ICTs and Capacity Building through Apprenticeship and Participatory Methods

Applied to an ICT-based agricultural water management system

Research in Progress

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Abstract:

This paper describes the COMMON-Sense Net project, a research in progress and joint development between the Swiss Federal Institute of Technology, Lausanne (EPFL) and the Indian Institute of Science (IISc) in Bangalore. The project concerns the design and implementation of an Information and Communication Technologies (ICT) system for agricultural management in a rural community of Karnataka (Southern India). It is unusual in the sense that it focuses on Environment-to-Person Information Systems (EPISs) rather than on Person-to-Person Information Systems (PPISs). Beyond its mere engineering value, we analyze the potential that such a project can unleash for ICT capacity building in the local context of the village. In particular, we study the correspondence between capacity building and knowledge creation, and we describe how a design science approach can foster this kind of capacity building if it is integrated in the project methodology in an iterative and participatory way.

Introduction

In this paper we describe a research in progress in the area of Information and Communication Technologies (ICTs) for development and outline a framework to study the project's impact on ICT capacity creation. COMMON-Sense Net (an acronym that stands for Community-Oriented Management and Monitoring Of Natural resources through a Sensor Network) is an ICT-based agricultural water management system to be deployed in a semi-arid region of Karnataka, India. Traditionally, such a project would be executed as a rather isolated engineering project focusing on its contribution to the improvement of rural water management. However, we believe that the consistent incorporation and analysis of the social environment can bring the additional benefit of helping the rural community to integrate into the Information Society by assimilating new ICT capacities. Thus, this paper focuses on the following research question:

Can an ICT engineering project contribute to building local ICT capacities for the Information Society in a developing country context? How can it achieve this?

We address this question by applying a set of theoretical concepts to the COMMON Sense Net project. We particularly look at human capacity building through participation as a form of ICT education in ICT for development projects. We believe that rural communities and developing regions ask for innovative methods that go beyond traditional classroom learning. Therefore we outline three categories of ICT capacities, introduce a process of knowledge and capacity creation, study apprenticeship as a form of knowledge and capacity appropriation and analyze it all in the execution of the COMMON Sense Net project.

The choice of India as a test-bed may be questioned by some, since this country is today widely recognized as one where information and communication technologies are booming at the fastest rate. As a matter of fact, teledensity has exploded from 2% to 7% between 1999 and 2003 and is foreseen to increase to 20% in the next five years (UK Trade and Investment 2003). On the other end, rural connectivity remains for the time being extremely low at just over 1%. Today, more than 970 million Indians do not have access to a telephone. Fortunately, there are several initiatives currently undertaken to reduce this gap and increase rural density by deploying GSM networks and wireless local loops (i.e. local wireless networks connected to the wired telephone network via an access point). The n-Logue project is in that regard exemplary (Prahalad and Hammond 2002). However, India remains, with its mix of high technology and rural underdevelopment, a paradigmatic case for the digital divide and an ideal field for a development project involving the use of ICTs.

The paper is structured as follows. In the next section we introduce the COMMON-Sense Net project for agricultural water management. This undertaking, which is partially financed by the Swiss Agency for Development and Cooperation (SDC), is a joint project between the Swiss Federal Institute of Technology, Lausanne (EPFL) and the Indian Institute of Science (IISc). In the following section we argue that capacity building is central to the development of an information society and has three basic axes:

infrastructure, applications & content, and usage. We ask ourselves how COMMON-Sense Net can help fostering these three capacities throughout the research in progress. We therefore introduce a model of dynamic knowledge creation (Nonaka, Toyama et al. 2000) in order to conceptualize capacity building as a form of knowledge. We then apply the concept to COMMON Sense Net. Afterwards we outline how dynamic knowledge creation can be instrumentalized in rural communities of developing countries, namely through apprenticeship and participatory methods. In the following section we review design science as a methodology to build and evaluate the agricultural water management system. Finally, we draw conclusions and introduce future work on the subject.

1 COMMON Sense Net

Several authors have discussed the formidable potential of ICTs to foster development in the South (Heeks et al., 2002; Negroponte, 1998; Walsham, 2001; Westrup et al., 2000). They show that ICTs can be applied to a wide spectrum of different areas to leverage development projects.

