Designing ICT tools to support participative catchment management processes.

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Abstract: Article 14 of the directive (Public information and consultation) calls for member states to '*encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the River Basin Management Plans.*' Whilst the need for public consultation is thereby firmly established, guidance on the design, implementation and management of appropriate tools, particularly Information & Communication Technology (ICT) tools, and processes to support such consultation remains sparse. This paper presents a critical analysis of the design of ICT tools in supporting stakeholder dialogue processes in catchment management. We first structure the various forms of stakeholder engagement and use limited case study literature to identify barriers to effective platform design and use. The paper finishes by suggesting a matrix of design guidelines for different levels and forms of stakeholder engagement based on a rational extension of the links between forms of participation (e.g. individual / group, dispersed / centralised) and the goals of participation (e.g. communication, education, dialogue, decision making). Conclusions are drawn concerning (a) gaps in knowledge relating to ICT – stakeholder interactions, (b) resources required for effective ICT exploitation in participative processes, and (c) information format and quality consideration for different types of support (e.g. pedagogic, communication).

Keywords: *Public participation, ICT tools, Design, Evaluation*

1. INTRODUCTION

Article 14 of the directive focuses on public information and consultation and dictates that: *'Member states shall encourage the active involvement of all interested parties in the implementation of this directive, in particular in the production, review and updating of the River Basin Management Plans'.* As of yet, the structure, format and extent to which the public will be involved in river basin management remains unknown, but it is clear that facilitatory tools will be required. Some of these tools will be ICT based and could have either pedagogic and / or decision support objectives and would be utilised to aid the participatory process.

2. PUBLIC PARTICIPATION

The involvement of the public in natural resource management in recent times has partly been due to the decrease in humanity's reliance upon technological innovation to solve environmental problems as well as the realisation that environmental issues have both social and moral dimensions [Huesemann, 2001]. The European commission may have taken this into account when formulating Article 14 of the Water Framework Directive, therefore recognising the benefits of the inclusion of both stakeholders and members of the general public in decision making regarding water environments.

The definition of 'participate' according to the Cambridge International Dictionary of English [Cambridge University Press, 2001] and which will be adopted in this paper is *'to take part in or to become involved in an activity.* The methods of participation which have been utilised in the past have been identified in various investigations [House, 1999, Smith and Blanc, 1997] and occur in the form of citizen's juries, roundtables, study circles and collaborative catchment management processes. However, the

actual degree to which citizens have decision making control is unclear. For example members of the public could be invited to attend meetings to discuss and resolve problems with regards to the environment, but not actually be provided with any decision making power. Arnstein [1971] proposed a 'ladder of citizen participation' which represented the degrees to which members of the public could be involved in decision making. The bottom rungs represent a lack of inclusion, the midsection increasingly including the public, but with degrees of tokenism, whilst the upper rungs represent citizen control over the decision making process

When considering Arnstein's ladder with respect to the Water Framework Directive, the degree of citizen participation stated is unclear. However, the wording contained within Article 14 of the directive [European Parliament and Council, 2000] implies that the level of public participation (according to Arnstein's ladder) will manifest itself either in the form of a partnership or delegated power. It is unlikely that the level of citizen power implied in the article is meant to exist in the realms of tokenism, although there is a possibility that a decline to this level may occur. It is equally unlikely that the article is actually stating that the public involved should have complete control, as this could lead to citizens making ill-informed decisions with regard to water resource management.

3. INFORMATION AND COMMUNICATION TECHNOLOGY TOOLS

Information and communication technology (ICT) tools are seen as a means to bridge the gap between members of the general public, who are now required to be involved in the decision making process and scientists, researchers and politicians who make decisions on behalf of the general public every day. There are a number of reasons why there is a breakdown in communication between these parties and this can be attributed to the public's general mistrust of science, their frustrations as they are unable to understand complex scientific issues and their relative ignorance. Another pitfall associated with public involvement in decision making is 'grudging tokenism'. This term, first coined by Arnstein [1971] describes the way in which members of the public are offered decision making power because the organisations offering the involvement are forced to by law. Even though the citizens involved may spend time deliberating and come up with solutions to certain issues, the organisations may fail to give their conclusions serious consideration.

The link between water resources management, environmental organisation, public participation, the Water Framework Directive and the inclusion of ICT tools in the decision making process can be seen in Figure 1. The summary is presented in the form of a cyclic process, with the 'break' in communication represented by two parallel lines.

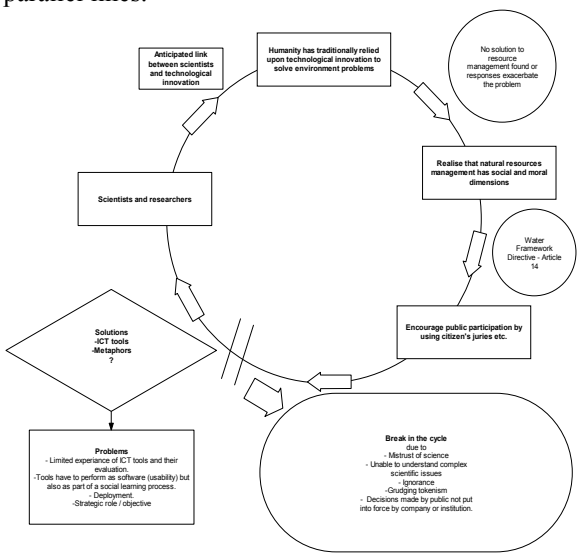

Figure 1 – The anticipated processes of water resources management

Therefore, Figure 2 underlines the need for research into the design and intended use of Information and Communication Technology (ICT) tools, because to date investigation in this area is extremely limited. ICT tools do exist in the form of decision support systems [Jamison and Fedra, 1996], but tools designed specifically to promote public participation or education are fewer in number and work carried out to analyse the interactions between the users and various interfaces is scarce. Future investigation in this area would have to address the multidisciplinary nature of the problem and would need to include elements of software design, psychology and pedagogy to provide an insight into the user tool interface, whilst also focussing on the intended role of the tool.

