. The tool helps to overcome problems encountered in the areas of a.) identifying the species without its flowers or before it flowers; b.) the use of the so-called dichotomous keys, which are widely used tools in the biological sciences to identify organisms by making sequences of decisions in a dichotomous way, and c.) the use of technical terms that are not understood by non-specialists. The multi-media approach of IDAO helps to overcome these problems in the

[2] The partners in OSCAR are: Centre Coopération Internationale Recherche Agronomique pour le Développement (CIRAD) from France, French Institute of Pondicherry (IFP) from India, Rice-Wheat Consortium for the Indo-Gangetic Plains (RWC) from India, and Wageningen University (WU) form The Netherlands. The project is co-funded by the European Commission under the ASI@IT&C programme.

following way. First of all it uses drawings instead of technical jargon. It provides an easy way of navigating and dichotomous decision making based on visual comparison of characteristics of the actual species with the drawings. Thirdly, the software is multilingual and uses technical names, English names and indigenous names for the species. Among other projects the software has already been used for weed identification in West Africa and on Reunion Island (see for more detailed information, Grard, 2004). Within the OSCAR project, the software will in a pilot phase be adapted to run on a Simputer (Simple, Inexpensive, Multilingual Computer).

The Simputer itself is invented, developed and produced in India. It is a handheld PDA-like computer device. By being inexpensive, by being portable, by running on the open source operating system Linux, by having network (including internet) facilities, by having 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 farmer communities in rural areas. Critiques have been skeptical about these intended target groups (see for instance McCollum, 2002; Noronha, 2003, and; Ganapati, 2003). Technical issues as well as economic and socio-cultural issues remain unclear. There were power problems, sales and production costs problems, but also, only a few projects have been recorded that actually use the Simputer in rural change projects. In July 2003, it was reported that 600 Simputers had been sold (Noronha, 2003) and 1,500 to 2,000 Encore Simputer machines were out in the market in September 2003 (Ganapati, 2003). According to Fonseca & Pal (2003:13) "there is limited evidence of end-user consumer purchases in rural India." The only information that seems to be available on existing projects that use the Simputer is the information that is provided by PicoPeta, one of the organizations involved in the manufacture of the Simputer (I4D, 2004).[3] These projects involve fields such as spot billing in electricity metering and microfinancing in Karnataka, India (see for more information http://www.picopeta.com/showcase/index.php). With the coming of the new Amida model of the Simputer in April 2004, the market also seems to have shifted a little bit to the urban rich and urban young who cannot afford to buy an expensive PDA, but can afford to buy a Simputer. For them the Simputer could be an interesting alternative as the price is more interesting. This shift in markets is emphasized by the way the Simputer is advertised (for instance on the website of the Simputer itself (http://www.amidasimputer.com; http://amidasimputer.com/gallery/).

The above does not mean that the Simputer could not be of interest to rural areas anymore, but, to make it meaningful, we need to look at how different disciplines that are involved in projects related to ICT4D, could work together in order to develop appropriate and sustainable technological applications.

CROSS-DISCIPLINARITY: MULTI-DISCIPLINARITY, INTERDISCIPLINARITY AND TRANSDISCIPLINARY

Within this context of ICT4D in the agricultural sector, OSCAR has adopted a cross-disciplinary approach. Cross-disciplinarity refers to crossing disciplinary boundaries and that can be done in many different ways. It could therefore serve as an umbrella term for multi-, inter- and transdisciplinarity. When a cross-disciplinary academic research project has adopted a multi-disciplinary approach, it can do more than one thing, but not in an integrated way. The different disciplinary perspectives exist side by side and provide parallel insights. They are essentially additive (see also Klein, 1990:56; Heijnsdijk, 1970). The different disciplines share an interest in a

[3] The Simputer is a joint product of Bharat Electronics Limited (BEL) and PicoPeta.

topic, like weed identification, HIV/AIDS, leprosy, or simply water, but the disciplines have their own disciplinary based perspectives and objectives. When we talk about *interdisciplinarity*, the emphasis is on 'inter', so on what is created in-between or through the intersection or at the interface of the two or more disciplines. The emphasis is on the relation, not on the separate disciplines that contribute to the whole. Interdisciplinarity is when one scientist or one group of mono-disciplinary scientists integrate disciplinary theories and perspectives that one is not familiar with through academic education and experience. It is in fact a difference between 'merging disicpines' and merely 'working across disciplinary boundaries' (Leeuwis, 2004).

