6TH INTERNATIONAL CONFERENCE ON FLOOD MANAGEMENT
September 2014 - São Paulo - Brazil
ICFM6

LET ME BE LEARNED: DECISION SUPPORT AIDING PUBLIC PARTICIPATION

R. Laine[1] and C. Cook[1]
1. University of Wollongong, Australia

ABSTRACT: With best practice flood risk management processes rightly emphasising the need for a collaborative, transparent and inclusive approach to improve community resilience, this paper explores a new Engagement Decision Support System (EDSS) as a mechanism to assist in this process. This paper presents the need, theory and development of a flood risk management EDSS and presents trial results, where the tool has been successfully utilised for three catchments in New South Wales, Australia. The results from these trials indicate that a well-structured, engagement focused decision support system can provide a mechanism for and empower the public to learn about, prioritise and make informed decisions about floodplain management options for their local catchment in a transparent objective facilitated process.

Key Words: EDSS, Decision Support, Flood Risk Management, Public Participation

1. INTRODUCTION

Flood risk management is inherently complex, yet there has been an increased institutional and citizen requirement to involve the public in the decision making process surrounding it (EC 2007, Cabinet Office 2011, US Government, 2013). This paper attempts to bridge that gap, providing a framework to allow the average citizen who is directly or indirectly affected by flooding or the management of flooding to not only to be involved in the decision-making process but be empowered to make informed flood risk management decisions. This paper firstly describes the concept of public participation, its requirement in flood risk management and offers a new public participation paradigm for the flood risk management cycle in the hope that it promotes dialogue about the role of public participation and hence, the role and influence of the public in the flood risk management process. The paper then goes on to explore how engagement focused decision support systems can aid the flood risk management public participation process and provides results of trials in three catchments as evidence that institutional and citizen participation requirements can be achieved.

2. PUBLIC PARTICPATION IN FLOOD RISK MANAGEMNT

Public participation has long been recognised as an essential element of democratic governance, as it moves beyond paternalistic institution decision making to inclusive pluralistic civic focused deliberative decisions. This is a significant transitional approach from the changing but still entrenched DAD (Decide-Announce-Defend) or DEAD (Decide-Educate-Announce-Defend) decision making mentality that is intrinsically evident in many flood risk management practices worldwide. Yet in adopting such an approach, as advocated by numerous researchers and institutions (Delli Priscoli 2004, EC 2007, Firus et al 2011, ICE 2014, Jha et al 2012, Sayers et al 2013, USACE 2009, US Government 2013, Walsh 1999 and WMO 2004) public participation in flood risk management has and will continue to transition to allow those who are directly or indirectly affected by flooding or the management of flooding to be involved in the decision-making process.

2.1 Public Participation

Numerous definitions of public participation exist in literature (e.g, Beierle et al 2002, EU Water Directors 2002, IAPP 2006, Smith 1983) but all generally revolve around the notion of a process that allows the public (i.e. everybody) to participate in, inform and influence decisions made that affect them. This process in the context of flood risk management could include identifying and defining the problem or opportunity, obtaining and gathering information, identifying and evaluating the risks and solutions, making and implementing the decisions, monitoring and reviewing the process and decisions made etc. through mechanisms such as questionnaires, workshops, focus groups, citizen juries, advisory groups, referenda etc. (Rowe and Frewer, 2000). It is these mechanisms available that effectively instill the level of participation, and hence define the role and influence of the public throughout the decision making process. As such, it is fundamental when embarking on the public participation process that three key commitments be made prior to seeking participation or selecting mechanisms. These are:

1) Decision makers will clearly define and articulate the level of influence the public will have at each stage of the decision making process and will implement the defined level of commitment when decisions are made.

2) The process will be equitable, inclusive, transparent, accountable and provide mechanisms to seek out and facilitate appropriate participation from those that are affected by the decision.

3) Clear communication and documentation will be provided on how the above commitments were decided and achieved.

Therefore, careful deliberation (potentially involving the public) is required to select the right mechanisms or combination of mechanisms at the right stage in the process to achieve the desired public participation goals and decision making outcomes as illustrated in figure 1. In the end, the goal of public participation is not to obtain utopian agreement among all that are affected, but to foster and reach inclusive balanced outcomes that instill civility, legitimacy and consensus in the decision made.

TO:	Inform	Consult	Involve	Collaborate	Empower
GOAL:	Share balanced and objective information to achieve mutual undertstanding of the problem, alternatives, trade-offs, opportunities and/ or solutions	Ask questions, listen and gain ideas, feedback, information and knowledge that will be considered and responded to during decision- making	Build networks, relationships and strong two-way communication with outcomes integral to decision-making	Build capacity to partner in decision-making with shared responsibility	Build capacity to pass full decision-making and responsibility to others
TOOLS: (mechanisms)	Fact sheets Brochures Web Sites Presentations Reports	Public comment Public meetings Public exhibitions Focus Groups Surveys	Workshops Deliberative-polling Social networks Online chat	Committees Consensus-building Participatory decision-making	Citizen juries Referenda Citizen panels DSS

Figure 1: The building blocks of public participation adapted from the IAPP public participation spectrum and AEMI community engagement model (IAPP 2006, AEMI 2013).