Current literature on ICT for development is so abundant that the term itself has become a common phrase for the civil society, as was illustrated by the recent World Summit on the Information Society and its major event, the ICT for Development Platform. However, we believe that this literature is still ignoring an important facet of information technologies by focusing on *Person-to-Person Information Systems* (PPISs) only. These are systems that either connect people among each other, that connect people with machines that store knowledge created by people, or that connect machines that exchange this knowledge. In contrast, in this paper we address the value and the issues of another important area of ICT for development that in our opinion is still rather poorly researched: *Environment-to-Person Information Systems* (EPISs). These are systems that collect environmental information and communicate them to machines and people. With the goal to improve living conditions, this sub-area of ICTs helps individuals and communities develop a better knowledge of the physical parameters that make up their environment (e.g. pollution monitoring, agricultural management, etc.). We argue that development projects that focus on designing and building the tools for collecting and disclosing environmental information have a direct impact through the artifacts they build, but can also have an indirect impact through the ICT capacities they create via dynamic knowledge generation. We will analyze this hypothesis in the COMMON-Sense Net project for ICT-based agricultural water management in rural India, which we introduce in the following lines.

The problem of agricultural water management is today widely recognized as a major challenge that is often linked with development issues (World Health Organization, 2003; Food and Agriculture Organization (FAO), 2001; FAO Agriculture Department, 2002). In the semi-arid areas of developing countries, marginal farmers and small farmers (with a land holding between 2 and 4 hectares) cannot afford to pay for powered irrigation. Neither can they protect their cultures against pests and diseases by spraying their fields with costly chemicals. Thus, they heavily depend on the unpredictability of climate.

Based on a study conducted for over a decade in the semi-arid region of Pavagada in Karnataka, India (Rao and Gadgil, 1999), it is by now recognized that reliable local metrological data and knowledge of soil moisture and ground water conditions can significantly improve agricultural management.

From an engineering point-of-view, sensors are a relevant answer to that challenge. However, a stand-alone sensor, due to its limited range, can only monitor a small portion of its environment. Because ground and crop conditions can change significantly over space and time, the use of several ICT-based sensors working in a network seems particularly appropriate.

The COMMON-Sense Net project aims at designing and developing an integrated network of ICT-based sensors for agricultural management in the semi-arid rural areas of developing countries. In addition of having an effect on yield and efficiency at the local level, the system should allow for the collection of extensive data that can be also used to better understand the effects of water - and possibly other environmental parameters - on agriculture, and thus to develop replicable strategies.

COMMON-Sense Net consists of a wireless network of ground-sensors that record periodically the state (salinity, humidity, etc.) of the soil, while subterranean sensors monitor the level and quality of ground-water. Sensors record data on a periodic basis and send them in a multi-hop fashion (meaning that every node is at the same time a data-collection, a transmission and possibly a relaying unit) to a centralized processing unit, which correlates them with external data and models in order to assess the optimal management strategy (be it for cropping, chemical treatment or irrigation). The centralized processing unit can be linked to external meteorological servers to get the global data useful for its computations. This can be done, depending on the environment, through a wired or wireless connection, or a satellite link.

Self-organized networks (also called ad-hoc networks) are communication networks that do not need any other infrastructure than the communicating devices themselves to operate. With such a paradigm, two or more devices may at any time create a local communication network, a device may seamlessly integrate or quit an existing network, a node may serve as communication relays for other nodes, all this without the need of any fixed infrastructure or the intervention of a central authority. In our case, the benefits of using a self-organized wireless network of sensors lies in the ease of deployment (sensors can be added, removed or moved around without having to reconfigure the whole network) and the resilience of the network against nodes failures.

Such a project seems at first sight to be merely about artifact building. However, in order to be successful, it must insure its own sustainability, and develop skills adapted to an information society.

2 Capacity building for the Information Society

We define capacity as the potential for an individual to develop skills that are instrumental to his or her development (be it educational, social, economical etc.). In this section we outline a simple framework categorizing ICT capacities for the Information Society (Osterwalder 2004) in order to define in what areas the COMMON-Sense Net project could influence the stakeholders' existing ICT capacities. Subsequently we introduce an adapted conceptualization of the knowledge creation process (Nonaka, Toyama et al. 2000) in order to understand and analyze the capacity creation process in the project's context.

