USER-CENTRED DESIGN, E-RESEARCH, AND ADAPTIVE CAPACITY IN CULTURAL INSTITUTIONS: THE CASE OF THE WOMEN ON FARMS GATHERING COLLECTION

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Abstract. This paper explores how the interaction between community members, researchers and cultural institutions can be leveraged to produce improved results for all through the interplay of user-centred design (UCD) and participative action research informed by structuration theory. We discuss through a case study of a Women on Farms Gathering (WoFG) collection in Victoria, our vision of UCD, the potential of using ICT to facilitate e-research, and the reflexive adaptation of cultural institutions.

Introduction

Giddens (1984) offers the insight that:

> The best and most interesting ideas in the social sciences (a) participate in fostering the climate of opinion and the social processes which give rise to them, (b) are in greater or lesser degree entwined with theories-in-use which help to constitute those processes and (c) are thus unlikely to be clearly distinct from considered reflection which lay actors may bring to bear in so far as they discursively articulate, or improve upon, theories-in-use (Giddens, 1984: 34).

In other words, meanings, actions, and structures are closely and continuously interdependent. According to Giddens, community cultures are generated and re-generated through the interplay of action and structure. Social structure both supports and constrains the endeavours of individuals, communities and, societies. Giddens' theory of structuration is the cornerstone concept for this paper.

We define cultural institutions as organizations that promote and support culture, education, and sciences. Cultural institutions have become increasingly sensitive to their communities and have over the years become more innovative in the designs and redesigns of their services, information systems, and work spaces to cater to the needs of these communities (Allmang, Liu and Sanders, 2005), reflecting a reflexive adaptation at an institutional level.

The implication for user-centred design as a technique for guiding institutional adaptation is that design consists less in products than in processes that engage all participants in reflective practice and continuous learning expressed in negotiated action outcomes.

The paper presents the case of the Women on Farms Gathering (WoFG) collection, with which we demonstrate our research approach and inquiry based on action-structure principles; reflected in our use of a design methodology which engages participants in immediate and intermediate processes. The WoFG project in its use of a participatory user-centred design methodology, grounded theory, participative action research, and e-research approaches demonstrates at a pilot level how the capacities of e-research can support a more mutually adaptive and supportive interplay between research, community, and cultural institutions.

User-Centred Design, Reflexive Adaptation, and Power of E-Research in Cultural Institutions

Perhaps one of the most famous representations in thinking about designing around users came from Norman's groundbreaking ideas in 'The Psychology of Everyday Things' (1998). There the 'traditional' information systems design philosophies and techniques are critiqued; reflecting a paradigm shift in information systems design. Here we discuss our vision of user-centred design informed by structuration theory; one that is integrated in its form and can be applied to both the technological and human dimensions of collaborative endeavours. We argue that this design methodology when applied to the services, applications and workspaces of cultural institutions provides them with a level of adaptive ability which empowers them to engage and respond sensitively to changes in their communities quickly. At the same time, we also discuss on the implications for e-research within this framework.

1. Tenets of Structuration Theory and Applications to User-Centred Design

In the study of the social realities of information technology, there are broadly two traditions: the assumption of social reality as subjective or objective (Orlikowoski and Robey, 1991). This opposition in theory is reflected in the assumption of social systems (of which information technologies are part) as the result of 'meaningful human behaviour', representing social realities as subjective; while the other focuses on the organisational aspects of social systems, independent of and constraining human actions, representing social realities as being objective (Bhaskar, c.f. Orlikowoski and Robey, 1991). Research assuming the subjectivity of social systems focuses on the subjective human experiences, interpretation of them, and elements of human behaviour modifying the social world.

On the other hand, the contrasting view of objectivism focuses on the definitions and properties of institutional elements which shape social systems, and through this process, provides explanations for their influences on human actions and relationships. Giddens asserted that the grounds of mutual exclusiveness between subjectivism and objectivism is flawed and therefore developed the theory of structuration to accommodate the two traditions. Structuration theory views the subjectivity and objectivity of social realities as equally important and is therefore used as a fundamental principle in our concept of UCD.