2.2 Requirement in Flood Risk Management

Flood risk managers in public, private and voluntary sectors are increasingly required to be more transparent, collaborative and participatory as governance shifts from "hierarchical to markets to networks" (Bevir and Rhodes 2006). Multiple institutions have embraced this shift developing strategies, plans, policies, standards and laws to incorporate public participation in daily work practices, particularly with regards to open information and collaboration on service delivery (OECD, 2014). Flood risk management institutions are no exception with many requiring public involvement to varying degrees within their flood risk management process (e.g Environment Agency, FEMA, Rjkswaterstaat, USACE).

Directives such as the EU 2007/60/EC (Assessment and Management of Flood Risk) have established a unified requirement for its member states to "encourage active involvement of interested parties in the production, review and updating of flood risk management plans" (EC, 2007). Similarly the US Government recently stated as a general requirement for federal investment in water resources in conjunction with its 'Open Government' initiative that "federal agencies should collaborate fully on water activities with Tribal, regional, state. local and non-government entities, as well as community groups, academia and private land holders to realize more comprehensive problem resolution and better informed decision making" (US Government, 2013). In England, the Civil Contingencies Act 2004 "encourages those delivering front line services to consider the need of the community and engage community members when developing and delivering services to them" (Cabinet Office, 2011). Likewise the Australian Emergency Management Handbook 7 states "Consultation is fundamental to the successful delivery of flood risk management to the community. It should be undertaken with internal and external stakeholders during all stages of the floodplain-specific management process"(AEMI[2], 2013). Hence, It is evident public participation is no longer disjunctive from flood risk management but an integral requirement.

2.3 Application in Flood Risk Management Cycle

As earlier stated, selection of the right mechanisms or combination of mechanisms at the right stage in the process to achieve the desired public participation goals and decision making outcomes is important. As public participation builds from inform to consult to involve diverging between collaboration and empowerment, the goals from the proceeding level of participation provide the foundations for the next. However, empowerment should not be viewed as the acme of public participation but rather an approach no more legitimate than the next, to achieve the desired goal at each stage in the decision making process. Further, the desired goals should not be considered certain, as the process requires sufficient flexibility to deal with intrinsic uncertainty of public deliberation and the flood risk management cycle itself. Rather, a mutual understanding and appreciation of the benefits and challenges (of which there is extensive literature (see. Evers 2012, Involve 2005)) should be fostered to reduce the chances of perceived failure and even ultimately the possible abandonment of the process.

The following paradigm for public participation within the flood risk management cycle (figure 2) is offered recognising the inherent limits in doing so i.e. governance arrangements, context etc. It is not the intent to provide the definitive approach but an attempt to promote dialogue about the application and selection of mechanisms and hence, define the role and influence of the public at stages throughout the flood risk management cycle. The following provides a brief reasoning for the proposed level of participation:

- **Review:** This stage involves assessing whether the current residual risk of utilising the floodplain is acceptable. Therefore, an approach that allows those affected by flooding or the management of flooding to actively be involved in deliberating and defining the level of residual risk they are willing to accept for utilising the floodplain should be employed. In examining risk management practices world-wide this may involve minimum government standards (e.g. the 1% AEP flood minimum residential floor level) which provide an excellent platform for understanding and consensus building. Mechanisms for this stage could include: facts sheets, surveys, public meetings, workshops, citizen advisory committees, citizen juries, decision support systems etc.

- **Identify Risk:** This stage involves understanding flood behavior for the full range of floods up to and including the Possible Maximum Flood (PMF or Qmax) and undertaking a risk analysis to understand the impacts of flood on the community that utilises the floodplain. Due to the technical complexity and impartially required at this stage, it is unlikely or even detrimental (due to bias or agendas) to move beyond the consult level of participation through mechanisms such as fact sheets, presentations, questioners, interviews, public meetings, public exhibitions and reports to collect local knowledge of both the flood behavior and risk to achieve accurate representations of flooding for the full range of floods and a mutual understanding of the risks flooding presents.

- **Identify Risk Management Measures:** This stage involves identifying appropriate and technically feasible flood management measures to address as a minimum, the determined unacceptable residual risks. Therefore, mechanisms such as public meetings, decision support systems, public workshops, focus groups, technical steering committees could be employed to find measures (flood management, building management, land-use planning management & response management measures (see Laine et al, 2012)) that reduce risk to life and property.

