Contextuality of Participation in IS Design:
A Developing Country Perspective

S.K. Puri[*]
New Delhi, India
puri_sk@hotmail.com

Elaine Byrne
School of Public Health,
University of the Western Cape,
South Africa
elainebyrne@telkomsa.net

José Leopoldo
Nhampossa
Dept. of Informatics,
University of Oslo
leopoldo@ifi.uio.no

Zubeeda B. Quraishi
Project Coordinator, HISP-
India, Dept. of Informatics,
University of Oslo, Norway
zubeeda@hotmail.com

* Corresponding author.

ABSTRACT

Participatory approaches to information systems design have evolved over approximately the last three decades, mainly in Scandinavia, Europe, and lately in the US. However there has been limited and peripheral research and debates over participatory design approaches and techniques in developing country settings. This paper explores three case studies in developing countries where participatory approaches have been used in the design and implementation of health information systems. The investigation reveals the politics of design, the nature of participation, and the methods, tools and techniques for carrying out design projects are shaped with respect to the diversity of the socio-economic, cultural and political situations faced in each of these settings. Though common strategies, such as capacity development, could be found that cut across the three case studies it is the importance of the contextual nature of participatory design that emerges most strongly. There is no single algorithmic best practice regarding participatory design in information systems which is applicable to all situations

Categories and Subject Descriptors

H.3.4 [**Information Systems**]: Information storage and retrieval-*Systems and Software*;
J.3 [**Computer Applications**]: Life and medical sciences-*Medical information systems; Health*
K.4.3[**Computing Milieux**]: *Computers and society*-Organizational Impacts

General Terms

Design, Documentation, Human Factors, Management, Theory.

Keywords

Participatory design, health information systems, developing countries, community IS.

1. INTRODUCTION

User participation in information system design (ISD) has been considered to be an important determinant of the eventual success of the system [38, 21]. The participatory approaches to ISD have evolved in the West over approximately the last three decades, mainly in Scandinavia, Europe, and lately in the US. This subject has evinced considerable research and has been a topic of keen debate in the information systems (IS) literature, and more recently in other fora, for example, the biennial Participatory Design Conference (PDC). However, much of the research and debates have been confined to the Western contexts, with only limited and peripheral contact with the developing country settings. Although some evidence of the attempts to extend IS research to the third world domains has recently become discernible in the mainstream IS literature [for example, [56, 48], the issue of participatory design (PD) in these settings has lacked specific attention. An exception may be the emerging consensus in the last PDC conference (Malmo 2002), emphasizing participation should be viewed in broader contexts (outside of Western organizations), and that it should be analyzed within a larger process perspective that emphasizes its dynamic and political nature [8].

The use of information and communication technologies (ICTs) has been expanding during the last decade or so in the developing world as well. Some of the donor agencies, like the World Bank, for example, have argued for much greater penetration and use of ICTs by developing countries to usher knowledge intensive societies for ensuring their economic survival in the current era of globalization [57]. Other donors have been insisting on the use of ICTs to bring in greater transparency, and for inculcating more effective monitoring and evaluation of programs and projects aimed at poverty alleviation. The use of ICTs in these settings is also being promoted to address social exclusion of the poor [18]. The state governments are also pushing to tackle the digital divide [43], and to increasingly adopt e-governance in the rural sector also, for example through community-based networks [45]. It is thus clear that the use of ICTs would be increasingly implicated in community development programs in the third world, for example in the health IS design sector.

By and large, in most of the western approaches, participation of intended users is seen as a precondition for good design and increases the likelihood of integrating the new system into the

organization [46]. In the western context there is little discussion on the degree and type of participation or how this can be facilitated outside of organizational/corporate contexts. When related to community development programs the argument for participation is based on a more intuitive and ethical basis rather than on empirical grounds. This paper explores different approaches to participation in three different contexts – all within developing countries. The cases illustrate on a practical level the process of participation and how this was facilitated in the design and implementation of health IS. An analysis of the cases illustrates the differing types and degrees of participation which can be used with IS design and implementation. From these studies we argue that the participatory design and implementation of IS in developing countries bring in new challenges to fostering and nurturing participation, and that these represent a point of departure vis-à-vis the Western organizational scenarios foregrounded in the IS literature.

The rest of this paper is organized as follows. In section 2, a theoretical framework is developed based on major strands of participation in IS reported in the relevant literature to understand their underlying assumptions and aspirations. The next section provides the empirical basis of this paper, three case studies, one each from India, South Africa and Mozambique. These cases are analyzed in section 4 with reference to the theoretical backdrop of section 2, in particular to examine if the Western approaches to PD can be directly applied to the developing country contexts, particularly in the case of community-based IS applications in rural settings. The analysis brings out some viable, context-dependent implementation strategies, including capacity development, to meet these challenges. Section 5 concludes with remarks regarding what we mean by participation in ISD in a developing country context.