2.1 Human Capacity for the Information Society

Kaplan (2001) defines the information society as a society where the ability to access, search, use, create and exchange information is the key for individual and collective well-being. Accordingly, Osterwalder (2004) proposes a list of the resources and the related human capacities that are essential for the development of an information society (cf. Figure 1). The resources are threefold. First, there has to exist an ICT infrastructure in terms of hardware, access and software. Second, locally relevant applications must be available. Third, a widespread ICT user base should exist. In order to provide these resources an Information Society must develop three main human capacities. First, it has to build the capacity to provide and maintain infrastructure at a reasonable price. Second, it has to build the capacity to create and maintain useful local applications and content. Third, it has to build the capacity to understand and use applications.

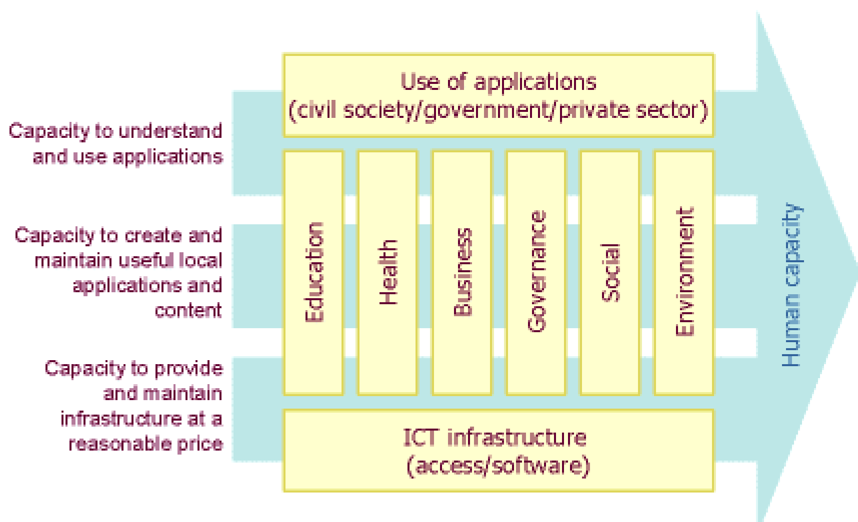

Figure 1: Human Capacity for the Information Society

As regards the COMMON Sense Net project and the described capacities we can ask ourselves the following three questions (Q1, Q2, Q3):

Q1) To what extent does the project help developing an ICT infrastructure for farmers in terms of developing capacities to provide and maintain an ICT infrastructure for water management?

Expected observations: The sensors are supposed to be self-maintaining and can be moved around without configuration work. Local stakeholders should be able to use them with little prerequisites. However, as users will not develop any specific capacity in that domain, failing nodes will constitute a particular challenge. An engineer will still be necessary for reparation. Therefore, special attention must be given to the search of a specific model to foster community involvement and minimize outside specialist intervention.

As regards the front-end of the system local stakeholders will be involved and trained in order to take care of it. This front-end will be based on community premises (the school for instance) in order to familiarize people with computers and their use. The possible defection of people operating the system must also be taken into account, as they may leave for a better position as soon as they learned new computing skills. Using people actively involved in the community, such as school teachers, could moderate this risk. Finally, the involvement of children into the project should be considered to expose them to and familiarize them with modern information technology.

Q2) To what extent does the project help develop locally relevant ICT-based agricultural water management applications, notably in terms of developing capacities to create and maintain these applications?

Expected observations: The development of skills to create and offer locally relevant ICT applications is particularly important. One of the fundaments of our approach is to develop the agricultural water management system based on community involvement.
We hope that this effort unleashes capacities to combine the locally existing knowledge and experience with the enabling forces of technology. Of course, this approach demands facilitator capacities from the engineers who have to mediate between tradition and change. We believe that the major challenge lies in the development of a sense of ownership of the local stakeholders in the applications. Hopefully, ownership will lead them to improve and maintain the water management system.

Q3) To what extent does the project help the farmers develop their capacities to understand and use the ICT-based water management systems? Is there a spill-over in terms of developing more general ICT-usage capacities?

Expected observations: This project will expose local stakeholders to new models for their agricultural environment. This will have an impact on the decision process for crop selection, cropping patterns, pest management etc. More generally, the possible impact ICT can have on their daily life will be presented in an integrative rather than disruptive way (using new information sources to accomplish more efficiently usual tasks). We will also evaluate to what extent the access to the water management system as a central and indispensable application will encourage the development of more general computer literacy skills.