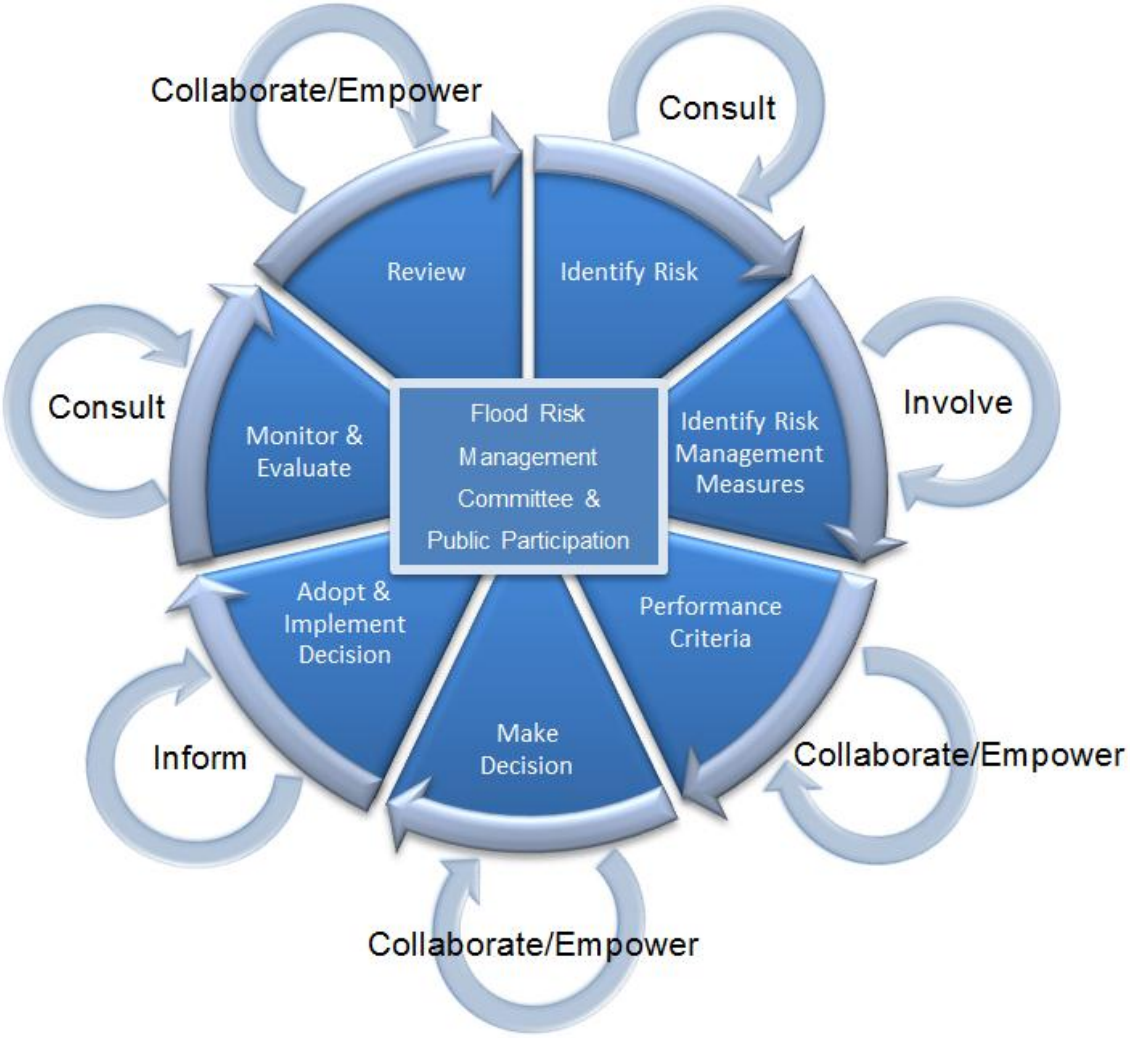

Figure 2: Application of public participation to flood risk management cycle (adapted from Laine et al., 2011).

- **Performance Criteria:** This stage involves establishing robust, specific, measurable, accountable and result orientated performance criteria against which flood risk management decisions and outcomes can be evaluated. Therefore, the public including those who are directly or indirectly affected by flooding or the management of flooding should establish the performance criteria. This can be facilitated through mechanisms such as public workshops, surveys, decision support systems, taskforces, forums, committees, citizen juries and panels.

- **Make Decision:** This stage involves making informed decisions about the use, the relevant risks, and the management of floodplains in light of the information gathered. This is an extremely complex task that requires a thorough understanding of the options and tradeoffs involved in flood risk management including the social, safety, economic, environmental/ecological, political and flood behavior tradeoffs. As such decision making should be inclusive, civic focused and deliberative and can be facilitated through mechanisms such as public workshops, decision support systems, committees and citizen juries.

- **Adopt and Implement Decision:** This stage involves implementing the decisions made which could include spin-off public participation cycles particularly in the investigation, design and construction of works; however, it primarily involves keeping the public informed about implementation of the decisions made. Mechanisms could include fact sheets, reports, websites, information portals, advice centers etc.

- **Monitor and Evaluate:** This stage involves both monitoring and evaluating the decisions made against the performance criteria through time and reporting on these outcomes. This important milestone allows the decision makers to document and reflect on whether the outcomes were achieved and if not, why not. This could be undertaken through involve, collaborate or empower mechanisms; however, for efficiency consult and inform mechanisms such as public comment, meetings, surveys, facts sheets and reports can adequately address this stage. The outcomes of the evaluation stage in conjunction with flood events, flood behavior changes, and shifts in environmental/ ecological, social, political attitudes may then prompt the flood risk management cycle review stage and associated public participation approaches.

