From liability to opportunity: an institutional approach towards value-based land remediation

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ABSTRACT

The remediation of contaminated sites impacts on stakeholders in potentially beneficial ways, yet stakeholder dialogue has historically been focussed on costs, risk, liability, stigma and other negatives. Shedding light on stakeholders' remediation values can help reform remediation policy towards more positive outcomes of site clean-up. We adopt institutional theory to elicit plural motivations and cognitive assumptions as embedded in stakeholders' expressions of remediation values, objectives and outcomes. We explore in four case studies with varying size, complexity, cultural diversity, and geographical location (three in Australia, one in Fiji) how remediation values operate within remediation decisions. Our findings suggest that more than economic costs, liability and risks are at play in decision-making on contaminated land. Our research confirmed that different socio-ethical, environmental and sustainability values are evaluated differently by different types of actors (site owners, regulators, auditors, residents, local government, consultants). We found that remediation values often shift in the course of a remediation decision-making process, suggesting learning and improved understanding. Remediation policy that better facilitates and aligns stakeholders' articulations of initial and emergent outcomes sought from site clean-up is likely to enhance both economic and social value outcomes of remediation. Further research is needed on how remediation policy could better incorporate remediation value dynamics in stakeholder consultation and engagement.

Keywords: contaminated sites; remediation values; social values; beliefs; preferences; collective action; stakeholder engagement; property regimes; policy reform.

1. Introduction

The chemical contamination of land and groundwater resources has been a long-standing problem (Khan et al., 2004). Some thirty years after several major public scares, such as the Love Canal case in the U.S. (Kolata, 1980) and the Lekkerkerk case in the Netherlands (Griffiths and Board, 1992), triggered initial *ad hoc* policy responses, the clean-up of contaminated sites continues to be a focus for environmental policy making. Australia alone has more than 160,000 contaminated sites and Asia an estimated 5 million (CRC CARE, 2011). Site remediation policy in most Western jurisdictions has substantially matured since the early days (Fowler, 2008). However, significant challenges remain in the face of other major environmental policy issues (e.g., climate change, biodiversity loss, and ageing populations) that are competing for increasingly limited government funds. Therefore, both a necessity and opportunity exists for remediation policy makers to tap into the potential of what Hajer (2011), in an energy policy context, has termed the 'energetic society'. Hajer (2011) has argued that governments have much to gain from a better utilisation of its citizens' creativity and innovation potential. Many individuals and organisations already consider ecologically responsible behaviour as a precondition for success and survival. With appropriate institutional change such values can be harnessed into action (Kluckhohn, 1962). Therefore, remediation policy reform requires an understanding of the institutions – societal conventions, social norms and formal rules (Vatn, 2005) - that interact with remediation actions.

The traditional policy approach to site contamination, triggered by public fear and community outrage in high-profile cases during the 1980s (e.g., Austin et al., 2011; Gushee, 2010; Rushbrook, 2006), was to clean up every contaminated site to a residential standard,

where children could play safely and biota would not be affected. This approach was soon found to be impracticable and prohibitively expensive (see e.g. Hamilton and Viscusi, 1999) and was gradually replaced by a risk-based approach (e.g. Davis et al., 1997; Lemming et al., 2010; Panagopoulos et al., 2009). A risk-based approach allows for contaminants to be cleaned up to a level commensurate with the intended land use after clean-up, for example industrial, commercial, or high-density residential use. Risk-based, 'fit for purpose' clean-up requires a trade-off between costs and risks (Boussabaine and Kirkham, 2003; Day et al., 1997; Latawiec and Reid, 2009; Pollard, 2005; Runhaar et al., 2010).

A recent development addressing both the benefits and challenges of complexity and costliness of site clean-up is 'sustainable' and 'green' remediation (Bardos et al., 2011b; SuRF-UK, 2009; U.S. Sustainable Remediation Forum, 2009). Both are industry-led approaches aimed at finding new clean-up solutions that consume fewer resources and cost less, for example innovative low-energy and low-cost remediation techniques such as controlling the bioavailability of contaminants and in-situ treatment, containment and application of institutional controls to provide certainty that the sites will be safe in the long term (Bardos et al., 2011a).

Site remediation involves more than merely 'working out' the optimal remediation solution (Pollard et al., 2004). Site remediation generates both private and public benefits, for example increased land value, new jobs and new green spaces. Under the sustainable remediation paradigm, such benefits are articulated in terms of cost/risk reductions derived from increased resource use efficiency. The current emphasis on remediation costs and risks implicitly adopts a conventional economic frame of analysis for the working out of the 'optimal' or 'most efficient' remediation solution. Rather than addressing *how much* benefit remediation might add, or *how efficiently* it might do so, we ask how stakeholders'

remediation values play a role in the remediation decision-making process (RMDP) – what do stakeholders expect, hope, want, and need to get out of the site clean-up? And do these expectations, hopes, wants, and needs change throughout the process?

Our analytical approach covers a theoretical continuum (Figure 1) of value-focussed thinking (VFT) (Keeney, 1996), institutional analysis and development (IAD) (Ostrom et al., 2005) and volitional pragmatism (VP) (Bromley, 2008). We adopt institutional theory to elicit plural motivations (Cooper et al., 2004) and cognitive assumptions (Sauer and Fischer, 2010) as embedded in stakeholders' expressions of remediation value. We explore in four case studies with varying size, complexity, cultural diversity and location how stakeholders' remediation values operate within remediation decisions. One case study was conducted in Fiji, and three in Australia in the states of New South Wales, South Australia, and Western Australian. We engaged ethnographic (Fiji) and decision-theory (Australia) methods to collect data from stakeholders involved in and impacted by remediation processes.