According to structuration theory, the cumulative effect of people's living and working within social frameworks is the production and reproduction of culture. The cultural context is generated and regenerated through the interplay of action and structure. Social structures both support and constrain the endeavours of individuals, communities and societies. This is also referred to as the duality of structure (Giddens, 1986), which sees that the institutional properties of social systems are created by human actions, and in turn shape future actions. It recognises that 'man actively shapes the world he lives in at the same time as it shapes him' (Giddens, 1984).

Reflecting the same principles, the user-centred methodology of design draws on similar paradoxes. The design of information systems, however exhaustive in its process and engagement with users, imposes certain forms of structure on the communities of users. Yet this process of design must also call on the human actions shaping the eventual structure of information systems. It is this engagement and involvement of users that the paper is addressing; the relationship between community actions and how they eventually shape social structures that are continually being negotiated by cultural institutions and their communities. Many information systems researchers argue for the case of iterative design (Carroll, 2000; Preece, 2002) which could be seen as a way to factor in the effects of human actions – but more critical for cultural institutions is the importance of factoring actions in a way which would reflect the cumulative actions of communities as a whole, and incorporating this in the design methodologies of information systems, services, and workspaces. As Rose and Scheepers (2001) pointed out, while the use of structuration theory to theorise the field of information systems and its empirical scenarios is not new, there is little effort in using the theory to influence the field in practice. Structuration theory is a complex one which cannot be adapted unless in relevant contexts. The following sections examine the relevance of the theory to the user-centred design methodologies we propose.

The Duality of Structure

Perhaps one of the most important applications of this theory to UCD lies in the recognition of structure and agency as 'duality' – making clear the distinctions between structure and agency yet

recognising them as dependent upon each other iteratively. The application of this theory recognises that the structural properties of social systems impose themselves as influencing mediums and at the same time, outcomes of the social practices they 'recursively organise' (Giddens, 1984, pp 25). These dimensions are illustrated in the well-known diagram as below (Figure 1):

Structure   signification ⟷ domination ⟷ legitimation

Modality   interpretive scheme   facility   norm

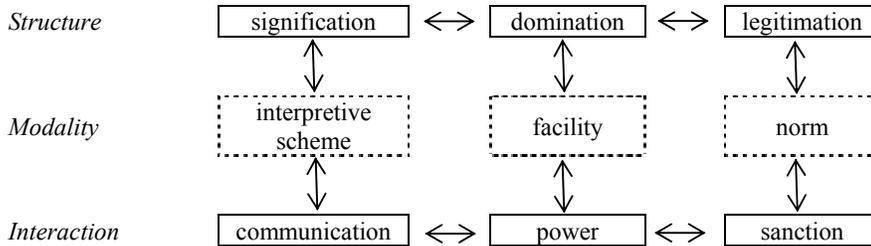*Interaction*   communication ⟷ power ⟷ sanction

Figure 1. Dimensions of the duality of structure (Giddens, 1984)

As illustrated in figure 1, social structure and human interaction are broken down into three columns. Each structure and interaction are then associated with each other recursively via the linking modalities. For example, as humans communicate, they use interpretive schemes to help them make sense of their interaction; at the same time these interactions change or reproduce the same interpretive schemes that are embedded in structures as signification. The facility used to allocate resources is manifested in the wielding of power, which in turn produces and reproduces facilities influencing social structures of domination. Norms on the other hand, referred to also as moral codes; provide sanctions for human interactions, which ultimately also produce legitimation within structures.

Orlikowski and Robey (1991) have done much work in theorising aspects of information systems using structuration theory. According to them, 'in its constituted nature – information technology is the social product of subjective human action within specific structural and cultural contexts – and its constitutive role – information technology is simultaneously an objective set of rules and resources involved in mediating (facilitating and constraining) human action, and thus hence contributing to the creation, recreation and transformation of these contexts'.