3. DECISION SUPPORT AIDING PUBLIC PARTICIPATION

Flood risk management has inherent complexity, whether it be understanding the behavior of floodwater, its interactions, uncertainties, assumptions and associated risk through to making informed balanced accountable decisions based on variable social, safety, economic, environmental/ecological, flood behavior and political tradeoffs. Institutions and the public themselves are requiring individuals to be more involved in the flood risk management decision making process; yet there is clear evidence in behavioral decision research that “humans are quite bad at making complex, unaided decisions” (Slovic et at. 1977) “as they mis-process important information (Kahneman et al, 1982); they seem to have little instinctive ability to clarify objectives (March, 1978), create a wide variety of alternatives (Keeney, 1992) or structure decision tasks (Simon,1990)”(McDaniels et al, 1999). This is a perplexing gap and one decision support can offer assistance to close.

3.1 Engagement Decision Support Systems

Engagement Decision Support Systems (EDSS) are structured, accessible, interactive, tailored computer based tools that seek to engage and assist the public to make informed decisions about complex issues. They do so by guiding the user through a series of questions and steps, delineating user inputs and supplying unbiased quantitative and/or qualitative data in plain accessible language and/or pictures to enable the user to make informed choices between competing options or scenarios. For example, this may involve, at the “Make Decision” stage of the flood risk management cycle, allowing the public to click on an interactive map at a given location, discover the flood behavior information for various events, see what flood risk management measures are available and what impact these have on flood behavior both

cumulatively and individually, allow the user to explore and understand the tradeoffs that will have to be decided upon, and submit their preferred choices for dissemination and aggregation.

3.2 EDSS Development

A new generic EDSS for the selection of flood risk management measures has been developed to assist at two stages in the flood risk management cycle. These stages are: “Identify Risk Management Measures”, and “Make Decision”. Although intrinsically similar as management measures are presented, the “Identify Risk Management Measures” stage is principally concerned with exploring and identifying flood risk management measures including innovative suggestions from the public which can then be modeled and feasibility assessments conducted. The “Make Decision” stage on the other hand, provides sufficient information to the decision makers i.e the public, to systematically and equitability consider the social, safety, economic, environmental/ecological, and flood behavior tradeoffs (derived from the modelling and feasibility assessments) and make informed decisions.

3.2.1 Model

The development of a generic EDSS for floodplain management measures is underpinned by the following framework:

1) Development of a quick to run, easy to use, digestible, interactive mobile phone compatible website with multiple databases collecting and providing information and a single matrix appraising options at the back end.

2) The identification and selection of constraints to which the flood risk management options are appraised. This can be achieved through public participation mechanisms such as surveys, forums and committees etc. and typically comprise social, safety, environmental/ecological, economic, and flood behavior constraints.

3) The scoring of standard and site specific flood risk management options against the selected constraints. This involves utilising the “preference scale“ pairwise analysis approach via expert judgment, interviews, case studies, literature reviews and research queries to derive justifiable, unbiased and consistent scoring scales for each option. These learned scores are then entered into the matrix and sensitivity analysis conducted.

4) The user assigning importance weightings for each constraint based on their value systems via the website to which equation 1 is applied:

$$O = (O_1, O_2, \ldots . O_n)$$

$$where\ O_j = \sum_{i=1}^{m} w_i c_{ij} \qquad [1]$$

$$O_j > O_{j+1}$$

w_i represents the user defined importance weight for m constraint, and c_{ij} represents the learned score for m constraint and n option

5) The user being presented with the list of equitably ranked preferences based on equation 1. The user is then encouraged to investigate and understand why options ranked the way they did, learn about the management options, and specific advantages/ disadvantages and constraints. The user is then presented with the opportunity to re-rank the options (hopefully now better informed about the tradeoffs they are making).

6) The users submitting their preferred floodplain management options and additional demographic information for dissemination and aggregation.

7) Decisions made from or informed by the aggregation of all responses collected, which is then communicated and reported to the public.

3.3 EDSS Application

The EDSS model has been applied to three catchments in New South Wales. The interactive mobile phone compatible website for all three catchments was branded 'Floodengage' and programed in PHP with an SQL database back-end. While the technically feasible options were slightly different between catchments, all utilised the same constraints as determined by the respective floodplain management steering committees. These constraints, broadly categorised were: aesthetics/amenity; equity; risk to life; community awareness/understanding; ecosystem impacts; water quality; initial costs; maintenance costs; reduction in flood damages; and adverse impact with all questions being asked in 'plain English' with pictures and supporting information e.g "How important is it to you that the floodplain management option does not threaten local plants and animals and their habitat?".

From a user's perspective the process involved 5 steps 1) Understanding the context, process and level of influence they had over the decisions made; 2) Assigning their level of importance to each constraint on an interval scale gauge from "Not important at all" to "Extremely important" (Figure 3); 3) Receiving a list of most preferred options based on their inputs, and then being provided with an interactive opportunity to explore each option and understand the options tradeoffs; 4) The opportunity to re-rank options via a simple drag and drop function (hopefully informed about the options advantages and disadvantages); and 5) The option to leave feedback and provide demographic information prior to submitting for dissemination and aggregation. The following is a summation of the three catchment trials and their respective results.