In order to observe and further analyze the process of capacity building throughout the COMMON Sense Net project we use the conceptualization of knowledge creation provided by Nonaka, Toyama et al. (2000). We understand capacity building in the three areas described above as a form of knowledge creation as described in the model by Nonaka, Toyama et al. (2000). They explain the dynamic process of contextualizing and processing information in a way that allows generating value as well as new knowledge and capacities.

2.2 Knowledge creation, context and knowledge assets

Nonaka, Toyama et al. (2000) outline four elements in the process of knowledge creation: The knowledge creation cycle, a shared context for knowledge creation and the circulating knowledge assets.

The first element of knowledge creation, which Nonaka, Toyama et al. (2000) call SECI (acronym for Socialization, Externalization, Combination, Internalization), functions like a spiral describing the interactions between actors in order to transmit knowledge in it tacit or explicit form, and the actions of individuals or groups in order to translate knowledge from tacit to explicit, and vice-versa. This process follows four modes feeding each-other in a spiral (Figure 2). First, the socialization process of transmitting and converting new tacit knowledge through shared experiences. Socialization typically occurs in a traditional apprenticeship. Second, the externalization process of articulating tacit knowledge into explicit knowledge. The success of such a conversion depends on the sequential use of metaphor, analogy and model. Third, the combination process of converting explicit knowledge into more complex and systematic sets of explicit knowledge. Finally, the internalization process of embodying explicit knowledge into tacit knowledge.

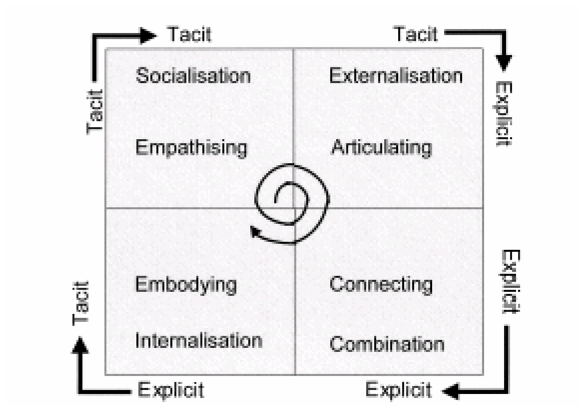

Figure 2: Knowledge creation cycle (Nonaka, Toyama et al. 2000)

In the COMMON Sense Net we aim at analyzing these four phases with regard to capacity building. The first phase of socialization concerns discussions between farmers to emphasize their desires and aspirations regarding agricultural water management. The second phase of articulating their desires concerns discussions between farmers and technical specialists. The third phase of combining knowledge concerns the connection of the aspirations of the farmers with technical knowledge in rural engineering, water management and ICT in order to design a system. The fourth phase consists of applying the system with farmers and specialist. The loop starts over with phase one.

The second element of knowledge creation that Nonaka, Toyama et al. (2000) mention is the context, which they call *ba*. This is particularly interesting for the case of ICT for development projects such as COMMON Sense Net. It is often stressed that the particularities of the developing country context (stakeholders and environment) and technology development are highly dependent (Biggs and Smith 1998). The COMMON Sense Net project covers a wide diversity of contexts, which must be carefully considered during the execution of the project and the analysis of the ICT capacities. Among several other diverse contexts most importantly figure the involved rural Indian village, the laboratory at EPFL in Switzerland and the laboratory at IISc in Bangalore.

The last element of knowledge creation that Nonaka, Toyama et al. (2000) mention are the knowledge assets. Knowledge assets are the inputs, outputs and moderating factors of the knowledge-creating process. Those assets are experiential (e.g. skills, know-how…), conceptual (e.g. concepts, designs, methods…), systemic (technological platforms, manuals, libraries of software components…) and routine-based (e.g. organizational routines). All these assets need to be 'mapped' in order to be usable. This mapping process is at the core of the dynamic knowledge creation. In the COMMON Sense Net project we particularly aim at observing the interaction between the tradition skills and know-how of the farmers in terms of agricultural water management and the modern concepts and ICT systems brought in through the project. We seek to analyze how this interaction creates new knowledge assets with reference to ICT capacities for the Information Society.

3 Apprenticeship & participatory methods to develop ICT capacities

In the previous sections we presented the three axes along which capacities are built for creating an Information Society and argued that analyzing the knowledge creation process was central to understanding capacity building. In this section we study apprenticeship as the main mechanism through which we believe ICT knowledge and capacity will be created in the COMMON Sense Net project.