Elsewhere (Lie, 2003b:199), I stated that interdisciplinarity is in fact a meeting of disciplinary cultures and made an inventory of concepts that try to grasp processes of cultural mixing. Some of these concepts could also be adapted to processes of the mixing of natural and social sciences. Terms like creolization, transculturation and hybridity could very well be applied to processes of disciplinary mixings. In this field of cultural studies, we moved from concepts such as assimilation, integration over multiculturalism to concepts such as hybridity and transcultures. The first are referring to processes of cultural adoption and unequal forms of mixing to mere co-existence. The latter are referring to forms of more equal cultural communications and the emergence of new kinds of mixed cultures. It is these kinds of new forms of *trans*grassed disciplinary perspectives that are often seen as ideal options for future disciplinary cooperations.

In the slipstream of the emergence of the participatory paradigm, the term *transdisciplinarity* seems to gain momentum in the fields that deal with crossing human, social and technical sciences (see e.g., Leeuwis, 2003; Tress, et.al., 2003; Visser, 2004). There seem to be at least two different perspectives on what transdisciplinarity entails. The first follows the work of Tress, et.al.. In addition to interdisciplinarity, transdisciplinarity tries to integrate non-academic perspectives and knowledges into interdisciplinary projects. A transdisciplinary project is a joint enterprise where non-academic stakeholders like farmers, fishermen, village leaders and extension officers create joint project ownership with academics who work in an interdisciplinary way. Academic disciplinary knowledges (interdisciplinarity) merge with non-academic, indigenous knowledges (see Tress, et.al., 2003:183). The second perspective implies that a transdisciplinary approach is an integrative approach, "based on an equal partnership between the social and the natural sciences" (Visser, 2003:27). What is essential here, is that something *new* emerges out of a collaboration; 'new' in the sense that it does not intrinsically belong to one of the interacting disciplines. This can be a new perspective, a new methodology or approach, it can be the use of new concepts or the emergence of new knowledge (see also Leeuwis, 2004:354-355). Like in the field of mixing cultures where transcultural processes refer to the emergence of something new; new forms of culture like they are for instance emerging through processes of reterritorialization. Reterritorialization is "the process in which deterritorialized cultures take roots in places away from their traditional locations and origins" (Short & Kim 1999:78).

OSCAR AND CROSS-DISCIPLINARITY

OSCAR is not a transdisciplinary project, although it could become one. It is primarily an interdisciplinary excersise in *β-γ cooperation* (Beta-Gamma cooperation). The term 'β-γ cooperation' is used here to refer to efforts that try to establish a research cooperation, or even an integration, between the 'hard' technical natural sciences such as the biological, agricultural and medical sciences, biotechnology, agroforestry, health and nutrition (the β sciences) on the one hand, and, the 'soft' social sciences such as anthropology, communication studies, economics and the social sciences in general (the γ sciences) on the other hand. The OSCAR project brings different scientists and different scientific perspectives together on the topic of weed.

In the OSCAR project at least four different technical and social disciplinary perspectives come together. On the technical side we can at least distinguish three kinds of scientific

perspectives and three kinds of scientists: 1.) the technical science perspective of weed identification >> botanists; 2.) the information and communication technology (ICT) science perspective (hardware and infrastructure oriented) >> communication/IT technicians; and, 3.) the technical science perspective of developing software applications (content oriented) >> software/program developers. The first perspective is a natural science technology perspective and the second and third perspectives are information and communication science perspectives. On top of that and what makes OSCAR an excersise in β-γ integration is the adding of the perspective of the social sciences. Although the social science perspective is far from being one coherent perspective and incorporates many different disciplinary focuses, OSCAR adds this perspective to the different technical perspectives.

One of the main fundamental differences between the perspectives is based on the fact that the different sciences define problems as they relate to the topic (weed in our case) from within their own disciplines. The nature of the problem statements and the formulation of the objectives are intrinsic to the respective sciences, which causes different approaches to projects. Problem definitions in the natural sciences are grounded in epistemologies that do not involve human subjectivities at the researched side (researcher vs. researched). 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, 2003b:3-5). A biological science identifies and formulates a problem statement at a biological technical level. Meaning 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 is 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, it needs for instance to find out to what extent the decline in the production of agricultural products is *caused by* weed identification and control issues.

The communication technology perspective that is added here, primarily seeks human social applications for technical solutions. These technical solutions are not participatory in nature. The technology is not developed in continuous interaction with end-users. The question that is asked here is "*How can the Simputer be used for species identification?*" This is solely a technical question and still has to determine a possible need for this with end-users. Combining a technological perspective with a human development perspective would lead to the more general question: *"How can ICTs be of use to agricultural development?"* or more specific *"How can the Simputer be used for agricultural development?"*. If we question this role of ICTs in general, we can identify three perspectives on the role of ICTs for development in interdisciplinary projects; a technology perspective, a **(**political-)economy perspective, and, a (socio-)cultural perspective. These perspectives are explained in Figure 1.

