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Decision Support Systems And Promoting Socially Just Environmental Management

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DECISION SUPPORT SYSTEMS AND PROMOTING SOCIALLY JUST ENVIRONMENTAL MANAGEMENT

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The Mauri Model Decision Making Framework (DMF) is unique in its approach to the management of water resources as the framework offers a transparent and inclusive approach to considering the environmental, economic, social and cultural aspects of the decisions being contemplated. The Mauri Model DMF is unique because it is capable of including multiple-worldviews and adopts mauri (intrinsic value or well-being) in the place of the more common monetised assessments of pseudo sustainability using Cost Benefit Analysis.

The Mauri Model DMF uses a two stage process that first identifies participants' worldviews and inherent bias regarding water resource management, and then facilitates transparent assessent of selected sustainability performance indicators. The assessment can then be contemplated as the separate environmental, economic, social and cultural dimensions of the decision, and collectively as an overall result; or the priorities associated with different worldviews can be applied to determine the sensitivity of the result to different cultural contexts or worldviews.

The October 2011 grounding of the MV Rena on Otaiti, had significant environmental impacts that were experienced in anthropogenic terms as impacts upon the social, economic, and cultural well being of many indigenous people. The Government's Recovery Plan goal is to 'restore the mauri of the affected environment to its pre-Rena state'. Mauri is the life supporting capacity of an ecosystem or its parts. The goal of mauri restoration is significant in that it positions environmental recovery in conceptual terms aligned to the aspirations of the indigenous peoples of the affected area. The reference to mauri facilitates the recognition of important meta-physical considerations not otherwise included in conventional decision making. The Mauri Model DMF is being used to investigate this challenge and discuss the sustainability implications of the disaster mitigation strategies being promulgated.

The Mauri Model DMF was digitised in 2013 to extend research regarding recovery options for New Zealand's worst environmental disaster. The open source website www.mauriometer.com was launched 21 August with the intention of promoting greater community involvement in decision making regarding the disaster recovery options being postulated. How does the Mauri Model contribute in the complex context of environmental disaster response? Three recovery options are assessed to illustrate the contribution that alternative frameworks can make to an enhanced understanding of real sustainability outcomes.

INTRODUCTION

Is objective decision making really a possibility in water resource management decision making? Much of the literature that discusses water resource management in contexts of competition for resources and barriers to integration suggests it is not [1]. Yet objective and holistic decision making are the prerequisite attributes of socially just outcomes.

The challenge of promoting socially just environmental decision making is inherently difficult due to increasing competition for resources and differing stakeholder perceptions of what environmental attributes should be valued and which attributes should be given higher priority. Many developed countries have established legal forums that hear the evidence of adversarial stakeholders and on behalf of the Government determine the most desirable outcome. Promoting socially just environmental decision making is thus difficult enough under 'normal conditions' let alone when the process is being driven by the urgency and uncertainty introduced in disaster response situations such as the Rena disaster recovery.

When the Merchant Vessel Rena ran aground Otaiti (Astrolabe Reef) on 5 October 2011, 25km offshore from Maketu, Bay of Plenty, it was carrying 1,700t heavy fuel oil, 200t marine diesel, cargo 1,368 containers of which 32 contained hazardous materials [2]. On 11 October, Minister for the Environment Dr Nick Smith, declared the grounding and oil spill, New Zealand's worst maritime environmental disaster [3]. Approximately 600t of heavy fuel oil entered the marine environment following the grounding and surge induced movement further damaged the hull with 267 containers being lost. The Rena was listing 20° and the hull had cracked in two a week after grounding. By 8 January 2012, the Rena had broken in two, the stern section settling lower in the water and almost completely submerged two days later [4].

Figure 1. Location map indicating Otaiti and MV Rena, Motiti, and New Zealand coast [5]

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The Mauri Model adopts mauri as the basis for sustainability assessment within a framework that readily aligns to contemporary legislation [7]. The Mauri Model can account for the different priorities inherent in the indigenous (Te Arawa Ki Tai) and western scientific (Regional Council) worldviews. These characteristics of the Mauri Model make it well suited to the challenge of effectively incorporating the conceptualisation of water as a taonga (ancestral treasure) on one hand and as public commons on the other.

That paper [7] introduced a set of pre-requisites for an objective Decision Support Framework in Aotearoa New Zealand, and then presented a framework designed to meet those criteria. This paper delivers new dimensions of understanding in hydro informatics using the MV Rena disaster response as a case study.

THE MAURI MODEL DMF AND ASSESSMENT OBJECTIVITY

The two subjective aspects of a Mauri Model assessment are the modelling of reality as four Mauri dimensions of equal importance and the selection of indicators. The abstraction or construct of reality as four equally important Mauri dimensions is however consistent with the framing of sustainability in the Resource Management Act. The selection of indicators can be subjective however an inclusive evaluation process can minimise the potential for subjectivity or stakeholder interests to overly influence indicator selection.