We define apprenticeship as a situation in which a learner works intensively with an expert to learn a new task that may necessitate the understanding of new concepts. We present it as an alternative to traditional classroom learning that can be very effective to instrumentalize knowledge as capacity in rural communities of developing regions.

Particularly for Environment-to-Person Information Systems a participatory approach seems an appropriate tool that can help overcome some underlying barriers to the development of innovative environmental technologies (Fleming and Henkel 2001; Sotoudeh 2003). The question is how much of a spill-over effect participatory learning can have on the development of more general ICT capacities.

Misperceptions, what Heeks 2001 calls design-actuality gaps, namely the gap between the technocrats who design systems using scientific knowledge and the local context characterized by “irrational” cultural features, seem to be at the root of most failures for Information Systems in developing countries. This recurring flaw calls for the concept of participative design and implementation.

In participative approaches, the end-user is constantly involved in the design and assessment of the product or service being developed for him. Cooper (2000) emphasizes the role that group working and end-user involvement can play in a successful implementation. However, Heeks (2001) warns that this is no guarantee to success in developing countries, since these techniques have usually been developed in and for industrialized countries organizations. A lesson to be drawn is that a participative approach in a developing country is instrumental to success if and only if it integrates a tool to bridge the contextual gap between design and use.

We claim that the resort to apprenticeship is such a tool. Freeman’s (1997) definition of apprenticeship is “learning by doing”. Adapting this definition to our context and trying to be more specific, we consider apprenticeship as the process by which a person acquires a new knowledge or skill by imitation and interaction with someone who possesses that skill or knowledge already, rather than in a formal way in the classroom with a teacher. What is interesting is that the apprenticeship process matches quite exactly the way indigenous knowledge is acquired (WorldBank, 1998). This particular feature of apprenticeship means that it is much less disruptive than other forms of education as far as radically new forms of knowledge are concerned. In particular, if one looks at the main features of indigenous knowledge as summarized by the World Bank (1998), one can identify where the potential of apprenticeship lies:

- tacit knowledge: apprenticeship is based on the tacit experience of watching someone doing something, without necessarily verbalizing the knowledge or skill presented.
- transmitted in a non-written form: apprenticeship is a transmission process based on interpersonal interaction rather than in books.
- experiential rather than theoretical knowledge: apprenticeship is learning by watching and doing, thus experiencing rather than studying.
- learned through repetition: apprenticeship is learning by imitating.
- constantly changing: learning process adapts to changing circumstances.

Our hypothesis is that there are some aspects of apprenticeship that make it particularly suited in the acquisition and integration of radically new paradigms of knowledge. It is a self-organized process in which every individual takes ownership of the knowledge he or she is acquiring. Not relying on formal teaching, it can be more integrated in the social structure and possibly more equitable since people not having the time, the resources or the will to attend classes can be reached through it. Solving concrete issue one after another insures that people are interested in the process and increases the likelihood of them persevering in the endeavor. It allows for unexpected forms of organization to develop and is adaptive. Ultimately, it is empowering. It reserves surprises for the "teacher" as well as for the student.

The challenge lies in bootstrapping the process, in other terms in convincing the local stakeholders that a new formerly unheard of form of knowledge can be of value to them. One possibility is finding a local partner who speaks both languages, who understands and uses the indigenous knowledge, but masters also the language of technology and science. At this stage, a more formal teaching approach may be needed in order to form such a partner. But here again, knowledge exchange, rather than knowledge provision proves to be a key-concept in integrating new forms of knowledge in traditional societies without losing the value of what indigenous knowledge brought to the community in the first place.

The COMMON-Sense Net project is proposing to local stakeholders an ICT system that will help them accomplishing more efficiently daily tasks in accordance with specifications they laid down themselves (in our case the information requirements for agricultural management). A hypothesis we want to verify is that such an approach will represent an incentive for farmers and their families to learn by watching and imitating, in particular in using the internet resources that can complement their knowledge of agricultural techniques. Evidently, such an interest can be raised only if the system is developed successfully in the first place. This raises a methodology question that we address in the next section.