FIG. 1. THREE PERSPECTIVES ON THE ROLE OF ICT4D IN INTERDISCIPLINARY PROJECTS

	A Technology Perspective	**A (Political-)Economy Perspective**	**A (Socio-)Cultural Perspective**
BASICS	The perspective stays within the domain of technology. Human beings are primarily seen as users of technology.	The perspective is primarily 'from the outside in' and 'from the top down'. Human beings are primarily seen as economic factors.	The perspective is primarily 'from the inside out' and 'bottom up'. Human beings are primarily seen as socio-cultural actors.
ASSOCIATION	No association with other fields of development (outside technological development) is envisioned. This does not mean that the ICTs could not be of use to other fields of development, but the technology is not developed in a participatory way.	Close association with political development, policy and regulatory reform. The creation of the so-called 'knowledge economy' is the primary objective.	Close association with social development, processes of democratization and human rights. Access to information, the right to communicate and the use of appropriate technology are among the key concerns.
EMBEDDING	The total development of a community equals the technological development of that community. ICTs are part of that technological development. Technological development is a necessity for economic development.	The total development of a community equals the economic development of that community. Technological development and innovations are necessities for economic development. Social and cultural development is a(n) (automatic) spin-off of economic development.	The total development of a community is of an economic-political nature as well as of a socio-cultural nature. Both aspects are given equal attention, but the economic-political development should serve the socio-cultural development. Technological-economic development is not a goal in itself.
OBJECTIVE	The guiding objective is the innovation of technology.	The guiding objective is to offer media forms and ICTs to bridge the digital divide and thus (automatically) close the information gap between and within communities. The perspective is technology and media centered.	The guiding objective is to offer relevant, cultural, and social sensitive information. The media form (which can include ICTs, such as the Simputer and the internet) is chosen accordingly. The perspective is information, content, and socio-cultural centered.

Based on the above, the remaining part of this paper discusses the (communication and information) technology perspective and the (socio-)cultural perspective in more depth. The

political-economy perspective will not be discussed, as this perspective is not (yet) represented in the OSCAR project.

THE COMMUNICATION AND INFORMATION TECHNOLOGY PERSPECTIVE

THE SIMPUTER

The Final Report of ITU-D Focus Group 7 (ITU, 2000:59) reports on the potentials of handheld computers and identifies the following potential rural uses: a.) digital image capture, b.) internet/multimedia information access (WWW, ftp, telnet), c.) e-mail/messaging, and d.) voice- or text-based database access. Although the Simputer is included in the review of the ITU, additional possible technical features of the Simputer—as they were mentioned earlier—are that it is inexpensive (hardware wise[4] as well as software wise by running on the operating system Linux), that it is portable (as of course all handheld computers are) and robust.

The people from the Simputer Trust describe the device as follows:

> The Simputer is a low cost portable alternative to PCs, by which the benefits of IT can reach the common man. It has a special role in the third world because it ensures that illiteracy is no longer a barrier to handling a computer. The key to bridging the digital divide is to have shared devices that permit truly simple and natural user interfaces based on sight, touch and audio. The Simputer meets these demands through a browser for the Information Markup Language (IML). IML has been created to provide a uniform experience to users and to allow rapid development of solutions on any platform.
>
> (http://www.simputer.org/simputer/)

Although the Simputer looks like a PDA (a handheld palm sized computer), it is not a PDA and it is not primarily meant to run PDA kind of applications like keeping an address book and agenda.

FREE, LIBRE OR OPEN SOURCE SOFTWARE

The Simputer runs on Linux, which has been given much attention in the ICT4D discourse. Linux is the name of an Open Source Operating System (OS) that can be used on desktops, laptops and also the Simputer. Unlike Windows, the best known proprietary software (the opposite of Open Source Software) that was developed by the Microsoft Cooperation, Linux is free in the sense as mentioned below. The Texas, Canadian and Chinese governments have for instance already shifted to Linux and Appache, the Open Source Software that runs on webservers now has a market share of 63%, more than twice that of Microsoft products (Reddy, 2003).

[4] Originally the price was intended to be around USD 200,--. The prices in April 2004 for the three Amida models (Amida 1200, Amida 1600, and, Amida 4200) are respectively in Indian Rs 9,950, 12,450, and 19,950.

Free Software, Open Source Software and Libre Software are confusing terms for those who are not familiar with software development as most of the end-users are. Underneath the wings of the World Summit of the Information Society (WSIS), the Free Software Foundation (FSF) Europe produced a document to clarify the concepts (FSF Europe, 2003). This document first of all makes it clear that it is important to understand that Free in Free Software is referring to freedom, not to costs. Quoting one of the first documents that defined Free Software the following four freedoms are referred to: 1.) the freedom to run the program for any purpose, 2.) the freedom to study how the program works, and adapt it to your needs, 3.) the freedom to redistribute copies so you can help your neighbor, and, 4.) the freedom to improve the program, and release your improvements to the public, so that the whole community benefits.