Once indicators have been chosen for each dimension the mauriOmeter scoring of indicators forces objectivity as only integer scores are permitted and these are determined using a simple decision tree. The mauriOmeter scoring is reproducible by other practitioners to verify indicator scoring and averaged dimension results.

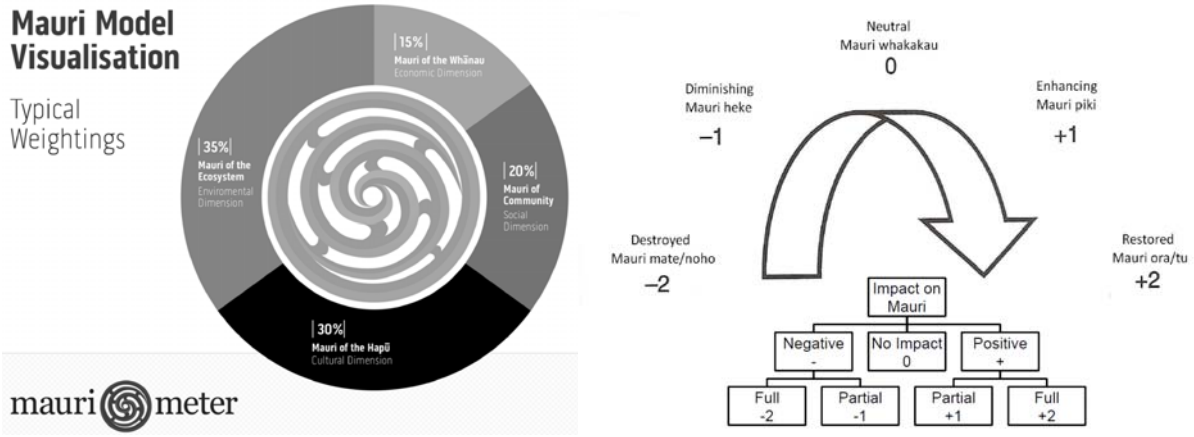

Figure 2. Mauri dimensions and the mauriOmeter

The calculated worldview hierarchy priorities are determined by each particular stakeholder and these results are also repeatable. An additional MM framework objectivity verification is to ensure that the stakeholder nominated indicators are included in dimensions for which those stakeholders identify as their highest priority. This approach ensures that the sensitivity analysis for a particular stakeholder worldview is robust and a fair and true representation of the option under consideration as perceived by a particular stakeholder.

Within the specific context of the goal of restoring the mauri of the environment to its pre-Rena state, consultants preparing consent applications regarding the remaining Rena wreckage have stated that it is impossible to restore the mauri to its pre-Rena state [8]. These statements have been made in the absence of an analysis of mauri leading to public concern regarding the purpose of the consenting process being conducted.

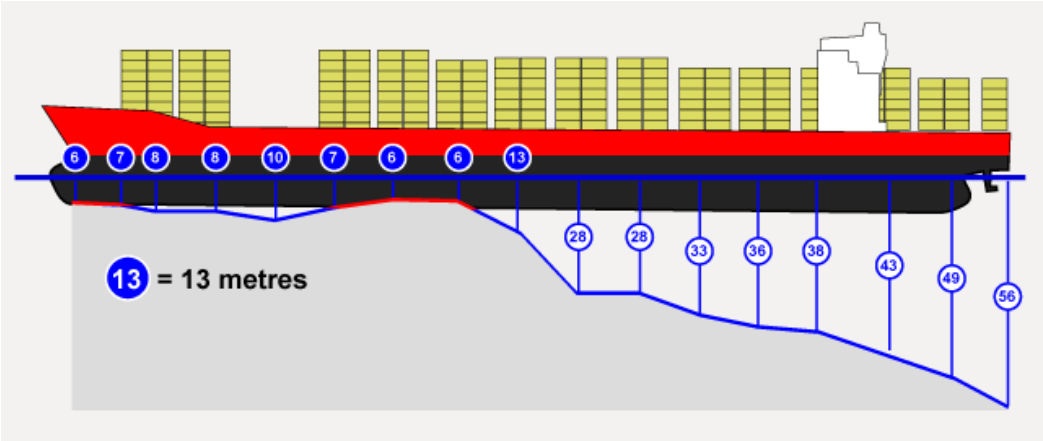

Figure 3. Merchant vessel Rena grounded on Otaiti (Astrolabe Reef) [9]

RESEARCH METHODOLOGY

The research challenge has been defined as three phases of investigation, all of which use the Mauri Model Decision Making Framework [10] as the primary methodology. These are the determination of the pre-Rena state of mauri [11], quantification of the change that has occurred since the Rena grounding, and the comparison of potential solutions regarding their ability to restore mauri.