2. PARTICIPATION IN ISD

User participation in ISD has been researched and practiced in various forms since the 1970s in Scandinavia and Europe [19, 14]. These PD approaches have also influenced systems development in North America since mid-80s [25]. However, PD has followed somewhat diverse trajectories in these societies, each strand having been influenced by the local political, socio-economic and cultural factors. The evolution and adoption of somewhat different approaches to PD over time in the West has been well articulated in the IS literature [for example, see 1], and it is not intended to discuss the course of these developments at any length in this paper. Accordingly, in the following sub-section 2.1, we provide a simplified roadmap of the PD trends in the West in order to understand the contemporary debates and to derive lessons for developing countries settings. In section 2.2 we look at the trends in developing countries in relation to participation and more recently to participation in IS design.

2.1 Participatory Design in the West

The participatory tradition can be traced back to the rise of the Industrial Democracy program in Norway during the mid-1960s following debates around the organization of work at the micro-level of shop floors. This program provided a common framework for joint collaboration between research and labor unions, subsumed several work sites with the objective of introducing new technologies in consultation with workers, and with a strong emphasis on democratization of the workplace. The Norwegian initiative inspired similar moves in Sweden, for example the DEMOS project [20], which sought to recast the entire industrial operations and functionings through collaborative schemas jointly developed by the management and the trade unions [26]. This strand of PD sought to redress asymmetrical distribution of power in the industry, with a view to empower workers and shop supervisors by developing their managerial and technical skills to strengthen their bargaining capacity vis-à-vis the management [40].

Subsequently, these democratic underpinnings provided the basis of user participation in IS. An additional motivation was to draw upon users' knowledge of work processes into ISD to improve the end product, and also to reduce resistance to the induction of these systems in organizations. The workers, on the other hand, feared deskilling of labor, automation of decision-making in their purview, scaling down of workforce etc. as the negative outcomes of computerization [30]. The above factors led to considerable diversity in the participatory approaches to ISD. Bansler [3] identified three main schools in systems development research in Scandinavia based on the criteria of knowledge interests, notions of organization and labor force and capital/labor relations. These are: (i) system-theoretical, (ii) socio-technical, and (iii) critical. The system-theoretical school adopted a scientific basis for systems development based on engineering principles. Its main accent was on rationalization, information modeling, efficiency and control and profit maximization. The organization was treated as a cybernetic system from a system engineering perspective, and labor was viewed as 'objects' – as a system component during design. The socio-technical school advanced user participation to achieve ends of higher productivity through the means of job satisfaction, focusing on mediation of conflict between workers and management. The organization was considered in this paradigm to be consisting of two sub-systems, viz. social *and* technical functioning together and adapting to each other. The workers, considered as subjects (individuals), were fully involved in design and attempts made to harness their knowledge of work practices. In both the system-theoretical and socio-technical developments, workers and management were assumed to have a common goal of enhancing productivity through induction of new technologies, and to raise (or maintain) the workers' standard of living. In the critical tradition, the focus was on achieving industrial and workplace democracy, the organization being considered as a framework of conflicts, and the design emphasis on participation alone was seen as inadequate and more fundamental structural changes were sought.

Asaro [1] described European participatory approaches in IS to have generally been based on the socio-technical school, which led to research in Britain focusing on autonomy in workgroup organizations through power sharing, joint responsibility and multiple leadership [44]. This approach is exemplified by the Effective Technical and Human Implementation of Computer-based Systems (ETHICS) methodology [37]. ETHICS aims at developing systems that are technically efficient while also providing greater job satisfaction to employees. This is achieved by considering various technical and social objectives separately to agree on the 'best-fit' jointly by management, design teams, and elected representatives of employees.

In the United States, the participatory design approach was adopted on a different scale governed by the socio-political conditions that are different from those obtaining in the Scandinavian countries [25]. While the legislation regulates participation is most Scandinavian and European countries, there is no similar enabling mechanism in the US. In main, participatory approaches to system design in the US were adopted by way of "engineering codevelopment" [1, p. 276], with a primary focus on customer-centeredness. The methodology used was to place working prototype systems at customer sites for obtaining feedback to 'tune' the artifact as per the customer needs. Besides seeking to involve users in design, reducing the overall product development time, and improving user satisfaction, this approach also aimed at improving the skills of designers by exposing them to novel work situations in which traditional design practices, for example life cycle methodologies, could not be applied. Another strand of participation evident in the US is the shifting focus of organizations towards business process reengineering in which the various organizational tasks and business processes around them are analyzed to eliminate redundancies to establish a tighter, functionally related process flows [1]. It is claimed that the employees tend to establish a closer and more direct relationship with the reengineered processes that they engage with.