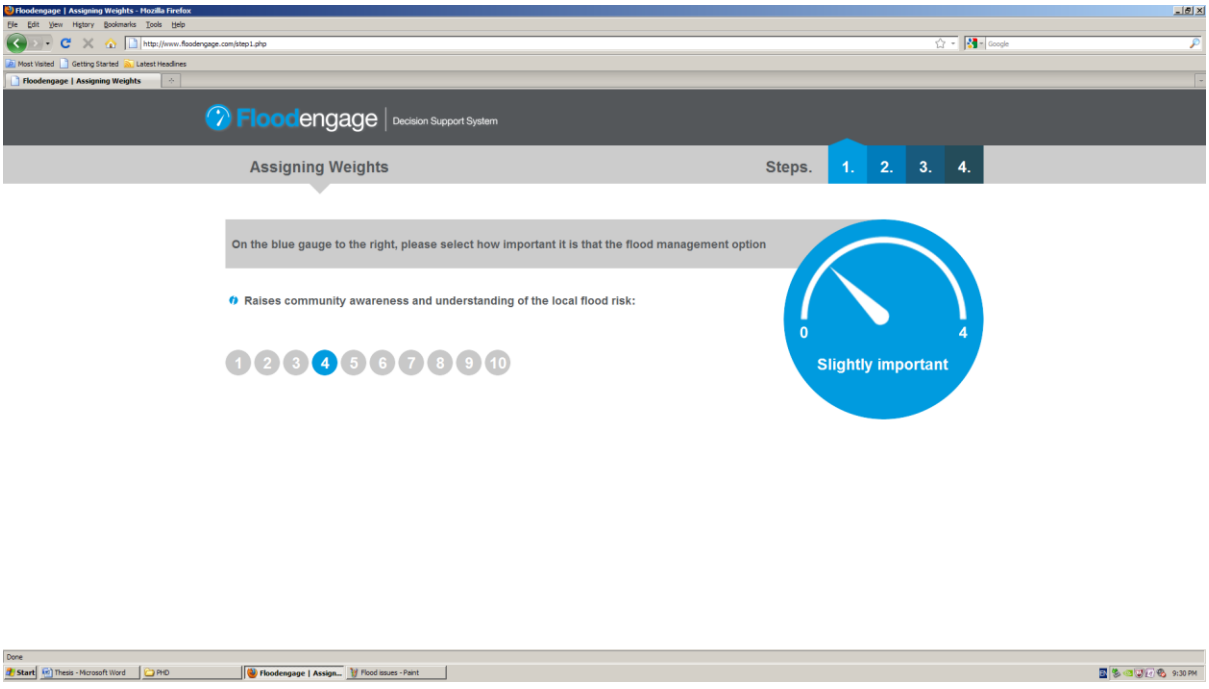

Figure 3: Floodengage Step 2- User importance weightings for each constraint.

3.3.1 Horsley Creek Catchment Trial

The Horsley Creek catchment is located 100 kms south of Sydney, on the south east coast of Australia. The catchment drains an area approximately 9 km^2 of mostly urbanised land which includes the township of Albion Park (Reinco, 2011). The catchment has around 13,000 occupants with two thirds occupying flood prone land. The median age is 33 years, 16% of homes are leased with a medium individual income of $550 AUD per week (Qpzm, 2014). The Floodengage program was utilised by Shellharbour City Council to supplement traditional mail-out surveys for the Horsley Creek Floodplain Risk Management Study and Plan. The online Floodengage consultation was launched on the 30th of May 2013 remaining open for submissions until the 12th of July 2013. During this consultation period the website received some 592 website views. Of these views 47 valid responses were submitted. Respondents favoured floodplain management measures that reduced risk to life, reduced flood damages and did not cause adverse flood impacts. 30 respondents (64%) ranked local flood policies and development controls their most preferred floodplain management measure of the 18 feasible options. The aggregated community level of support for each option from most preferred to least preferred is presented in figure 4.