The first phase requires the determination of the pre-Rena state of environmental mauri. The determination of the pre-Rena state of environmental mauri is achieved by considering the century long period prior to the disaster event and how events during that period of time have altered the mauri of the ecosystem under consideration.

The second phase determines the changes in mauri of various indicators since the grounding event measuring the accumulating impacts over time while interim responses have been implemented to address contaminant spills and to remove or mitigate the impacts of wreckage in the vicinity of Otaiti. Analysis of these impacts has been performed for the four mauri dimensions on a three monthly basis since the grounding to ensure that both the efforts of the salvage teams and the self-restoring capacity of the ecosystem are included along with the measurement of the accumulation of mauri impacts over the disaster response period.

The third phase involves the evaluation of possible recovery actions proposed in the consent application. The third phase includes the identification of additional measures necessary to achieve the restoration of mauri to the pre-Rena state. The third phase incorporates the ability of the Mauri Model Decision Making Framework to clarify the ways that worldview priorities influence the selection of preferred solutions and a worldview based sensitivity analysis is conducted to illustrate how different solutions are expected to contribute.

Determination of the pre-Rena state of Environmental Mauri

The determination assessed 24 indicators representing the four mauri dimensions and how these indicators were impacted by specific events over the one hundred year period prior to 5 October 2011. The resulting mauri trends for each dimension are combined to produce an equally weighted representation of the mauri state immediately prior to the Rena grounding. The smoothed mauri trend for the ecosystem is presented in Figure 4 and shows that the pre-Rena state of mauri can be conservatively determined as +0.22.

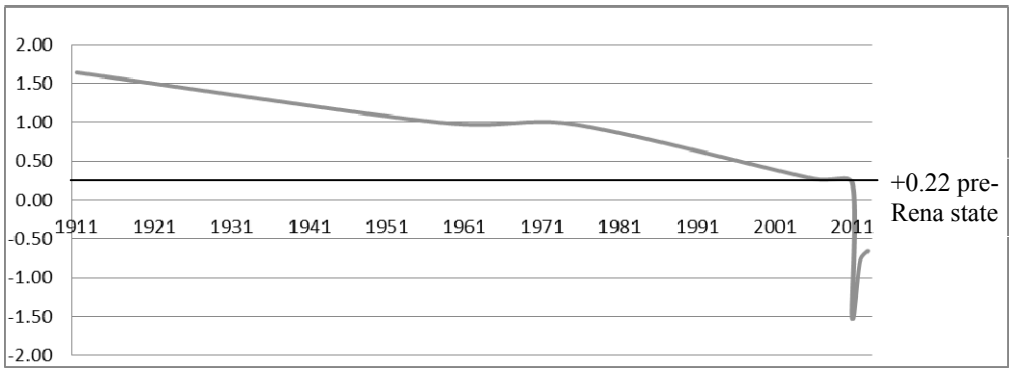

Figure 4. The pre-Rena state of mauri determined using 100 year retrospective analysis

Measurement of changes in mauri since the grounding event

The 24 indicators are evaluated at six month intervals to calculate the accumulation of impact upon mauri between October 2011 and April 2014, a period of 30 months at which time the consent applications are expected to have been lodged.

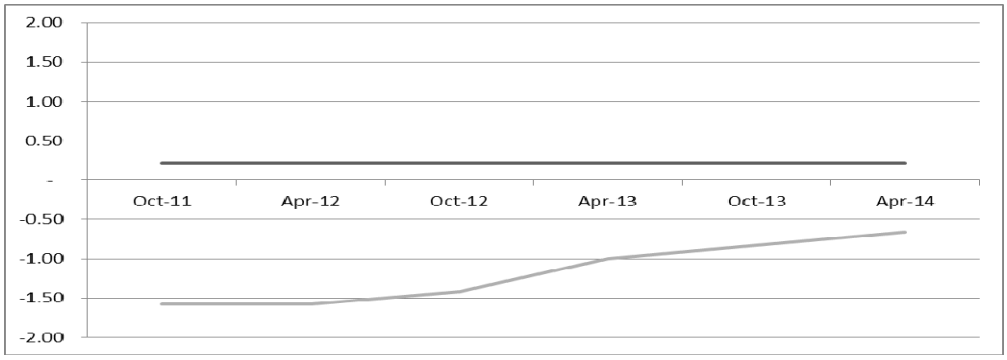

Figure 5. The cumulative change to mauri in the 30 months following the Rena grounding

The mauri trends for each dimension are combined to produce an equally weighted representation of the accumulated impact upon mauri since the Rena grounding. The area confined between the plotted mauri curve and the pre-Rena mauri state +0.22 is calculated as -3.46 mauri-years and is presented in Figure 5.