The main streams of development of the participatory design tradition in the West evoked varying and diverse trajectories in different societal contexts, impinging as they do on the "questions of democracy, power and control at the workplace" [19, p. 41]. Bass and Shackleton [4] made a distinction between industrial democratic aspirations of the Scandinavian and European strands of participation in workplace settings, and the participative management approaches, for example in the US. They argued that while industrial democracy movements constituted formal, structured and often legally supported mechanisms, participative management tended to be more informal and its practice in organizations varied as per individual managerial styles and corporate ethos. The participative approaches were thus considered to be behavioral. Therefore, issues that could be addressed using these approaches tended to be different.

In summary, PD in the Western countries can be characterized by a workplace focus where it is recognized that it is ethically and morally right that workers should be involved in the development of systems which are to affect their working lives, but also by the recognition of the failure of the traditional technical approaches and that participation may help overcome some of these failures [22, p. 52]. However as this brief summary illustrates there is considerable diversity in the participatory approaches to ISD. More recent critical analyses of PD suggest that while PD may be necessary, it is not sufficient in itself to ensure success of IS [6, 28], other important determinants of success being power and politics at the workplace. Also, PD theory and practice need new directions in the changing socio-economic situations arising from globalization, visualized by Giddens [24] as 'runaway world'.

2.2 Participation and ISD in Developing Countries

A special issues of *The Information Society* recognizes that IS from the "developed" world cannot be replicated in developing countries and addresses the question of how to adapt these IS in such a way to balance "… global solutions, technologies, and practices on one hand, and local requirements and institutional dynamics on the other" [48]. Braa and Hedberg, in an article in this issue, [10] examined the participatory prototyping of a health IS in South Africa, the process and output of which impacted on all three case studies presented in this paper. However, there remains limited literature in mainstream journals on developing country experience in IS design, especially on the differences in eliciting participation from community based settings as compared to the Western workplaces. Braa and Korpela et al. have debated the involvement of community members in developing countries who will be served by the health system [12, 32], but the thrust of their arguments for participation is again more intuitive than being based on sound empirical rationale.

As Byrne and Sahay [15] note the issue of community participation has been dealt more comprehensively by international agencies like the World Bank and UNICEF in development projects initiated outside the IS field employing varying participatory techniques. Though the success of these participatory approaches in addressing the complex socio-historical-cultural conditions is open to debate [35], some of these methodologies (like the Participatory Rural Appraisal [16]) have been recently adapted, though in a limited way, in IS design and development projects. Given the present context where there are increasing attempts to develop e-government applications aimed at the community in developing countries, and rising concerns about the digital divide, the need to develop approaches to facilitate PD involving community-based IS is being recognized as an important need by IS researchers [42] as well as the need to rethink what we mean by participation in a social developmental context [15].

3. CASE STUDIES

In this section, we describe three case studies from South Africa, India and Mozambique relating to the use of IS in the health sector.

3.1 Research Approach
Participatory action research approach to implementing, analysing and evaluating the changes in the IS was adopted by individual researchers in their respective countries. For case 1, reported from South Africa in section 3.2 below, a total of 10 interviews, 15 focus group discussions (FGD) and one meeting took place between July and September 2002 (one additional FGD with children was conducted in May 2003). The case study from India is based on participation of the researcher in the development and use of the IS described therein during 2001-03. She has been functioning as project manager of this ongoing program since 2001. She conducted semi-structured interviews with officials from organizations involved, mainly the state, district, and sub-district level government officials, medical staff and health workers in primary health centres (PHCs). Case study 3 in section 3.4 was similarly researched in Mozambique, and is based on interviews with key informants, participant observations, group discussions, meetings, workshops and training session conducted from 2001 to 2003 at the Ministry of Health, and in Gaza, Inhambane and Niassa provinces of Mozambique. The researcher was directly involved in the efforts to institutionalize the health IS discussed in this paper.

The three cases are linked as part of a broader action-research program which aims at creating counter networks within the health sector of various developing countries. HISP (Health Information Systems Project) was initiated in South Africa in 1995, where it is now implemented nationally. It is also currently ongoing in different degrees and rhythms in various countries including in Mozambique, India, Tanzania, Malawi, Mongolia, Cuba, Ethiopia, Nigeria and China [36]. HISP seeks to strengthen processes around the design, implementation and sustainability of HIS with a focus on the local level, and building the capacity of health workers to use information more effectively and operate ICTs for this purpose. The South African case study explores the extension of the district health IS to include community-based child health data, whereas the cases for India and Mozambique explore the early implementation stages of the system in their respective countries. DHIS is the application software developed in South Africa in 1999, which was first used successfully in Western Cape [10]. This development took place under the HISP.