For information systems, they are forgotten as often as they are remembered in the conduct of everyday life, and have long since overflowed their original ambit of the workplace to include almost all other aspects of living.   So extensive are the potentials of information systems in the current state of the world that the term 'information systems' has become too diverse a concept to be captured in any short definition. Information systems – when considered as an object of study – require constantly renewed effort at definition depending on context. It is now a reality of the techno-social condition that people need to grapple continuously with the multiple personae of 'information' and 'information systems' while interacting with them to fulfil their everyday activities. Clearly this interaction with information systems while influencing them to accomplish perceived everyday tasks needs to be accounted for.   Orlikowoski (1992) further explores the structurational model with information technology. This is shown in Figure 2.
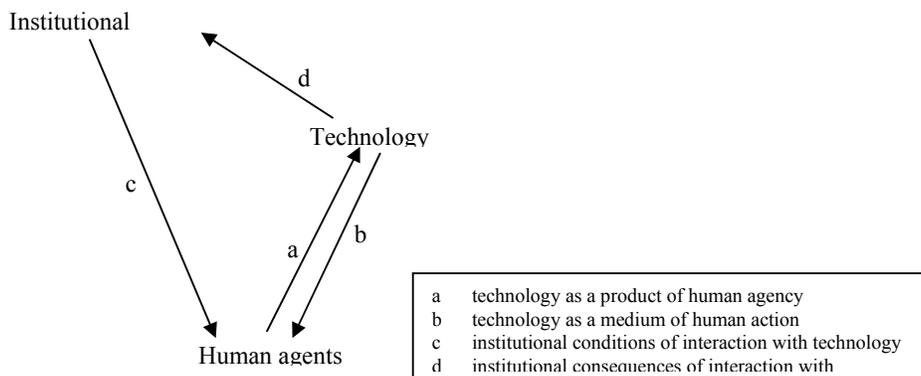
Institutional

d

Technology

c

a   b

Human agents

a	technology as a product of human agency
b	technology as a medium of human action
c	institutional conditions of interaction with technology
d	institutional consequences of interaction with

Figure 2. Structurational model of technology (Orlikowoski, 1992)

The recursive nature of technology based on structuration theory is reflected in the structurational properties of technologies as being created and changed by human action; but also used by humans to accomplish actions. This is combined with a hermeneutic view of the interpretive flexibility inherent in technology.

Structuration theory and Its Application to User-Centred Design

The information systems' complex of disciplines has evolved significantly in the past 20 years. Part of this change is marked by shifts towards user-centred computing, with characteristic terms such as usability, user-centred design, human computer interaction, and user computing, being used almost interchangeably. Karat and Karat (2003) express concern that the evolution of the UCD field as becoming akin to 'family values' in nature – to which everyone applauds and subscribes, but with little agreement on its definition: 'if we cannot define what UCD is, then we are faced with allowing virtually anything to be called a UCD process'. The term 'User Centred Design (UCD)' is much used, but still there appears only a basic consensus as to its meanings and implications: the consensus that user needs should inform processes of information systems design. Organisations express their own user-centric design philosophies in different ways. However all would claim a focus on the functional needs of users. Karat and Karat (2003) acknowledge the diversity of interpretations of UCD, but note that they are all agreed in distancing themselves from Taylorist principles of techno-centric, mass production in information systems design methodologies. Beyond these clear points of agreement there is a broad consensus in the UCD world that reality is 'mutable', there are 'no certain truths', and 'knowledge is constructed through communally created knowledge and action'. A principle advocated if not yet realised in practice is that UCD involves the collective participation of all stakeholders.

The conceptual journey towards UCD gained pace in the 1980s. Penniman (1985) stressed the importance of user experience and satisfaction being included in the performance measurement of information systems. However after two decades Karat and Karat (2003) still characterise UCD as a relatively young discipline undergoing evolution. They observe that the term is still often used loosely, reflecting the changing scope and nature of UCD. There has yet to be a consistent agreement in the field with respect to the focus areas practised by the industry and academia, though all are agreed that UCD is fundamentally about understanding the needs of users, and harnessing such understandings in the design process.