The term Open Source is in fact a term that was introduced in the late 90s to market Free Software. The term Open Source is less value loaden and was introduced to promote the type of software by using primarily the technological features and not the ideology of freedom that is implicitly associated with the use of the term Free Software. Libre Software is then a third term for the same and was introduced by the European Commission to avoid the ambiguity of the English word Free Software and to end misunderstandings with the term Open Source Software. Open Source Software is therefore not per definition free of charge (although some of it is), but basically tries to break through Microsoft's global monopoly by introducing competition (and cooperation) again.

BRIDGING THE DIGITAL DIVIDE WITH TECHNOLOGY

Bridging the digital divide by using the Simputer that runs on Linux, means introducing ICTs and providing infrastructure (wireless or connected to desktops). From an end-user perspective, open source software is not always an interesting option. First of all, Linux, and applications that are running under Linux do not have the same status as Microsoft's operating systems and applications. Second, it might in some cases be more appealing to run illegal versions of Microsoft software than to turn to Linux. Linux is still far from being widely accepted. Although this is a known critique, it seems to have relevance only to less portable projects than the Simputer. The critique mainly applies to telecenters, school projects and other projects where major office application, such as Word and Excel can be run. Although it is possible to do basic text editing and to work with a spreadsheet on the Simputer, it is not comparable with the major desktop/notebook applications. To compare the use of the Simputer with PDAs would make more sense, but there is still little research done on the possible uses of PDAs in development.

Within this technological perspective, we must note that the tool—in our case the Simputer—that is going to be used to bring about change for the better has already been selected *before* the *inter*disciplinary problem statement has been formulated. The technical problem statement and the social problem statement have been formulated separately. This does not mean that the tool can never be appropriate in an agricultural development context, and it does not mean that we cannot match up the tool with a suitable problem. But, the fundamental question is if we should match technology with problems and find suitable problems for ICTs to solve or that we should let the character and the specific features of the problem determine the appropriate tools to be used. In this respect it might be more relevant to adopt a people centered approach in stead of a technology centered approach. Don't ask: ""What can the people do with the technology we have developed?", but ask: "How can we develop technology that people need?", "What are the technologies that are already there?", and "How can they be improved in a participatory way?".

PARTICIPATORY INFORMATION AND COMMUNICATION TECHNOLOGY DEVELOPMENT (PICTD)

Participatory Technology Development (PTD)—or if related to ICTs, Participatory Information and Communication Technology Development (PICTD)—is in fact a reaction to the many failures of technology transfers in a perspective that is closely related to the 'diffusions of innovations' and traditional ways of looking at extension services interpretated as 'telling the people what is best for them'. PICTD refers to the close cooperation of all kinds of stakeholders for the development of appropriate ICTs, but refers particularly to the participation of the end-users in the development process. The idea is that the end-users are involved in all stages of technology development. PICTD is not a garanty that the technology will be appropriate and of relevance to the end-users, but reduces the risk of the technology not being suitable. One of the most important phases in which to include the end-users is the phase of the formulations of the problem.

Many scholars wrote about Participatory Technology Development (PTD) and the approach being essential to developing appropriate technology and provided examples of cases (see e.g., Conroy & Sutherland, 2004). Others tried to structure the approach and identified phases, stages or steps (e.g., the Sustainable Agriculture Extension Manual published by the IIRR at http://www.iirr.org/saem/contents.htm, and; http://www.gtz.de/agriservice/english/topics/reform/topics1d2.htm). Important to recognize in these processes is that in order to bring about social and structural change in a sustainable way, the problem must be felt as a community shared problem and the 'solutions' must be community based. Individual behavioral change and communications that are related to this kind of change, could be part of it, but as ICTs and especially mass media are collective tools, the focus is on collective change related to the function of a community. Therefore, the formulation of the problem must be a community activity and the problem statement must be shared by the members of that community. In the end, the problem statement should not only be an integrated beta-gamma problem statement, but also a problem statement that is carried by the community (a transdisciplinary problem statement).