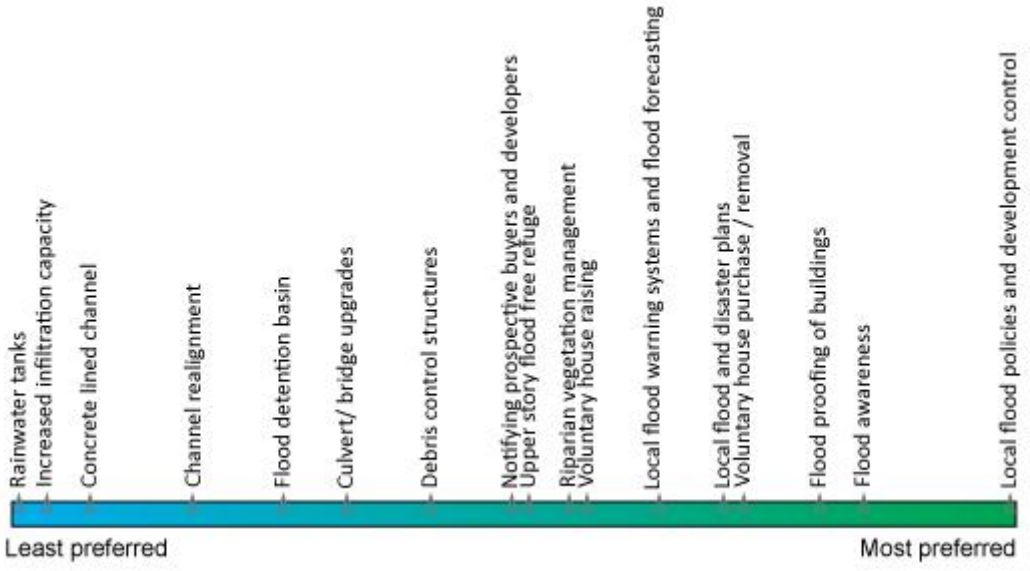

Figure 4: Horsley Creek floodplain management measure preference scale (Laine, 2014).

3.3.2 Black Creek Catchment Trial

The Black Creek catchment is located 150 kms north of Sydney, on the south east coast of Australia. The catchment drains approximately 26 km^2 of agricultural, urban and uncleared native land which includes the Cessnock City CBD (DHI, 2010). The catchment has around 14,000 occupants with around half the urbanised land identified as flood prone. The median age is 39 years, 34% of homes are leased with a medium individual income of $426 AUD per week (Qpzm, 2014). The Floodengage program was utilised by Cessnock City Council to supplement traditional mail-out surveys for the Black Creek Floodplain Risk Management Study and Plan. The online Floodengage consultation was launched on the 26th of September 2013 remaining open for submissions until the 24th of October 2013. During this consultation period the website received some 351 website views. Of these views 4 valid responses were submitted. Respondents favoured floodplain management measures that reduced flood damages, reduced risk to life and did not cause water quality issues. 3/4 respondents ranked local flood policies and development controls their most preferred floodplain management measure of the 19 feasible options. The aggregated community level of support for each option from most preferred to least preferred is presented in figure 5.

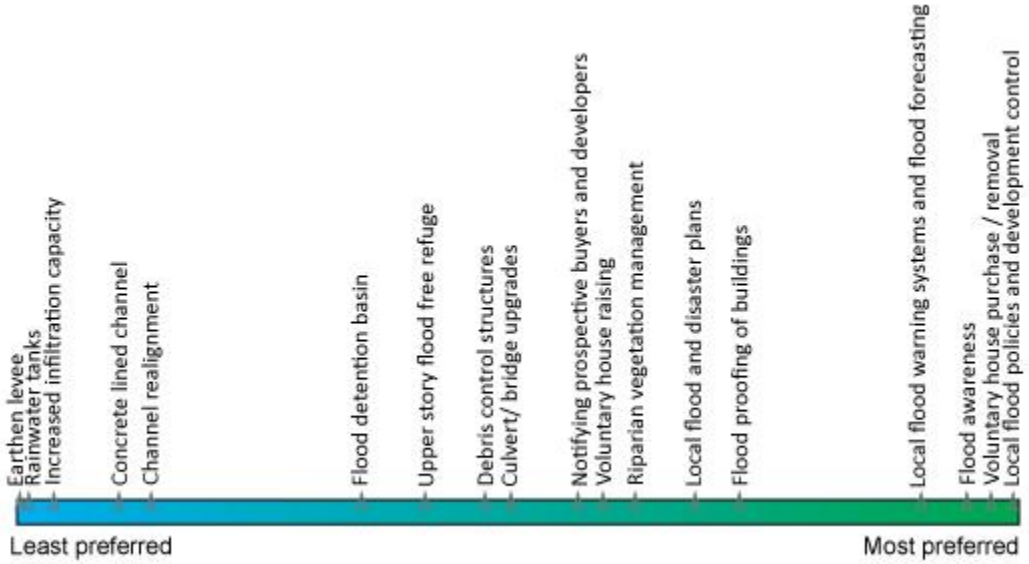

Figure 5: Black Creek floodplain management measure preference scale (Laine, 2014).

3.3.3 Wollongong City Catchment Trial

The Wollongong City catchment is located 84 kms south of Sydney, on the south east coast of Australia. The catchment drains approximately 7.3 km^2 of urbanised land which includes the Wollongong City CBD. The catchment has around 18,000 occupants with more than 2500 commercial and residential properties identified as flood prone (WMA Water , 2013). The median age is 32 years, 56% of homes are leased with a medium individual income of $500 AUD per week (Qpzm, 2014). The Floodengage program was utilised by Wollongong City Council to supplement traditional mail-out surveys for the Wollongong City Floodplain Risk Management Study and Plan. The online Floodengage consultation was launched on the 10th of December 2013 remaining open for submissions until the 17th of January 2014. During this consultation period the website received some 874 website views. Of these views 49 valid responses were submitted. Respondents favoured floodplain management measures that reduced risk to life and did not cause adverse flood impacts. 37 respondents (76%) ranked local flood policies and development controls their most preferred floodplain management measure of the 16 feasible options. The aggregated community level of support for each option from most preferred to least preferred is presented in figure 6.