The consequences for the study of user centred design given the implications of structuration theory are plain. Given that user centred design sets itself up to understand the needs and expectations of users as comprehensively as possible, this involve the assessment of requirements of perceived users of information systems. This too, has changed significantly over the years, with user feedback now being engaged as early as the conception stage of any design process (Bonner, 2002). Yet a dilemma exists, which imposes itself as a dynamic influence to the consequential structure of social systems to be designed. The dynamic interplay of user needs and feedback (action) and translating these needs into some form of requirements for any information system (structure) cannot be satisfied in a linear, streamlined methodology of design. As Bonner (2002) pointed out, users have found it difficult to communicate ideas or concepts beyond their own experiences. Many practitioners have also found problems with the classic process of user-centred design; that it is poorly timed, time-consuming, costly, and most of all, the iterative suggestion of user-centred design implies that there can never be a good-enough information system for the community to use (Fraser, 2002; Head, 1999; Cockton, 2004). Perhaps it is not a difficulty to be resolved – but a condition or state to be continuously negotiated between cultural institutions and communities.

It is this interpretation of the relationship between people and information systems that leads us to characterise UCD more as a process of emergence rather than known purpose, and to propose as its appropriate 'design' methodology a reflexive process of participative, community and action based, hermeneutics. Our concept of UCD draws its procedures, and its explanatory and prescriptive power, from the hermeneutic study of communities in which people live and work – the very basis of structuration theory. This requires the study of user centred design methodologies distinct from the typical study of users as single units. The very cultures of knowledge creating communities are considered, and through a participatory research process, the ideal that such cultures should be included in the user-centred design methodology.

2.   The Reflexive Adaptation of Cultural Institutions

A consequence of designing information systems which includes workspaces, applications and services using this concept of design methodology is that it enables cultural institutions to be adaptable to changes in their communities. The explored structuration model applied to information technology makes the agency and institutional attributes of human and technologies interactions evident.

Such a process enables cultural institutions to progressively minimise the impositions of structures on the communities concerned, and at the same time, through community engagement, maximise interactions from the community to provide institutional responsiveness in the continuous design and redesign of information systems. This is referred to as the reflexive adaptation of cultural institutions – an ability which allows them to enable dynamic interplay and dialogue with the communities they serve. This will be illustrated in the later discussion of the case study.

Reflexive adaptation is also considered in its duality. Too often are social and information systems designed around once-off assessments of user needs – failing to consider the adaptive abilities of users in their interactions with information systems (Spinuzzi, 2003). In the context of cultural institutions, this consideration of changing community capacity is especially important in view of the fact that the very aim of cultural institutions is to promote culture and knowledge; and such promotion cannot take place unless cultural institutions design their services in ways that are sensitive to changes in the needs and abilities of the communities.

3.   Enabling E-Research

Upon recognition of the potentials and benefits of e-research for Australia's research community, the Australian Minister for Education, Science and Training and the Minister for Communications, Information Technology and the Arts announced the establishment of the e-research co-ordinating committee (Australian Government, 2005). This action was largely inspired by the acknowledgement of the opportunities e-research provides for Australian researchers to collaborate at national and international levels.

The emergent cluster of ideas constituting e-research focuses on the ability of ICT to support collaborative research processes across time and place, often involving large teams and datasets. In the context of this paper, particular attention is paid to potentialities that arise when e-research intersects with research approaches suited to inquiry based on structurational or action-structure principles. The Women on Farms Gathering project uses a participative action research approach to engage which engages the community at various levels. There is no better way to illustrate this other by the analysis of WoFG as a case.