THE SOCIO-CULTURAL PERSPECTIVE

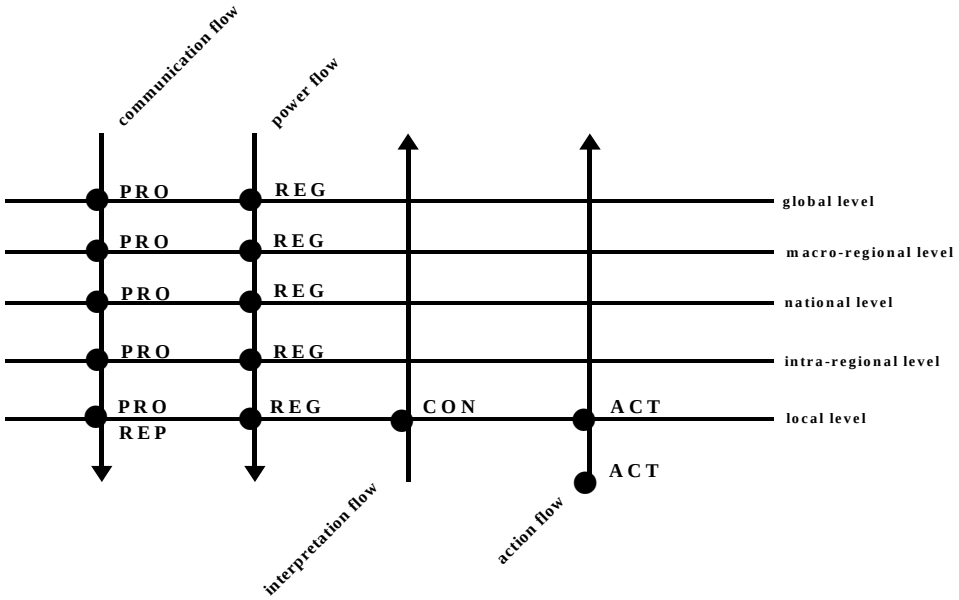
Seen from a socio-cultural perspective, the Simputer has in fact little to do with bridging the digital divide for the so-called 'rural poor' (often farmers). For the rural populations in developing countries ICTs probably corresponds to learning Microsoft Office and Internet functions. "It means learning the functions which are associated with getting jobs or advancing into higher education (word processing, including CV writing, and spreadsheets) (Slater & Tacchi, 2004:9)". Bridging the digital divide is about learning to be comfortable on a mainstream computer. The Simputer is merely a digital tool that can be used in specific circumstances and for specific purposes such as electricity billing and maybe weed identification. Having said this, let us now turn to a socio-cultural perspective within OSCAR.

APPLYING A NODAL POINTS APPROACH

To establish a socio-cultural perspective in the OSCAR project—which also tries to incorporate the political-economic perspective and the technological perspective—I will build on the nodal points approach which was first put forward in Servaes & Lie (2002) and later embedded in a perspective on spaces of intercultural communication (Lie, 2003b). Basically, the nodal points approach identifies five nodal points. The nodal points serve as focus points of

research and are created through crossing horizontal societal levels and vertical flows. The frame of analysis that is used in the nodal points approach distinguishes four vertical flows: a power flow (consisting of regulation and policy), a communication flow (consisting of media content or other information, but also products and commodities), a flow of interpretations and a flow of (counter)actions. The power flow and the communication flow are top-down flows. The interpretation flow and the action flow are bottom-up flows. The horizontal societal levels are laid out on a vertical continuum, ranging from the global level to the local level. In-between we find macro-regional levels (either defined by culture, politics or economic relations and alliances (e.g., Africa, the European Union or South Asia…). National levels are defined by the nation states. At the intra-regional levels we find provinces, counties, villages and all kinds of local communities. By crossing the societal levels with the different flows, the following nodal points can be indentified at the different levels: production (PRO), regulation (REG), representation (REP), consumption (CON), and action (ACT).

FIG. 2. THE NODAL POINTS ANALYTICAL FRAMEWORK



THE NODAL POINT OF CONSUMPTION

Consumption is the most pressing nodal point. The basic question here is related to who the end-users of the Simputer and the weed identification software will be. There seem to be three

possible groups of end-users in this regard: a.) farmers, b.) extension officers, and, c.) students and scientists.

The envisioned end-users of the software for species identification will not be the farmers at local community level. The project will not use a *primary user model*, but a *mediated user model*. This means that the end-user will not interact directly with the technology. Instead, a trained user will serve as an interface between the farmers and the technology. (Fonseca & Pal, 2003). The reasons for the decision to work with mediators are the following assumptions. a.) There will not be sufficient facilities for maintenance of the hardware at the local community level. b.) the identification of species could much easier be coordinated at a higher level of centrality. Extension officers could play an initiating role in identifying the different weed species and recommend ways of dealing with the weeds; c). There is no long term perspective related to the introduction of the Simputer and the IDAO software if it would be introduced at the farmer level. Once the farmers know how to identify the different weed species, there is no need to keep the Simputer and its software in the community. It is a short term learning tools. Although, it might be possible to combine the species identification software with other kinds of applications that are relevant at the community level, it does not seem useful to bring the ICTs directly to the farmers and make it 'community property' (see also McCollum, 2002). Many studies have shown that when new technology is introduced without any form of training, guidance, maintenance and other sustainability building instruments, the project is doomed to fail.