Summaries of the field observations, and interviews were individually prepared soon thereafter, and discussed with the concerned participants. An interpretive research approach was adopted in identifying key themes in the data analyzed by individual researchers and in the field work reported below. Interpretive approaches in IS research proceed on the assumption that knowledge of reality is socially constructed by human actors [55] through shared meaning [31]. A primarily technical approach is limited since it does not take into account the human dimension of the eventual system use [33]. This realization of the importance and interconnected nature of the technical and social have led to an increased sensitivity to the social context of IS design [2]. Interpretive researchers take the stance that the social world is relativistic and can only be understood from the point of view of individuals who are directly involved in the activities which are to be studied. The interpretive paradigm seeks to understand the fundamental nature of the social world, as it is, at the level of subjective experience [13], how people assign meaning to those experiences [17], and the processes through which intersubjectivity is constructed.

3.2 Development of a Child Health Community-Based Information System: a Case Study from South Africa

This research was conducted in oKhahlamba, which is one of five municipalities in the UThukela District lying in KwaZulu-Natal on the eastern coast of South Africa. The population of oKhahlamba is mainly rural, poor and relatively under-resourced. The UThukela District Child Survival Project (TDCSP) was selected by the National Department of Health as one of three learning sites for the development of a community component to child health in 1999. The design of the child health community-based information system (CBIS) was part of this child health project.

Traditionally decisions that affect the community at large are taken collectively. Community meetings (*imbizo's*) are called and the case for and against the issue are made. Through traditional structures community members can air their opinions and concerns. Therefore it was important before embarking on any intervention to have a collective decision made regarding community support for a child health project. Once that support

was given in oKhahlamba, the next step taken was the creation of a common vision for the community and the district concerning the development of their children. The key players (community health workers, parents, early childhood and crèche teachers, caretakers, social workers, health facility staff, clinic health committees, government organizations) who affect the situation of children were identified and were included in the discussions on how the CBIS could best serve their needs. From the outset it was important for the roles of the researchers, project staff, community members and department of health staff to be clarified. Through meetings and discussions these were documented in the project plan at the commencement of the project.

After co-determining a vision for child health (*To achieve optimal health, growth, development and well-being of children in the uThukela Health district)* a child health monitoring and evaluation workshop was held in February 2000. At this meeting community members felt that the existing routine health IS and the periodic surveys conducted in their area did not adequately address their concerns. Community members felt that these were facility focused and they preferred an IS that provided data that they could use to monitor the situation of their children. A review of the existing district health IS was conducted in November 2001 and confirmed the recommendation from this workshop that a CBIS was needed.

To understand in more detail what the information needs were in relation to this vision, who should be involved in the IS and the format the information should be communicated in, a participatory action research approach to implementing, analysing and evaluating the changes in the IS was adopted. Interviews, FGDs and the meeting referred to in section 3.1 above took place within this overall context.

Discussions were facilitated by people who were familiar with the area and who also had an understanding of the norms and values of that society. Arrangements were made to enable people to participate in the design process through use of the local language and having meetings near where they lived or worked. In the initial stages because of differentials in status and roles within the community, groups comprising, for example, mothers, councillors, facility staff, met separately to discuss what they wanted for their children. At a later stage representatives from the various groups met jointly to share the findings from the research and to discuss the way forward. To achieve some uniformity in participants' ongoing negotiations, discussions and reflections, orientation on child health issues and training on data collection methods and analysis was held.

Listening to different community members views in the field work facilitated a greater understanding around the meaning of 'well-being' and 'at risk' for a child, what factors/practices contribute to these situations, how the situations can be measured and, based on what action can be taken, who the information should go to. Additionally surveys and reports from the project [50, 51, 52, 53] provided a broader understanding, as well as giving accounts of the local knowledge and practices with respect to health, communication channels, cultural and traditional practices. Through group and individual analysis of the field work locally determined indicators *(izinkomba)*, appropriate data collection tools and different information flows were incorporated into the district health IS. Some of the new indicators included

were around the context the child grew up in, for example, communication and relationships within the household, deaths within the family, love ('*a house with warm hands'*) and being looked after by an adult ('*not leaving a child to stroll in the road'*).

The system implemented has built upon the traditions and culture in practice and therefore it is primarily a paper and oral based system. An example of this is the feedback to the community of the data collected by the community health worker. Parents, children, district health staff, councilors, teachers, clinic health committee and other interested parties are invited on a quarterly basis for feedback of the data collected from their village in the previous months. Community halls or school classrooms are used as the venue. The session commences with prayer and is opened by the councilor. Through the use of song and dance the various roles of the people involved in health are explained and people are introduced. The topic for the day is then explained, for example it may be on TB, and through discussion, role play and question and answer sessions the topic is discussed. The community health facilitators and the community health worker for that village present the data using pie charts and histograms on flip chart paper. They explain the data they found, ask questions on why this is the case and discuss the possible action that can take place to improve the situation for children (this they call the triple A cycle – assess, analyze and act). Children sing songs and dance to express their views and concerns on health issues. Participants express their understanding through words sung to the tune of a familiar hymn accompanied by traditional dances. The day is very celebratory in nature and is closed by the chairperson of the clinic health committee who summarizes the days' proceedings and agreements made. The village health days strengthen a learning cycle approach, which encourages critical reflection and is linked with action. The learning process builds upon existing community skills and resources, their talent for song and dance, and on their knowledge and practices.