The Case of the Women on Farms Gathering (WoFG) Collection

The first gathering was held by Victorian farm women in 1990, Warragul, Victoria. The first gathering included a collection of symbolic objects and stories consisting of: two large banners, videos, photographs, oral histories, memorial plaque, and a range of memorabilia (t-shirts, mugs, bags), uniforms and symbolic icons such as a cow pat and irrigation shovel, magic wand, cheque, Mallee stone, Mallee root, peaked cap, computer motherboard, a jar of Mallee soil and seeds, farm work boot, horseshoe, spring, ceramic hands and an open lock and key. It became an annual event thereafter, with each gathering held in different locations. As the years went by, these gatherings grew in attendance and depth, with themes selected for each gathering and the number of artifacts increasing.

Yet the conception of items collected as a heritage and significant collection was not realised until the gathering in 2001, when, items from past gatherings were brought together to contribute to a series of history boards displayed at the Beechworth Gathering in 2001. Committee members of the Gathering then contacted Museum Victoria for a neutral, central institution who could ensure the sustainability of the collection. From there, a Heritage Group was then established and consists of twenty-one women from across Victoria, each representing past gatherings. In 2003, representatives of the Women on Farms Gathering Heritage Group and Museum Victoria signed an agreement to work together in making visible a story that has long been ignored: the vital and creative role of Victorian women in sustaining their rural industries and communities. Over 260 participants signed a three-metre long scroll as witnesses to this special occasion.

4.   Developing the Collection

The scope of the collection comprises of iconic objects, texts, oral history recordings, videos, photographs and memorabilia relating to the lives of Victorian women of farms. Since the first gathering the collection has seen the inclusion of stories – both oral and written – about and brought to the gatherings, and physical artefacts: all working together to facilitate the promotion, sharing, development, networking, and celebration of the diverse roles and memories of Victorian women on farms and in rural communities.

With the involvement of the Museum, the collection had grown considerably in both depth and breadth. This came about through the unique partnership between Victorian women on farms, represented by the Women on Farms Heritage Committee, and Museum Victoria. As the collection and engagement with the community grew across time and distances, the need came up for a medium to communicate and exhibit the collection to members of the public and members of the community. This led to the formulation of a digital approach to develop the WoFG collection.

Desired Outcomes & Approach

Because the WoFG was a self-initiated 'grass-root' endeavour, the gathering was seen as a particularly valued partner by the Museum. They provided unique experiential knowledge, instantiated both in objects and stories. The involvement of the Museum as the cultural institution in the partnership was intentionally kept in equal engagement with the WoFG community. Such guiding principles were largely based on participatory action research philosophies, which saw the community as a knowledgeable partner, the researchers as collaborators, with a primary goal to contribute to the betterment of the community in context (Nyden, 1997; McKay and Marshall, 2001).

Because the WoFG community was seen as a partner, rather than identifying the aims of the information system up front, they were identified through discussions with the community representatives; in this case members of the Women on Farms Heritage Committee. The main identified considerations for the development of a digital representation of the WoFG collection were, not in any order of importance:

- Travelling / mobile exhibition: to overcome the physical limitations of the collection, a digital representation of the collection should help bring the exhibit from the Museum to the community and members of the public.
- To use the digital medium as a form of storage and preservation of the collection.
- To serve as a tool for participatory engagement and research with the community. Two components exist – one which is accessible by members of the public that showcases the WoFG collection, while the other components acts as a researcher's desktop, facilitating the sharing of resources between members of the Women on Farms Heritage Committee and stakeholders of the Museum. The second component will also facilitate collaboration between researchers and the community. In addition, it was hoped that having the collection accessible publicly through the Internet would make contributions to the collection from other members of the community easier. These members may not be physically located on a Victorian farm; but could identify with the community whether through their own experiences or those of others such as their mothers, grandmothers and relatives.
- Storage and archiving of the collection should also enable the cultivation of memories for the community over time.
- As a marketing tool, to generate public interest in the stories and collection of the women on farms community

With these identified aims, an approach was developed to develop the digital tool needed to fulfil these objectives.