4 Methodology: Design Science (Design & Evaluation)

In our research we are confronted with the task of co-designing a locally relevant agricultural water management system embedded in an Indian rural community. Therefore, we aim at applying a participatory approach including the project stakeholders, their environment and their values in order to achieve sustainability. To fulfil this and achieve scientific rigour in our approach we apply the design science research methodology that has recently gained increasing scientific acceptance (March and Smith 1995; Hevner, March et al. 2004). Design science is an attempt to create things that serve human purposes, as opposed to natural and social sciences, which try to understand reality (March and Smith 1995; Au 2001). The generic iterative process of design is described by Takeda (1990) in Figure 3 and serves as a basis of reflection for the design process of a water management system in Chennakeshavapura. Ideally the design process steps are gone through conjointly by all stakeholders involved. In other words, villagers, farmers, academics and other parties involved first define a problem. Then they work out a suggestion. Thereafter they design and develop a system, before proceeding to its evaluation. And, finally, the whole process restarts after the stakeholders' conclusions.

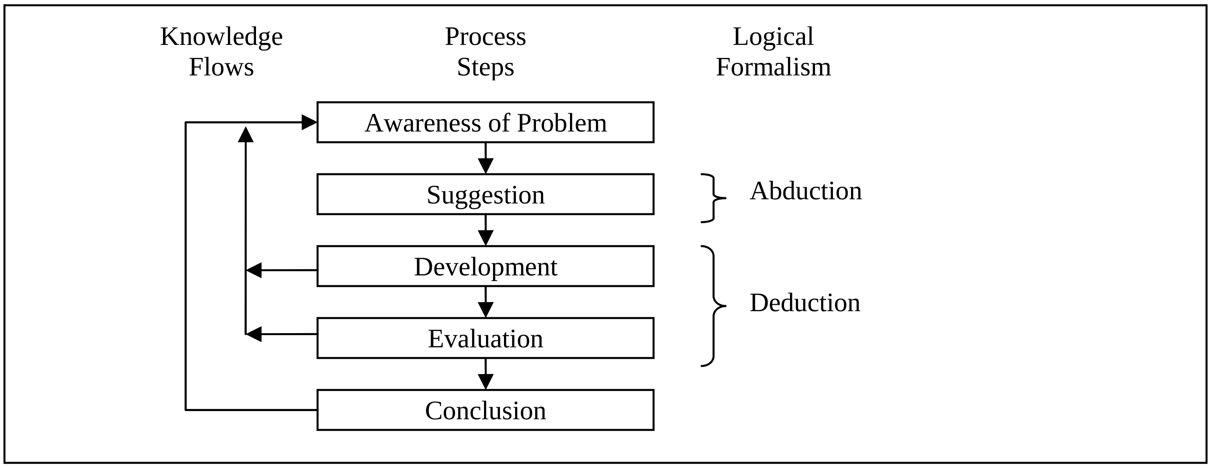

Figure 3: Reasoning in the Design Cycle (Takeda 1990)

At first sight, the COMMON-Sense Net project seems to be a typical infrastructure-based project. Such an observation raises immediate concerns about the acceptance of the developed technology, its sustainability etc. In particular, one may wonder how such a project will help building ICT capacity in a rural community mostly concerned with agricultural issues such as crop yield, climate variability, management of pests and diseases attacking the plants etc.

However, our claim is that far from being distinct, infrastructure building and knowledge creation as capacity building instrument are complementary. They may not only be achieved in parallel, but can leverage each other in a very efficient way.

A closer look at the methodology will substantiate this claim. The project is built as a set of iterations, working in spiral towards the achievement of the goal. Each iteration is built with phases matching those of the design science research framework. We start with the recognition and definition of a problem (agricultural water management in semi-arid areas of developing countries), propose a technology-based solution, then develop the appropriate system and evaluate its use and usefulness in the local cultural and social context, and draw conclusions for improvement, scalability and replicability of the approach.

However, since there is a substantial uncertainty as far as evaluation is concerned, we do not restrict ourselves to a single iteration, which is likely to lead to significant mismatches between the final artifact and its intended use. Consequently, we use several iterations (4 at the moment) from problem statement to evaluation in order to adapt the artifact to the local context in an incremental way. Each iteration is conducting evaluation of the output of the previous iteration and building of the output of the current one sequentially, and by using extensively a participatory approach (as will be shown in the list below). This can be described as a corrective iterative approach (CIPA).

Iterative processes are not uncommon in information systems design - see for instance the Rational Unified Process or RUP (Rational Unified Process, 1998). In our case, iterative design was made absolutely necessary by the uncertainties linked to the design of a technical artifact meant to translate the tacit requirements of a traditional society. The language gap and the initial unawareness of the local stakeholders of the capabilities of modern technology called naturally for a method were corrective approximations are made as the needs are being more explicitly expressed.