Based on the field work the CBIS was implemented in the municipality in June 2003 and agreement was reached to expand the system to the rest of the district. However as the TDCSP project leader commented in the evaluation of the project "*This process has shifted thinking within the project from the idea of the monitoring of community interventions to the empowering approach of communities monitoring themselves and the status of their children. ... The work shows potential but is still in its infancy.*"

3.3 Institutionalizing District Health Information Software (DHIS) – an Indian Experience

Efforts to use the HISP approach and adapt DHIS in an Indian setting were initiated in 2000 in the Andhra Pradesh state of India. The health related information processing in this state, as in most other parts of the country, has traditionally been paper-based. These manual systems, typically operated and maintained by the concerned departments, carry the legacy and inefficiencies of a bureaucratized set up, with massive duplication of data, and variety of reporting formats devised over the years without much thought to their reconciliation and rationalization. The main source of primary data is the network of Primary Health Centres (PHCs) in each district. Health workers responsible for data

collection from households and locations serviced by a PHC received little training for the task, and the lack of professional supervisory capacity, abetted by bureaucratic apathy, ensured that practically no data control policies or practices to ensure some level of standardization were in place. PD approaches had never been adopted, the prospect of different hierarchical levels working together to achieve a common objective considered 'unimaginable.' Andhra Pradesh state was chosen for a pilot research project since the state has lately been demonstrably keen to introduce e-governance based reforms. The HISP pilot was taken up in the political constituency of the Chief Minister (CM) of the state, falling in Chittoor district, as decided by his office. The CM has been nationally as well as globally perceived as an icon of IT promotion in Andhra Pradesh [23]. HISP potentially provided an instance to demonstrate his IT vision in a much neglected social sector.

An initial survey and preliminary studies conducted by project staff in PHCs (there are 89 PHCs in Chittoor district, catering to the basic health care needs of about 3 million population) revealed a centralized, top-down and hierarchy-based work culture. Data handling was extremely compartmentalized involving multiple forms and registers maintained at various staff levels. Two main but disparate datasets comprised about 1200 data elements. This data was collected by Multi purpose Health Assistants (MPHAs) who functioned as the interface between communities and PHCs. The datasets had a high level of redundancy. Data was even being collected for programs and projects that had long been wound up since there was no culture of interaction among higher level officials and MPHAs. Consequently, MPHAs had little understanding of why data was being collected, how it would be used, and they raised no questions even when identical data was collected repeatedly to complete different input formats pertaining to different programs. Based on the data collected, about 40 reports were manually generated monthly for various desks in the hierarchical ladder. No one in the PHC knew or cared how these reports were eventually used or improved decision-making.

The HISP team took up identification of minimum dataset (MDS) adopting a participatory prototyping approach. This exercise was carried out over a year involving intense discussions to scrutinize the multiple reports being generated and the data elements collected under various programmes. The participatory prototyping for the MDS was carried out for over a year, and involved multiple discussions on data elements and forms used with the various staff. Several workshops were organized in which staff at various levels participated in discussions along with MPHAs. The MPHAs provided useful inputs based on their field experience, and as they grew in confidence, they also provided incisive and valuable critique of existing data collection approaches. Bringing together inter-program functionaries together with MPHAs also provided opportunities to discuss openly how the monthly reports were actually being used, and how these could be rationalized without subtracting from their informational value. These iterative prototyping efforts and wider consultations eventually resulted in MDS being reduced to 400 data elements, while the number of reports required (restructured for more effective presentation) was brought down to 10.

The revised MDS and the reporting system based on DHIS was implemented in 9 PHCs in 2001. Six months after the system was

made operational, the HISP team made a presentation to the State Health Department. The usefulness and value of the HISP approach was acknowledged, and it was formally extended to 49 PHCs by the state government soon after the presentation. The extension of HISP/DHIS to over 1300 PHCs covering the entire state of Andhra Pradesh was recently approved in principle, an Memorandum of Understanding having been accordingly signed between the HISP and the State Government in January 2004.

3.4 DHIS – User Participation in Mozambique

The case describes the challenges encountered in the process of HISP implementation, which commenced in 1999 as collaboration between the Mozambican Ministry of Health (MoH), Eduardo Mondlane University, University of Oslo and University of Western Cape. The aim of this initiative was the provision of a tool and processes to capture data and provide routine management reports, and develop the capacity of the health staff to effectively use this tool [9]. The Mozambican health sector is extremely donor dependent with multiple donors supporting different health programs. The fragmentation that arises as a result of this multiplicity seriously impedes the introduction of new initiatives like HISP.