5.   A User-Centred Design Methodology & Outcomes

One of the most distinctive characteristics of the design methodology used in this project lies in the way user requirements were gathered. Instead of using interviews and meetings with only key stakeholders, researchers and developers involved in the project were engaged in the discussion groups and meetings between the Museum and the community. The generation of functional requirements were therefore largely inspired through observations and first-hand engagement with the partnership

between the cultural institution and the community. Thereafter, these functional requirements were worked out into technical specifications with the developers.

The rationale for this methodology is distinctive. One significant difference is that the assessment of users and their needs was drawn away from the typical study of users as individual units (Spinuzzi, 2003; Smith, 1997). Instead, users were studied holistically as a community; in their collaboration and working together. This reflects the intention to consider the cumulative effects of people living and working together in the contexts of specific communities – the production and reproduction of cultures cannot happen to individuals working and living alone. Yet it must be mentioned that that the construction of self-knowledge is inevitable when people come together as a community (Castells, 2003). In fact, Calhoun (c.f. Castells, 2003) noted that:

"We know of no people without names, no languages or cultures in which some manner of distinctions between self and other, we and they, are not made… Self-knowledge – always a construction no matter how much it feels like a discovery – is never altogether separable from claims to be known in specific ways by others."

It is possible that the aggregation of individual needs, when assessed separately, might lead to the same design arrived at when the community's needs are negotiated collectively. However, there would seem to be a better balance of power in the latter approach, effectively a transposition of the user from object to actor in the design process. A challenging insight on UCD is provided by Spinuzzi's characterisation of the user as a 'victim' to 'rescued'. Such an interpretation can be drawn from UCD literature that concentrates on the adeptness of designers, developers, even usability specialists and managers to capture the needs of users effectively, but go no further than providing effective interfaces and systems to 'rescue' end users. This was proven by the comments of a participant in the Heritage Committee – who, so to speak – feared IT researchers even if they bring gifts, might be construed as an unwillingness to be 'rescued' in this way. Lottkowitz (2005) wrote:

"I don't mean to caste aspersions on IT researchers as such, but frequently there's a lack of sensitivity about the different needs in rural communities, and ways to get research 'out there' in a credible fashion." She also commented: "… I have a sense from the early discussions about this project that it needs to be women focused and driven, and IT is not always friendly for many women in the communities of interest …"

Yet it is notable that this same participant has championed an e-bulletin for the groups involved in the project. She recognises the irony of her commitment to that system alongside her scepticism about the involvement of IT researchers.

This 'us and them' tension is a manifestation of the kind of problem in information systems design practice that our proposed community-based, adaptive approach to UCD seeks to address. Discussion with a humanities academic involved in the project conjured the analogy of the Procrustean bed. This refers to the ancient Greek account of a person named Procrustes who offered hospitality to travellers, claiming that his bed exactly fitted the length of each guest. He did not reveal that this was achieved by stretching the guests or chopping off their legs to obtain the correct fit. Those inside the IT professions may under estimate the extent to which users suspect the Procrustean approach to be the underlying methodology of information systems' design. These comments and experiences from both researchers and members of the community seem to support concerns expressed in the kind of literature referred to in earlier sections; that something is out of kilter in the conceptualisation and practice of information systems, even where those involved believe they are doing their utmost to consider user needs.

Mackenzie (2002) in his exploration of UCD argues the need for a common lexicon by which a convergence of design strategies can be achieved; one that constructs representations appropriate to the task, person, and the critical features of the world. The study suggests that there is a 'black box', perhaps, another dimension upon which user-centred design can rest. In a sense our project is a search for a permeable, transparent box that assists users to design and re-design the information systems components of their world. In this visualisation the 'systems designer' is one of the many actors in a complex and largely self-organising choreography which comprehends both the provision of interfaces to deliver on needs, and the capacity for independent and group adjustment and innovation both to overcome problems in using an information system, and to seize opportunities that information systems may help realise.

This project seeks to advance understanding and definition of UCD both in theory and practice through focussing on how people as individual and in collectivities act, and in doing so interact with (adjust to or change) the structures, especially the information systems, that both enable and constrain their scope of action. At the core of our envisioned reconceptualisation of UCD is a design matrix of

technology-community adaptation. The adaptive possibilities envisioned are summarised the 2x2 matrix presented in Fig. 3.