Next to extension officers, students could be other possible end-users. As the Simputer could be used as a mobile training device, different kinds of mobile databases could be made availbale in the field through the Simputer. So, instead of trying to apply the Simputer at the local community level, it seems more appropriate and sustainable to implement it at a higher regulatory level (students and extensions agents). The nodal point of consumption for study therefore shifts from the local level to the intra-regional level. In the first place to the level where the extension managers operate. Fonseca & Pal (2003: 13) note in this regard that the Simputer was originally designed as a *general-purpose* device for a *specific audience*, but that it would be more logical to aim at a general audience and develop applications for specific purposes. OSCAR, however, was orginally designed to aim at a very specific audience with a very specific purpose. The audience was thought to be (illiterate) farmers who experience weed identification and control problems and the purpose of the IDAO software and hardware computer device is to provide a mobile tool for weed identification and control related decision making. Both purpose and audience were therefore very specific. It seems logical to look for other audiences and other applications. Extension service providers in the public and private sectors in the Indo-Gangetic Plains (IGP) in Pakistan, India, Nepal and Bangladesh seem to be logical end-users in this regard.

THE OTHER NODAL POINTS

If we apply the whole frame of analysis and the other nodal points to the OSCAR project and the role of ICTs and the Simputer in agricultural development, the nodal points of *production* and to a lesser extent *regulation* have already been discussed under the technology perspective. Under production we have seen the Simputer technology that was first put forward as a national Indian invention. Although the Simputer could of course be used in other parts of the world, it is primarily targeting at a (rural) Indian audience. The IDAO software is a global tool, aiming at a variety of fields at a global level. The software is not restricted to a particular audience in a particular region of the world. The Simputer itself and the information that is generated by and communicated through the Simputer, the IDAO software and the knowledge about weeds make up the communication flow. Within this communication flow different nodal points of the production of hardware, software, information and knowledge can be identified. In the end—to make it useful to the local end-users—the aim is to produce information/knowledge that is as close as possible to the local level. The nodal points of regulation (power, politics and policy) are

closely related to the nodal points of production through the political-economy perspective. However, this perspective is not discussed in this paper.

The nodal points of *representation* and *action* are important here for being aware of issues related to how the perception of this tool is in the different regions within the IGP. How the tool itself, but also the LINUX software is represented is on important topic. People are more familiar with desktop and notebook computers running on Microsoft software, than that they are with a PDA-type computer running on LINUX. *Action* than refers to being aware of activities (meetings, daily conversations, negotiations) that counter(act) upon the whole idea of the Simputer or computer in general. An example of such a counteract is provided by Slater and Tacchi where they quote an angry man from a remote Himalayan village coming up to the researcher saying: "What will poor people do by learning computers? If we go to learn computers who will feed our stomach? Poor peoples spend their life as a laborer. None of us here has time for computer. Will starve if we don't work for a day. Anyway what is the use of learning computers? Hey Nima lets go for work, why do we need to waste our time here? We are not going to benefit anything out of it. It's the same old thing, they simply document, nothing will happen practically… (Slater & Tacchi, 2004:8)."

AGRICULTURAL DEVELOPMENT, EXTENSION AND ICTS

The relevant question to ask is still about the potential value of the Simputer for agricultural development, assuming that rural areas are intrinsically linked to agricultural development issues. Potential users are thus, farmers, extension agents and students in agricultural sciences. These are the relevant end-user stakeholders. Based on the above, extension officers and students in agriculture and agricultural extension seem to be the most interesting groups to look at for possible uses of the Simputer. Extension and ICTs relate primarily to the communication flow as identified above. If the extension is non-participatory and the ICTs are merely used to disseminate information to the rual farmers, there is in fact a higher level involved than the local level and information is produced at a university (at regional, national or international level), or is from government agencies at different policy levels flowing down to the rural farmers. It is mainly in this field that extension and ICTs are related to agricultural development.

Extension in the field of agricultural development has seen many changes in the past decades. First of all, with the change in philosophy and rationale behind extension services towards more participatory approaches and participatory technology development (PTD), a shift has been made in thinking about the role of extension services in broader information and knowledge sharing processes. (see for instance Leeuwis, 2004). A second trend in extension services, situated at a less conceptual level and a more professional level, seems to be the development towards what Sulaiman calls 'extension-plus' (Sulaiman, 2003). Extension has long been primarily associated with 'transferring technologies to farmers'. 'Extension-plus' means that extension now plays an expanded role. It seems to be a recognition that extension should merge with, or at least should incorporate, other fields such as improved access to markets, research, advice, credit, infrastructure, farmer organization development and business development services. "Research and extension strategies should emerge out of a broader livelihood analysis organised through a wider consultative exercise." (Sulaiman, 2003:xi). Next to these developments in fundamental thinking in the academic and professional worlds, a third global economic trend from public services to private services can be identified. Although, for instance in India, the state Department of Agriculture (DoA) continues to dominate extension provisions, initiatives towards privatization and public-private partnerships do exist.