The MoH represents a complex institution with many actors at different hierarchical levels with different interests, educational backgrounds and agendas. The management style is highly centralised, whereby the senior staff are resistant to share power and tended to adopt rather authoritarian and hierarchical approaches, for example even small decisions need approval from the highest level. In addition to the limitation of availability of trained personnel (both medical and IT proficient) [11], the infrastructure in Mozambique is very poor and most health districts do not have electricity or proper roads and transportation facilities. Given this context, the challenge for HISP is to identify appropriate strategies for adapting and strengthening the DHIS within the existing infrastructure and technical constraints.

The HISP philosophy is based on cultivating participative approaches and creating collaborative mechanisms between MoH's top, middle and lower level managers, and field level health staff. For example, to develop a hands-on understanding of the health IS, a multidisciplinary team was established including senior IS researchers, PhD students in computer sciences and medicine and international masters' students of IS and public health. This team was responsible for implementing an action-oriented research to apply participatory approaches through training and education of managers, doctors and health workers. These activities aimed at (i) improving the working knowledge of computer usage in general and health IS in particular, (ii) building realistic expectations of the DHIS application, and (iii) minimizing resistance to change. This was done through organizing several seminars, workshops and training sessions in three provinces where HISP was being implemented. The HISP team played an important mediating role in facilitating interaction and communication between the MoH staff and province and district level field workers. Such interaction has historically not existed in the past and the presence of the HISP team seen as being relatively "neutral", helped to diffuse some of the historically existing gaps due to power structures.

An implementation plan called "strengthening health management information system within the context of sector-wide approach and health reform" was finalized by the MoH with active inputs from HISP and the district staff to guide the adaptation of DHIS.

The participatory process suggested that DHIS was seen by all as a prototype rather than a ready-to-use software. Through this process, the team, tried to understand the reactions of the users and how the tool met their needs. The reactions were gathered through observations, interviews, workshops and training sessions. These interactions helped to identify limitations in the prototype and implement suggestions for improvement. For example, it was suggested by the province authorities that it would be wise to develop new and locally relevant data elements, for example to register diseases that were specific to some regions that were related to local food habits, and which were typically not reflected in the national health IS. An example is the dietary cyanide exposure from exclusive consumption of insufficiently processed bitter cassava which is a major source of calories in certain regions, resulting in a condition known as konzo. Konzo is characterized by the abrupt onset of an isolated and symmetric spastic paraparesis which is permanent but non-progressive. The disease has been reported only from poor rural communities in Africa. Its name is derived from the local designation used by the Zairian population affected by the first reported outbreak, in 1936. In the Yaka language, konzo means 'tied legs', an apt description of the resulting spastic gait.

During one of the open discussion session, one of the participants expressed his concerns as follows:

> Although Konzo is not considered to be a major public health problem [in Africa as a whole] it affects communities. Therefore, data must be collected and used to address or prevent Konzo in our region.

This suggested the need for DHIS to be flexible to allow for the extension of the datasets to include both locally relevant data in addition to that required by national authorities.

In summary, the HISP participatory approaches firstly served to mediate the relation between the senior MoH staff and province and district level health workers, an interaction that historically has been non-existent; secondly, through the close interaction with the field staff in the local language, a lot of indigenous knowledge was elicited which typically gets lost in the top-down approaches to systems development employed by foreign expatriates. This local knowledge is being attempted to be inscribed into the software. A limitation of the approach to date has been the primary focus on the province for conducting of the training programs, which to some extent excluded the districts. However, the very weak infrastructure in the districts makes it difficult to conduct training programs efficiently.

4. ANALYSIS AND DISCUSSION

In the above case studies, the underlying strategies used were of participation and capacity development. The participatory approaches used in the three cases, however, differed. The differences are discussed below in the first three subsections, whereas the last subsection explores the common strategy of capacity development to enable participation that was used in all three cases.

4.1 Participation: Traditional Forms of Participation and Communication

Two important aspects of participation in the South African case were the reliance on the tradition and culture of participation in communities as well as ensuring that the key role-players (multi-leveled and multi-sectoral) participated. If the information from the IS is to be used for action it is important that in the process and in the output of the IS traditional and cultural practices are incorporated. The approach to participation was in line with traditional and customary traditions where decisions are made collectively (based on the principle of *ubuntu* – collective personhood and collective morality). Traditional communication channels were used for data collection and feedback of information. In the village health days song, dance and poetry are all used in a collective celebration of what has been achieved, but also what needs still to be done. The case also illustrates the importance of participation of role players in the design process from the outset so that a common vision can be determined. Reaching a common understanding between the users and providers of the health services is impossible without their joint participation. For actors to participate in dialogue there is the need to recognize the structural conditions that are required for such a dialogue to take place, and to address some of the constraints to achieving this. Therefore having meetings in the local language, with people they trusted, in convenient places and times, as well as conducting multi-sectoral and multi-leveled meetings were all strategies adopted.