4. DISCUSSION

The balanced responses from these preliminary EDSS trials indicate that accelerated learning occurred to some degree. This is evident as the decisions made appear to overcome narrow uninformed preferences that one typically witnesses when conducting traditional paper based surveys (i.e. development controls being least preferred and channel clearing most preferred), rather more closely reflecting preference choices of a learned flood manager. Further, analysis of the results indicate that some users post receiving the most preferred options list in step 3, preceded back to step 2 changing value inputs, sparking examination of their own values and triggering user “what-if” sensitivity analysis i.e. **What** will happen to the list **If** the importance input is changed (Simonovic 1999, Lemass et al 2008). Therefore, the EDSS allowed the user to gain a greater appreciation of alternate views, the social, safety, economic, environmental/ecological and flood behavior tradeoffs, and complexities involved in flood risk management. Further, the EDSS trials have been shown to increase confidence in the recommendations made as it is a transparent auditable structured framework that is easily tracked and can clearly be communicated and reported to the public.

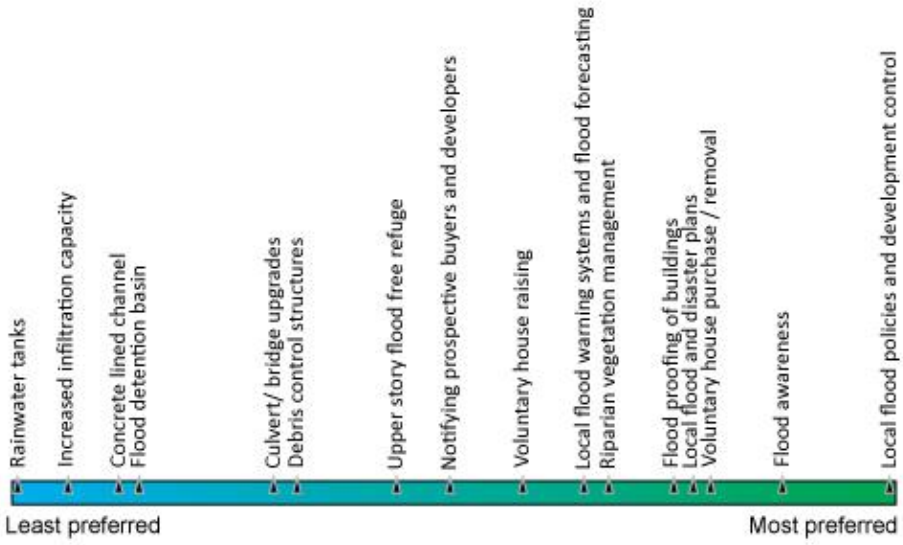

Figure 6: Wollongong City floodplain management measure preference scale (Laine, 2014).

Participation rates however, were limited particularly in the Black Creek catchment (primarily attributed to the older demographic and workforce patterns of the community) hence demonstrating that one public participation mechanism cannot be solely relied upon. Rather a suite of mechanisms are required to actively engage and attain representation from those impacted by the decision. For the Black Creek catchment for example, this could have involved further public awareness of the website, manned stalls with the EDSS, door knocking, public workshops etc. with the primary focus to help people understand the complexities and make informed decisions. Further public involvement earlier in the flood risk management process would have also aided in collective decision making.

5. CONCLUSION

Public participation is changing the ethos of decision making in the flood risk management realm. With this change comes a requirement for flood risk managers to understand the tools available and commitments that are made in embracing this transition. This paper has described mechanisms available to practitioners and presented a public participation paradigm within the flood risk management cycle in an attempt not to provide a definitive approach but, to promote dialogue about the role of public participation and hence, the role and influence of the public in the flood risk management process.

The development of EDSS such as ‘Floodengage’ may become an important part of the transition equation as they can effectively bridge the gap between community values and complex decisions. It has been demonstrated that engagement focused decision support systems can provide an important mechanism to collaborate with and empower the public (including: community members, politicians, developers, planners, engineers etc.) to learn about, prioritise and make informed decisions about flood risk management options for their local catchment in a transparent objective facilitated process.

Like all tools limitations apply. However, it is envisaged with future technological uptake, advancements, and increased institutional and public desire to build participatory culture, engagement focused decisions support systems will become a key mechanism in aiding public deliberation in the future democratic sphere. It is hoped that in doing so those who are directly or indirectly affected by flooding or the management of flooding will not only be involved in the decision-making process but be empowered to make informed decisions based on civic inclusive deliberative exchanges of ideas and values.

6. REFERENCES

AEMI (Australian Emergency Management Institute). (2013) Community Engagement Framework- Handbook 6. Australian Government, Canberra.

AEMI^2 (Australian Emergency Management Institute). (2013) Managing the floodplain: a guide to best practice in flood risk management in Australia- Handbook 7. Australian Government, Canberra.

Bevir. M., and R. Rhodes. (2006) The Life, Death and Resurrection of British Governance. Australian Journal of Public Administration, 65 (2), 59-69.