Evaluation of proposed recovery actions

Three recovery actions have been evaluated in the consent application lodged by the Ship Insurers consultants. These actions are; Do Minimum; Partial Wreck and Debris Removal; and Full Wreck and Debris Removal. The contribution each action makes to the recovery of mauri is indicated in figure 6. In order for a recovery action to be mauri enhancing and thus contribute to the restoration of mauri, it must exceed the pre-Rena state of +0.22 by a sufficient margin and for the required duration to accumulate +3.5 mauri-years net enhanced mauri. Only the full removal of the Rena wreck can achieve a net enhanced mauri, and over the consent period of thirty years, this option is still incapable of restoring the mauri to its pre-Rena state.

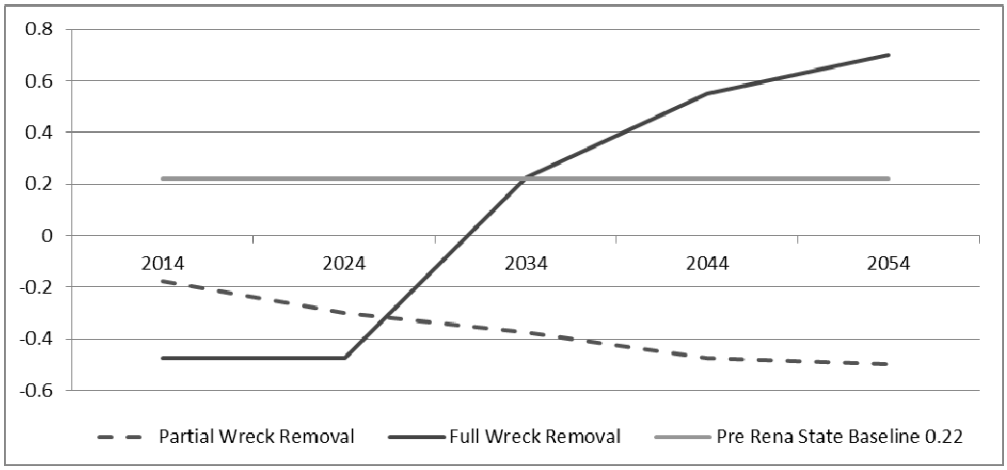

Figure 6. Two recovery actions plotted over 30 year consent period

DISCUSION

The evaluation of these options demonstrates that none of the proposed actions are effective in achieving the goal set by the Ministry for the Environment. If the implemented option is to actually contribute to restoring the mauri of the environment then modification through integrating additional supplementary actions is necessary.

It has been noted that the conventionally derived recovery actions proposed by the Ship Insurers consultants do not address the identified culturally oriented mauri impacts. Additional supplementary actions have been identified using the Mauri Model DMF that do address this mauri dimension. Evaluation of the supplemented options shows that can indirectly but effectively impact mauri over long timeframes. Their effectiveness is due to the manner in which these measures achieve the reinstatement of qualitative outcomes associated with the identity and obligations of the Indigenous Peoples of the effected ecosystem.

Supplementary actions identified include power sharing mechanisms and the empowerment of Indigenous peoples to be more effective in future disaster response situations. The enhanced capacity can be achieved for example through the establishment of education and research facilities that contribute to recovery monitoring, preparedness, and ecosystem enhancement activities. The greater involvement of Indigenous peoples in the ongoing management of the Otaiti ecosystem is also possible through co-governance and co-management arrangements with central and regional government agencies.

Evaluation of thee enhanced options demonstrates that it is possible to restore the mauri to its pre-Rena state over the 30 year timeframe associated with the resource consent process. The partial removal of the wreck and debris field incorporating enhanced Iwi capacity and the transfer and sharing of decision making powers facilitates both the know-how and the authority to influence future decision making and actions in regard to the Indigenous Peoples ecosystem of origin.

CONCLUSIONS

The Rena grounding in 2011 caused considerable adversity for the impacted Indigenous Peoples. Their involvement in the disaster response both directly and in terms of research into potential recovery options has significantly influenced the outcomes achieved since the disaster occurred. The direct involvement in the disaster response effort has contributed to the rapid recovery of the macro scale ecosystem [12].

The inclusion of concepts derived from Indigenous Knowledge in the Government's longterm recovery strategy has created the opportunity to generate new understandings of sustainability assessment when informed by all of the relevant knowledge systems available. The research presented in this paper demonstrates the viability of decision frameworks that effectively integrate science and indigenous knowledge. The research also introduces a new area of hydro-informatics that may have applications in other contexts internationally.

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