While involvement of all stakeholders in the Western participatory traditions has been emphasized, particularly in the socio-technical tradition, the challenges to doing so in community settings of developing countries are clearly different. Cultural practices are deeply embedded in the ethos of the community, and the participatory paradigm in these settings is bounded by the cultural traditions and practices. Ritual and ceremonies are the events to assert unity and harmony of the community. It is through these mechanisms that social fabric of a community is constructed, value systems to nurture common good are developed and find expression [39]. Another departure from the Western settings in the context of participatory parleys is the close linkage to the 'place,' which underlies the cultural and moral norms of the community, and the ways in which its knowledge is constructed and expressed. Basso [5, p.31] opined "knowledge of place is [therefore] closely linked to knowledge of self, to grasping one's position in the larger scheme of things, including one's community …"

4.2 Participation in Hierarchical Settings

The Indian case typifies efforts to foster participation in hierarchical settings. The trajectory of development programs in India, including IS endeavors involving community issues, is much dictated by a network of government institutions like the central/state government ministries, scientific institutions, and district administrative agencies. These institutions have existed historically with a strong sense of bureaucracy, with rules and resources drawn from the British colonial rule, and later reinforced by the socialist agenda of post-independent India [29, 47]. The course of health informatics in India has thus been strongly influenced by differential power relations arising from rigid hierarchical structures and strong bureaucracy.

Therefore, in starkly different historical, political and social contexts such as India, participatory processes will not arise naturally as a result of democratic aspirations or reasoned argumentation, as may be the assumption in formal workplace settings of western countries like in Scandinavia or the UK. Paradoxically, however, participatory processes often need to be initiated by government officials in-charge, rather than these emerging idealistically from grassroots as a bottom-up process. In the present case, enrolment of CM's office resulted in the alignment of the otherwise divergent networks of HISP, state health bureaucracy, PHCs. This perspective emphasizes that local action research initiatives (like instilling IS in PHCs and creating minimum dataset need to be linked to larger networks of power to become scalable and sustainable [27]). An implication, therefore, is that to enable participation in settings that are traditionally hierarchical and non-conducive to self-initiated bottom-up processes, the initiative may need to come from the top, and then be gradually nurtured over time.

4.3 Role of Mediating Agencies

The Mozambican case points out to the role of mediating agencies such as university academics in fostering participatory processes. Different kinds of agencies may adopt varying strategies for mediation. In the emerging institutional structures for supporting decentralized development in most developing countries, the government departments and officials continue to be important actors. They can function as effective agents of change by translating the interests and work style of the local government departments and realigning these with the need for more transparent and decentralized governance. In the Mozambican context, the mediating role of the academia lay in acting as a bridge between health bureaucracy on one hand, and the communities and the local health workers on the other. They also mediated between the policy formulated by national/state governments and its translation into concrete practice on the ground. The role of mediation played by the academic members of HISP was critical in creating the required environment for learning by doing. User participation means not only users participating in design but also designers participating in use. The designers should try to share practice with users. Participatory design is a learning process in which designers and users learn from each other and the users, in particular, must have a guarantee that their design efforts are taken seriously.

Non-governmental organizations (NGOs) and academia have come to play an increasing advocacy as well as intermediary role vis-à-vis government and people. These agencies are generally able to effectively communicate with government officials because of their educational background, experience, and contacts with the media, and can serve as 'gateways' between people and officials. Madon and Sahay [34], for example, describe a case study from India about developing information strategies to support the empowerment of marginalized slum dwellers in the city of Bangalore. The deficiencies in capabilities of the people, due to illiteracy in this case, were enhanced by an NGO who played the role of an intermediary, for example by developing systems in audio forms as a means of communication. The increasingly important role of local governmental and NGOs as mediators between global challenges and local concerns of exclusion and marginalization has also recently been addressed in urban contexts [7]. The mediating agency, a university in the

Mozambican case, was similarly able to act as the mediator and to inspire local people to achieve their participation potential.

4.4 Capacity Development

Efforts at capacity building and creating an enabling environment to facilitate participation were also a main focus in the three cases discussed above. Developing capacity comprises ability to use and analyze the information once the systems are in place, as well as the ability to adapt and change the IS to suit the ever-changing context. Capacity to participate was an important consideration as the unequal nature of social relationships and positions between different actors and also institutions was recognised from the outset. Forums were established that suited the needs of the various groups, such as discussions in the home language and having the meetings near home or place of work in the South African case. Access to information was also an important requisite for capacity to act in the case studies. In the South African study, much of the data collected through the existing district health IS is valid and useful, but was not getting to the people who can act upon it. As one project leader mentioned we need to look at how information is flowing and the possibility of establishing "feedback pathways" of this data.