The specific role of ICTs in extension services for agricultural development is another new development and has been discussed on several occasions (e.g., Engelhard, 2003 and especially for India, e.g. Sulaiman, 2003 & Maru 2003). Maru (2003), for instance, reviewed the

development of the use of three ICTs in agricultural extension in India: radio, television and the internet. The state run All India Radio, the Doordarshan Television and newspapers in local languages are still important extension channels, if you prefer to use the word 'extension' in this regard. However, they do remain traditional mass media channels and especially the Consultative Expert Meeting (CTA, 2003) called for new, more participatory forms of sharing information. In theory, the new ICTs could facilitate this, and make the sharing of information more demand-driven and more relevant to the needs of the farmers (see also Ban, 2004; Meera, et.al., 2004; Richardson, 2003).

An example of such an innovative use of new ICTs is the implementation of the so-called telecentres or information kiosks. In the south of India (Tamil Nadu) the kiosks, in so far as they are providing services to the rural farmers, make use of IndiaAgriline (www.indiagriline.com). IndiaAgriline is a web based service (a portal) that connects, according to its own saying, "farmers and others in rural India to markets and to market price information, knowledge like weather data, agricultural extension services and crop cultivation practices, social welfare agencies like Primary Health Centers and to their peers" (www.indiagriline.com). In Tamil Nadu there exists a network of information kiosks, for a large part working with the IndiaAgriline website portal and aiming at the sugarcane farmers. Farmers need to register as members, but the service is provided free of charge (except for the costs of access at the information kiosk; around 5 Indian Rupees per hour; author's visit February 2004).

Little has been documented on the specific use of PDAs in development processes. It might be clear that ICTs, and in particular those provided in the form of information kiosks, can easily be used for providing databases to farmers and extension workers (see also Van den Ban, 2004), but the question to ask in relation to the possible uses of PDAs and the Simputer is about *'mobile databases'*: When, if at all, do farmers, extension officers or students need a 'mobile database'?. Or when do they need other kinds of mobile information or when do they need to collect data in a digital format? PDAs could in theory serve specific purposes in specific fields and situations under specific circumstances. What these services are and if these services are appropriate remains to be seen. Bridges.org has in this regard launched a competition to support innovative uses of handheld devices at the local level (see www.bridges.org/ipaq_competition; Deadline for entry: 8 October 2004).

CONCLUSIONS

We need to cross borders and we have got to break out of boundaries. Processes of cross-disciplinarity are manifold, needed, but difficult. They incorporate understanding, respect and negotiation. It seems important to realize that crossing borders lies in more than one field and that it is important to identify these fields for each particular cross-disciplinary project. It is often not one border that needs to be crossed, but many. Topics and questions that relate to OSCAR and other cross-disciplinary projects that involve ICTs in agricultural development are:

- *Using Appropriate ICTs and ICT Applications:* For appropriate ICT applications and realistic opportunities in the field of development and social change, we need to think about combining situations from inside and outside agriculture. ICTs give the potential of integrating information in a cross-sectorial way, e.g. through 'mobile databases'. Participatory Information and Communication Technology Development (PICTD) can play an important role in this regard.

- *Crossing Knowledge Borders:* What is at stake here is academic and non-academic cooperation: How can we improve cross-disciplinary cooperation? What are the

conditions for succesful cooperation in transdisciplinary projects? Crossing the knowledge borders means taking indigenous knowledge seriously and stimulate transdisciplinary knowledge systems. The role of extension in agricultural development changes in this regard to something like 'participatory extension' and 'extension-plus'. This involves joint learning and changes the work of the extension agents. He or she has to become a good listener and a facilitator.

REFERENCES

Agrawal, B.C. (ed.) (1985). **Anthropological Methods for Communication Research; Experiences and Encounters During SITE**, New Delhi: Concept Publishing Company.

Ban, A.W. van den (2004). **World Trend in Agricultural Extension**, paper presented at the International Seminar on Best Practices in Poverty Alleviation Through Education in the Next Century, Suwon, Republic of Korea, October 2004.

Conroy, C. & Sutherland, A. (2004). **Participatory Technology Development with Resource-Poor Farmers: Maximising Impact through the Use of Recommendation Domains**, AgREN Network Paper 133.

Engelhard, R. (2003). **Proceedings: ICTs – Transforming Agricultural Extension? CTA's Observatory on ICTs**, 6th Consultative Expert Meeting, Wageningen, 23-25 September 2003.