Acceptance of technology by Community

	High	Low
High	A. Maintain technology	B. Adapt technology
Low	C. Adapt user	D. Re-design technology

(row label at left, rotated: **Acceptance of technology by Individuals**)

Figure 3. Proposed matrix of technology-user systems states in UCD

The horizontal and vertical bars of acceptance indicate acceptance of the existing information technology by individuals, and by the communities of which they are members. It is important that both the vertical and horizontal bars of the matrix are read as continua rather than dichotomies. Each bar represents continua of adaptation required to maximise congruence between the information systems and needs of its users. The system states ('system state' being comprised of both users and technological artefacts) defining the polarities of these continua are as follows:

A. The technology-in-use is accepted by the whole community as congruent with their needs. There is no UCD problem. From the viewpoint of UCD, the system-state should be monitored for ongoing user acceptance and technical performance. From the perspective of UCD, this is a desirable system state to be in – where acceptance is high for both individual users and communities.

B. The technology is acceptable to some individuals but not to the community as a whole. This is a UCD problem susceptible to adaptation. The technology should be adapted to satisfy the wider community while not losing utility for those who already find it acceptable, for example by the addition of assistive technology for a user with disabilities.

C. Acceptance of technology-in-use in use by some individuals is low, yet acceptable to the community as a whole. This is a UCD problem susceptible to adaptation. Users should be supported in efforts to adapt themselves to the technology, for example through training or readily available advice.

D. The technology is rejected by the community as a whole as incongruent with their needs: acceptance of technology-in-use by both individuals and the community as a whole is low. This is a critical UCSD problem. From its viewpoint, the system-state should be analysed both in regard to user needs and technological affordances for radical re-design.

Because the model comprises continua not dichotomies all intermediate possibilities can also be mapped against it, with appropriate hybrid solutions. This matrix was used as a tool in monitoring the states of technological acceptance by individuals and communities. With the generation of the functional and technical specifications, a website was developed fulfilling the objectives mapped out according to earlier discussions. Through the design methodology mapped out here, and the participatory engagement between the Museum and the community, the adaptive capacity of the information system in the interactions of both the Museum and the community was enhanced; and vice versa. The physical use and digital attributes of the collection was considered in its entirety; which takes into account also the spaces and contexts of use in which the digital collection was to be accessed.

The potential benefits and contributions to e-research are already demonstrated in this pilot study. Being a community that had its members geographically dispersed, the action-research tool enabled researchers and members of the community to contribute stories and submit digital objects to add to the collection, as well as share resources that were otherwise only communicated via email or face to face meetings (which do not happen very often because of the impositions geographical distances posed). Limitations in accessibility and software-dependent files (such as Acrobat Reader, Macromedia Flash, Java, etc) were also some of the limitations the community raised with regards to collaborations over email. Having a digital space through the website which allowed common files to be accessed through a shared repository helped members of the community, researchers, and the Museum to share information and enabled discussions within one organized and integrated space. More work calls to be done in measuring the role of the information system in facilitating e-research over distances and datasets.

Conclusion & Future Work

The paper has discussed, using a case study, the interaction between a cultural institution, community members, and researchers. It has explored how this interaction can be leveraged to produce benefits for all parties. These benefits have manifested in the form of reflexive and adaptive capacities of the cultural institution concerned. This has been achieved in the case study through the deployment of a participative action research approach, based on structuration theory, in the design, development, and use of a digital collection and research tool. At the same time, the tool has also been designed to be adaptive to changes in the needs of the community. The benefits of the tool in facilitating e-research has been demonstrated in a preliminary way. This is still an ongoing project and immediate work is pending; largely monitoring the direct and indirect benefits of the information system in the community, iterating the design and development of the tool using the proposed matrix (figure 3), and evaluating the impacts of the information system in both the community and Museum.

Acknowledgments

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