A notable feature of the HISP initiative in India was the focus on training of MPHAs and other staff, and efforts invested in capacity building at the level of PHCs. Besides providing on-the-job training on the use of DHIS, and data collection for the computer-based screens, long term capacity development has also been taken up by providing in-depth and intensive training to selected staff in PHCs. Two trainers from South Africa also conducted a 2-week course on health informatics. A positive outcome of these efforts, and inculcation of participatory methods, has been the empowerment of MPHAs to an extent (most of whom are women), since they are able to communicate on more equal terms with the PHC hierarchy. Gaining an understanding of computerized work environment in itself adds to the status of an individual, particularly women, in rural settings of India. A similar training approach was adopted in the case of Mozambique.

Given this common thread it is interesting to note how very little discussion in mainstream IS software design and development literature explores the capacities or capabilities to use data and information. Through a parable (Annapurna wanting somebody to dig her garden and finding it difficult to chose one of three laborers as each would be chosen if different criteria was used – poverty, unhappiness or illness), Sen explains how decisions made depend on the informational base and indicators selected [49, pp. 54-55]. In the selection of the informational base, Sen talks about the concept of 'capabilities' as a way to measure poverty or freedom [49, p. 75]. In the CBIS and DHIS cases discussed, we explored capacities to act based on the information that the participants wanted included or excluded, as well as the format in which the data was to be collected and transmitted. The constraining factor on capability to act in our cases was largely believed to be solved through the reworking of the data items collected, information flows and the development of communication loops.

Capacity in IS design and development is also needed as the IS is not static and the people involved need to be able to change it as their needs and situation also changes. Walsham [54] underscored

the context/process dynamics of IS. He explained that an IS is developed in a specific context, but, in turn, impacts the context itself, modifying or strengthening it. The changed scenario then requires modifications to the IS as well. Therefore, in the context of this paper, the design process in IS needs to be empowering, so that capacity remains at community level to introduce changes as may become necessary. In South Africa this was especially important given the recent move towards the decentralization of the health services where new role players such as local government and community health workers were taken on new positions of responsibility in relation to the delivery of health services. As such the DHIS needed to be adapted to reflect this changing context. Adaptation of DHIS to suit local procedures, working ethos, and different reporting requirements also posed strong technical challenge both in Mozambique and India as well. An added complexity in Mozambique was the need to modify input-output sub-systems to Portuguese (the original South African DHIS used English in these interfaces). Efforts are also being made to convert these features into the local language (Telugu) in Andhra Pradesh.

5. CONCLUSION

The above discussion has emphasized several important points of departure in ushering participation in non-western contexts of developing countries. Kensing and Blomberg [30] identified three main issues in participatory IS design, viz., the politics of design, the nature of participation, and the methods, tools and techniques for carrying out design projects. The case studies bring out the topicality of their analyses to developing country situations as well. However, within developing countries, these factors impinge variously due to diversity in respective socio-economic and political situations. In the South African case, participation was fostered through respect to communities' cultural heritage; the approaches used were also in consonance with their culture. In India, technology became an important element in the political network before being accepted. Participation in this case was initiated by the top political leadership. In Mozambique, mediating agency of a university played an important catalytic role in bringing about acceptance of participatory approaches. Thus, there is no single, algorithmic best practice applicable to all situations. This perspective emerging from our analysis lends support to Bass and Shackleton's proposition [4] that participatory approaches tend to be behavioral.

The term 'participation' has different meanings for different people. "The term has been used to build local capacity and self reliance, but also to justify the extension of state control. It has been used to devolve power and decision making away from external agencies, but also to justify external decisions" [41, p. 79]. What is important in participation is who decides what data to collect, who collects it, who interprets the information and uses the finding and how participation can make decision-making a more democratic process. Participation in ISD should be a social process of bringing people together to understand different views and share decision-making so a sustainable IS is designed that is culturally and locally specific. From the literature on participation in ISD from a Western perspective (barring some exceptions, for example [7]), the underlying assumptions of the democratization of the workplace, high literacy rates and a reasonable infrastructure are present. Though these assumptions can also be questioned in a Western context, it is unrealistic to

assume that any of these assumptions can be made in a developing country context. An interpretive approach to participatory IS design is needed to understand the socio-economic, cultural and political context that shapes the behavior and actions of the 'users' of the system.

This paper has attempted to address a deficit found in contemporary writings on participatory design in IS literature – the absence, or very little, discussion on the how, rather than the why, of participation in IS design and development in developing countries. As our analysis of the case studies show even though the same type of system (DHIS) was being implemented in developing countries contexts and that capacity development was a viable strategy in all three cases, the approaches adopted were significantly different. If we are to learn from research conducted in the area of participation there is the need for more debate that moves beyond the theoretical and ethical arguments, and discusses in detail the *process* of participation undertaken in ISD. It is from this type of analysis that we may be able to understand what we really mean when we call from an ethical and theoretical perspective for participation in IS design.

6. ACKNOWLEDGEMENTS

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