FSF Europe (2003). Free Software (a.k.a. "Libre Software" or "Open Source"), Free Software Foundation Europe (http://fsfeurope.org/projects/wsis/fs.html, last accessed: 8 September 2004).

Fonseca, R. & Pal, J. (2003). **Bringing Devices to the Masses: A Comparative Study of the Brazilian *Computador Popular* and the Indian *Simputer***, Final Report ICT4B, December.

Ganapati, P. (2003). **Simputer. Not a Common Man's Device Anymore**, Rediff Online, 17 September (http://in.rediff.com/money/2003/sep/17spec.htm, last accessed: 8 September 2004).

Grard, P. (2004). Fact Sheet: **IDAO. A Multimedia Approach to Computer Aided Identification for Capacity Building in Taxonomy**, Montpellier: CIRAD.

I4D (2004). Simputer Hits Retail Shelves, **Information for Development**, II(4):19.

ITU (2000). **New Technologies for Rural Applications**, Final Report of ITU-D Focus Group 7, Geneva.

Girard, B. et.al. (ed.) (2003). **The One to Watch. Radio, New ICTs and Interactivity**, Rome: FAO. (Edited in collaboration with The Friedrich Ebert Foundation (FES), Geneva office and The Communication for Development Group, Research, Extension and Training Division, Sustainable Development Department, FAO).

Heijnsdijk, J. (1970). **De Interdisciplinaire Benadering in Wetenschapsbeoefening en Wetenschapstoepassing**, Rotterdam: Universitaire Pers Rotterdam.

Klein, J.T. (1990). **Interdisciplinarity: History, Theory, and Practice**, Detroit: Wayne State University Press.

Leeuwis, C. (2004). **Communication for Rural Innovation. Rethinking Agricultural Extension** (third edition), Oxford: Blackwell Publishing.

Lie, R. (2003a). Community Development and the Internet. In: SERVAES, J. (ed.), **Approaches to Development. Studies on Communication for Development**, Paris: UNESCO.

Lie, R. (2003b). **Spaces of Intercultural Communication. An Interdisciplinary Introduction to Communication, Culture, and Globalizing/Localizing Identities**, Cresskill, New Jersey: Hampton Press.

Manohar, S. (1998).**The Simputer. Access Device for the Masses**, based on discussions with the Simputer group.
McCollum, S. (2002). "Simputers": When Technology does *not* Bridge the Digital Divide, **World Tech Tribute**, 19 September 2002.
Meera, S.N., Jhamtani, A. & Rao, D.U.M. (2004). **Information and Communication Technology in Agricultural Development: A Comparative Analysis of Three Projects from India**, AgREN Network Paper 135.
Noronha, F. (2003). Simputer, Computers for the Poor or an Idealistic Dream?, **Science and Development Network**, 11 July. (http://www.scidev.net, last accessed: 24 October 2003)
Reddy, C.R. (2003) The Free Software Option, **The Hindu**, 22 November .
Richardson, D. (2003). **Agricultural Extension Transforming ICTs? Championing Universal Access**, Background paper for CTA's ICT Observatory 2003, Wageningen, The Netherlands.
Röling, N. (2004). **Communication for Developmentin Research, Extension and Education**, paper presented at the FAO Communication Roundtable, 6-9 September, Italy: Rome.
Schramm, W., Nelson, L.M. & Betham, M.T. (1981). **Bold Experiment: The Story of Educational Television in American Samoa**, Stanford: Stanford University Press.
Short, J.R. & Kim, Y.-H. (1999). **Globalization and the City**, London: Longman.
Slater, D. & Tacchi, J. (2004). ICTs at Work in the Hands of the Poor. Innovation and Research in South Asia, **I4D**, II(5):6-11.
Servaes, J. (1999). **Communication for Development. One World, Multiple Cultures**, Cresskill: Hampton Press.
Sulaiman, R. (2003). **Agricultural Extension—Involvement of Private Sector**, National Bank for Agricultural and Rural Development, Mumbai, India.
Tress, B., Tress, G., Van der Valk, A. & Fry, G. (eds.) (2003). **Interdisciplinarity and Transdisciplinarity Landscape Studies: Potential and Limitations**, DELTA series 2, Wageningen.
Visser, L.E. (ed.) (2004). **Challenging Coasts. Transdisciplinary Excursions into Coastal Zone Development**, MARE Publications Series No. I, Amsterdam: Amsterdam Universityn Press.
Visser, L.E. (2003). **Our Common Future: Development Sociology and the Interaction between the Social and Natural Sciences**, Inaugural Lecture delivered in accepting the appointment as Professor in the Sociology of Rural Development, Wageningen, 2 October.