But the iterative method described here goes well beyond a traditional iterative software development process. In fact, we claim that it matches very closely the model of dynamic knowledge creation from Nonaka et al. (2000), so that the project as a whole becomes as much a knowledge creation instrument as an artifact producer.

Each iteration, with its correspondence in Nonaka et al.'s (2000) model of knowledge creation and context, can be roughly decomposed into the following phases of the design cycle of Takeda (1990):

Phase 1 - Awareness: Community meetings (divided in sub-groups) conducted by local stakeholders and focusing on the needs of the community regarding agriculture. Constructs are built at this stage. The community meetings are led by a local farmer who is also an agronomist and is exactly what Heeks (2001), using Earl (1989) calls a "hybrid". This is a person who "understand(s) both context, organization, and work processes of their sector and the role of information systems" (Heeks, 2001). This phase corresponds to the socialization phase where tacit knowledge is transmitted as such. It is essentially internal to the rural community. At this stage, focus is put on information needs. Here, the *context* is the village and its surroundings. Ideally, the engineer should be present but silent.

Phase 2 - Suggestion: Translation into a technical language, participatory process involving the "engineer" and the hybrid described in phase 1. Phase 2 corresponds to the process of articulating tacit knowledge into explicit knowledge (externalization phase). This phase transcends the cultural boundaries, involving the engineer and the local farmer so that they end up integrating each-other's language. The *context* is the village and the laboratory, where the engineer and the hybrid can feed each-other's *constructs* with the relevant images and metaphors in order to build *models* through which the artifact may represent reality.

Phase 3 - Development: The design and development of an artifact involves a multidisciplinary approach since the expertise needed for tackling the issues spans the areas of hydrology, agronomy and teleinformatics. Phase 3 corresponds to the combination phase, where explicit knowledge into more complex and systematic sets of explicit knowledge. At the moment, it is unclear how this phase could concern not only the "technocrats", but also the local community. Consequently, we can only think at the *context* here being the laboratory where engineers from different disciplines use a technical design *method* to build an artifact.

Phase 4 - Evaluation: This consists of the presentation of the artifact and its capabilities. Here we seek to integrate the artifact in the community on a voluntary basis. This phase corresponds to the internalization phase where explicit knowledge is embodied into tacit knowledge. Here the two communities are involved again and the *context* is the village. The artifact must be presented with the utmost care such as not generating to high expectations to the farmers in the first phases, where its usage still has to be refined.

Phase 5 - Discussion and refinement of the artifact, according to local findings and input. This phase corresponds actually to the first phase of the next iteration.

Consequently, the whole process can be described not as a mere artifact design and implementation, but as a complex process of dynamic knowledge creation within a rural community, within a scientific community, and between the two, normally compartmented communities.

The methodology described above also shows the complementarity between apprenticeship and a participative method. Apprenticeship is involved in the 1st and 3rd phases of each iteration, but its outcome goes beyond the sole evaluation and reshaping of the artifact. It fosters a seamless integration of new cognitive paradigms in the local society. It the artifact is successfully designed and implemented, it presents technology as something concrete and immediately useful, not remote and abstract.

5 Conclusion

In this article, we present an engineering project aimed at coping with development issues in semi-arid agricultural areas of Southern India, the COMMON-Sense Net project. We claim that such a project, dealing with the interaction of a rural community with its environment, and putting ICTs to use in order to improve the understanding of this environment with the goal of improving the community's livelihood, can be fully compatible with the issues raised by the scientific community as far as ICT projects for development are concerned (Heeks, 2001; Sein and Harindranath, 2003). Our hypothesis is that such a project, even if it focuses on a technical solution to a development problem, can foster the building of local ICT capacity and provoke ICT knowledge creation in original ways through apprenticeship and the use of participatory methods. Accordingly, we present concepts and a methodology to analyze this hypothesis.

This project is still in its infancy, since the participative gathering and analysis of the first environmental information requirements of the considered community were conducted in the first half of 2004. Many technical and social issues remain to be solved. Consequently, the claims made in this paper are yet to be substantiated and analyzed by the concrete results of the project. The first of the iterations described in section 4 will be fully completed in 2005. A full assessment of the capacity that was built during the first phase will permit to assess the methodogy used and to design the subsequent iterations in accordance to the findings.

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