Cabinet Office. (2011) Strategic National Framework on Community Resilience. [online: accessed 14 March 2014]. https://www.gov.uk/government/uploads/system/uploads/attachment_data /file/60922/Strategic-National-Framework-on-Community-Resilience_0.pdf

EC (Council of European Communities). (2007) Directive on the assessment and management of flood risk (2007/60/EC) Official Journal.

EU Water Directors. (2002) Guidance on public participation in relation to the water framework directive: Active involvement, consultation and public access to information. [online: accessed 14 March 2014]. www.eau2015-rhin-meuse.fr/fr/ressources/documents/guide_participation-public.pdf

Evers, M. (2012) Participation in Flood Risk Management: An introduction and recommendations for implementation. [online: accessed 30 April 2014]. http://www.diva- portal.org/smash/get/diva2 :442763/FULLTEXT01.pdf

Delli Priscoli, J. (1989) Public Involvement, Conflict Management: Means to EQ and Social Objectives. Journal of Water Resource Planning and Management, 115 (1), 31-42.

Delli Priscoli, J. (2004) What is Public Participation in Water Resource Management and Why is it Important?. IWRA, Water International, 29 (2), 1-7.

DHI. (2010). Black Creek Flood Study. CCC, Cessnock, NSW.

Firus, K., Fleischhauer, M., Greivin, S., Stickler, T., D'Andrea, A., Ferranti, C., Flex, F., Kobotschnig, G,. Fangucci, G., Scheibel, M., Ebers, M., Sereinig, N., Malvati, P., Grifoni, P., Bagnini, S., Guzzo, T., Vitale, V., and S. Wanczura (2011) IMRA: Integrative flood risk governance approach for improvement of risk awareness and increased public participation (IMRA), Final Report II-4. ERA-Net CRUE reference code: IMRA IV-3.2.

ICE (Institution of Civil Engineers. (2014) Shifting agendas: response to resilience. ICE, London.

Involve. (2005) The True Costs of Participation. [online: accessed 16 March 2014]. http://www.participationinstitute.org/wp-content/uploads/2009/06/pp_in_e_report_03_06.pdf

Kahneman, D., Slovic, P., and A. Tversky (1982) Judgment Under Uncertainty: Heuristics and Biases. Cambridge University Press, New York.

Keeney, R. (1992) Value-Focused Thinking: A Path to Creative Decisionmaking. Cambridge, Harvard University Press, Massachusetts.

March, J. (1978) Bounded Rationality, Ambiguity, and the Engineering of Choice. Bell Journal of Economics, 587-608.

McDaniels, T., Gregory, R., and D. Fields. (1999) Democratizing Risk Management: Successful Public Involvement in Local Water Management Decisions. Risk Analysis, 19 (3), 497-510.

Laine, R., (2014) Horsley Creek, Black Creek, Wollongong City FRMS&P Online Community Consultation Reports. UOW, Wollongong.

Laine, R., Lemass, B,. and C. Cook. (2011) A Structured Decision Support System for Flood Mitigation. ASFPM 35th National Flood Risk Management Conference, Kentucky, United States, May 15-30.

Laine, R., Cook, C., and B. Lemass. (2012) Decision Support: Informing Flood Management. 52nd Floodplain Management Association Conference, NSW, Australia, February 21-24.

Lemass, B. & D. Carmichael. (2008) Front-End Project Management. Pearson Prentice Hall, Frenchs Forest, NSW.

OECD. (2014) Civic Engagement: OECD better life index. [online: accessed 30 April 2014]. http://www.oecdbetterlifeindex.org/topics/civic-engagement/

Qpzm. (2014) Local Stats and Demographics. [online: accessed 5 May 2014]. http://localstats.qpzm.com.au/

Reinco. (2011) Horsley Creek Flood Study. SCC, Shellharbour, NSW.

Rowe, G., and L. J. Frewer (2000). Public Participation Methods: A Framework for Evaluation. Science, Technology, & Human Values, 25 (1), 3-29.

Simon, H. (1990) Invariants of Human Behaviour. Annual Review of Psychology, 41, 1-19.

Smith, L. G. (1983) Impact assessment and sustainable resource management. Harlow, UK: Longman. Cited in Rowe, G., and L. J. Frewer (2000). Public Participation Methods: A Framework for Evaluation. Science, Technology, & Human Values, 25 (1), 3-29.

Slovic, P., Fischhoff, B., and S. Lichtenstein. (1977) Behavioral Decision Theory. Annual Review of Psychology, 28, 1-39.

Simonovic, S. (1999) Decision support system for flood management in the Red River Basin. Report to the International Joint Commission Red River Basin Task Force, Winnipeg, Canada.

US Government. (2013) Principles and Requirements for Federal Investments in Water Resources. [online: accessed 30 April 2014]. http://www.whitehouse.gov/sites/default/files/final_principles_and_requirements_march_2013.pdf

Walsh, S. (1999) DAD IS OUT, POP IS IN. Journal of the American Water Resources Association, 35 (3), 1-7.

WMA Water. (2013) Wollongong City Flood Study. WCC, Wollongong, NSW.