4. ICT EVALUATION CONCEPTUAL MODEL

The careful design of possible applications is necessary in order for ICT tools to meet their pedagogic or decision support objectives. This is considered to be important because poor design and development of ICT tools could lead to user confusion, frustration, discomfort and ultimately result in the target audience (in this case the general public) making

uninformed water management decisions. Further, this could lead the organisations working with them to consider that the decisions made by the public are ill informed and inefficient.

We propose a conceptual model of ICT use within a participative management process comprising five components (see Figure 3); the application itself (this might be the piece of software or a networked learning activity), the user (either an individual, group, or part of a wider community), the human/ computer interface, the tool deployment context (i.e. under what conditions are the application and user bought together), and the strategic role of tool utilisation. Whilst it is clear that none of these components can be considered in isolation, the human – computer interface is perhaps the most significant with regard to design and performance evaluation. Consequently we further expound the model by distinguishing between four features of the human computer interface; '*Content Format'*, -the material contained within the ICT application, '*Content Structure'*- how the different elements of the application (both presentational and perceptual), are linked together, '*Functionality*' – the range of actions and operations which the user can achieve through using the tool, and '*impression*' – the impact the tool has on the user either in terms of attitude modification or the enhancement of knowledge and skills (Figure 2).

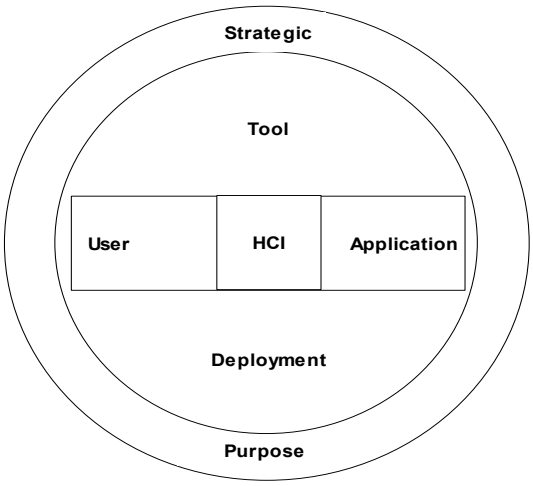

Figure 2– ICT evaluation conceptual model

The strategic role of an ICT tool describes the objectives of use. For example, why is the tool being deployed? Are primary outcomes to be evaluated in terms of individual / social learning or developing consensus, or both? How does the perceived information credibility affect the sustainability of learning outcomes or the consistency of attitudes to management options?

The relationship between strategic objectives and tool design is evidently crucial. By distinguishing between the human – computer system and the context and objective of tool deployment we are better able to explore the links between interface design, the experience of use, and the utility of the tool within the participative process as a whole.

5. DISCUSSION

This investigation has outlined the need for ICT tools to aid public participation and education. It has also proposed a conceptual model which includes all of the elements which are considered to be of importance when designing ICT tools. However, in order for the ICT tools to be designed so that they work in an effective way, the type of engagement applied as well as the goals of the participation need to be identified. Types of engagement include either individual (in the form of an interview) or group based discussion (participative fora such as citizen's juries, round tables, study circles and collaborative watershed management). These methods of stakeholder engagement can either take place in a central or dispersed fashion. The goals of participation in this context means the facilitation of ICT tools to promote communication, education, dialogue or decision making. The matrix (Table 1) attempts to link types of engagement with goals of participation together.

The matrix identifies six different methods of stakeholder engagement, three of which are identified as being individual activities, involving dispersed individuals and three being centralised group activities. The matrix reveals that the individual activities mentioned tend to exhibit communication and education based participative goals. The group forms of engagement all tended to bring individuals together in a centralised way and all were considered to be methods of communication, however, only citizen's juries and study circles possessed educational goals. All forms of group engagement were concluded to promote dialogue between the stakeholders and most possessed decision making objectives.

Table 1 – Stakeholder engagement matrix

Function	Forum					
	Individual			Group		
	Centralised / Dispersed	Dispersed	Dispersed	Centralised		
	Interviews	Exploratory platforms	Websites	Citizen's juries	Roundtables	Study circles
Communication	√	√	√	√	√	√
Education		√	√	√		√
Dialogue				√	√	√
Decision making				√	√	

These distinctions can be modified further with the inclusion of other factors which may affect the engagement process, such as stakeholder backgrounds (as different individuals will possess expertise and knowledge in different areas) and there also could be time or resource limitations, which could affect the engagement process.

6. CONCLUSION

It has been concluded that the careful design of ICT tools is required in order for such tools to meet their pedagogic and decision support objectives. Further, it is envisaged that effective guidance on tool design and performance evaluation needs to be developed within a context informed framework which considers the ICT tool as part of a directed process; a process which is of itself a matter of some debate with regard to the Water Framework Directive. The gaps in knowledge have been identified as being within the human computer interface, embedded within the conceptual model (Figure 3) proposed. The four features considered within the human computer interface, (the content format, content structure, functionality and user impressions) were found to be the main areas of focus for further investigation in this area. Consideration needs to be applied to the way in which tools of this type will be used during the participative processes described and provision will need to be made concerning the resources required to allow ICT exploitation during stakeholder interaction. Finally the information contained within future applications must be scrutinised in order to ensure that it is suitable for inclusion, this also depending on the type of engagement the tool will support (e.g. pedagogic, communication).

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