«FIGURE 1 HERE»

The paper is structured in six sections. After this introduction, we briefly address value theory to contextualise our specific case of site remediation (Section 2). We then frame our conceptualisation of remediation value against institutional theory in Section 3. Section 4 describes our methods and how they were applied in four remediation case studies. Section 5 presents results from our application of theory in the four case studies. Discussion, concluding remarks and suggestions for future research are provided in Section 6.

2. The Nature and Use of Value in Decision-Making

Value theory encompasses both a great variety of disciplinary perspectives as well as intellectual traditions that go as far back as Aristotle – as such, a comprehensive treatment of value theory is well beyond the scope of this paper. This section addresses the general nature of value and its use in the context of environmental decision-making.

2.1 The Nature of Value

The notion of 'value' arises when we aim to understand how, why and to what degree people attach importance or worth to objects (Dewey, 1939; Najder, 1975). Such objects can be physical (furniture, food, real estate, etc.) but in the context of value objects also extends to people, ideas, and thoughts (Jessup, 1949; Morris, 1956). Values range from personal preferences, as expressed by pleasure, desire, want, and need, to more conceptual notions such as health, efficiency, progress, truth, and beauty (Parker, 1957). The notion of value, its manifestation in 'values', and the human acts of 'valuing' and 'evaluation' have been subject to diverse economic, social scientific, and philosophical analyses (Anderson Jr, [1911] 1966; Brown, 1984; Heilbroner, 1983; Lowe, 1981). In philosophy, value theory broadly encompasses moral philosophy, social and political philosophy, aesthetics, feminist philosophy and the philosophy of religion. In a narrower sense, the philosophy of value is synonymous with axiology (Hartman, 1967), a now mostly obsolete tradition focussed on questions about the good (ethics) and the beautiful (aesthetics). In the social sciences, value theory has focussed on how values are grounded in, or relate to, the self and how such grounded values constitute society or influence political behaviour (Joas, 2000; Morris, 1956; Schwartz, 1993; Schwartz, 1994). Social psychology in particular has a strong tradition in

values research (Rokeach, 1973), which has also addressed environmental concerns (Stern and Dietz, 1994). In economics, value theory was born as moral philosophy (Anderson Jr, [1911] 1966; Heilbroner, 1983) but gradually, via the classical labour and cost-of-production theories of value of Adam Smith (1776) and David Ricardo (1817) and later Marxist labour theory of value, narrowed down to the utility theory of value that dominates contemporary economic thinking (Ben-Ner and Putterman, 1998; Vatn and Bromley, 1994). Utility theory establishes a relation between price and usefulness, using the notion of marginal utility to explain prices and quantities. As such, an explicit notion of values is largely absent from modern mainstream economics (Mirowski, 2002).

As none of these disciplinary attempts to classify values enjoy authoritative and wide acceptance today, we adopt Brown's (1984) terminology to set the broad scope for our enquiry into remediation values. Brown (1984), drawing from philosophy, sociology and economics, distinguished between held values ('someone has a value', 'someone's value') and assigned values ('the value of an object', 'what a thing is worth'). *Held values* are labels to describe concepts of the preferable as well as modes of conduct. As such, held values reflect social norms: values to which others in society are asked or expected to assign great value. Held values can be further classified as instrumental (means), such as moral and competence values, and terminal (ends), such as personal and social values. *Assigned values* are expressions of the relative importance or worth of an object. Here, value is that which arises from the preference of a subject (e.g. the actor in the remediation process) for an object (e.g. a certain remediation technology) in a given context (e.g. a contamination problem involving multiple actors with conflicting interests).

Through a preference relationship, assigned values reflect the held values of a valuing subject (the 'valuer') within the particular context of the preference relationship (Brown,

1984). A preference context can be set by the marketplace, a legal notice or a sense of moral obligation. For analytical purposes assigned values are thus to be conceived not as merely static but rather as continuously interacting with held values, the latter being the ultimate motivator for action in the decision-making process (Kluckhohn, 1962; Sauer and Fischer, 2010). Brown's (1984) distinction between held and assigned values is consistent with many similar value distinctions proposed in the environmental planning literature, for example Stephenson's (2008) distinction between 'embedded' (held) and 'surface' (assigned) values.

2.2 The Use of Values

Environmental decisions involve stakeholder actions in light of the information they possess about how their actions are linked to the potential outcomes they seek (Ostrom et al., 1994, page 29). Outcomes are affected and guided by the participants' own valuations of possible outcomes (Norton, 2005). Such individual valuations - inner evaluations of information in relation to possible outcomes - essentially determine policy outcomes. Keeney (1994, page 44) has argued that "there is a vast discrepancy between the way decision situations *are* usually examined and the way they *should be* examined in order to be consistent with the decision-maker's values and information". Policy tends to rely on *alternative-focussed* thinking to 'solve' decision problems. By incorporating values, *value-focussed* thinking takes a much broader and integrative approach to complex problems. Whilst solving decision problems is an aim of value-focussed thinking, it also engages with the identification of decision opportunities - or problem finding.

Keeney's (1994, page 33) definition of values aligns with Brown's (1984) notions of held values:

> "Values, as I use the term, are principles of evaluating the desirability of any possible alternative or consequence. They define all that you care about in a given decision situation. It is these values that are fundamentally important in any decision situation, more fundamental than alternatives, and they should be the driving force for our decision-making".

Value-focussed thinking aims to make explicit the links between values and outcomes in decision-making (Keeney, 1996; Keeney, 2006). It broadly requires objectives to be structured to explicitly relate 'means objectives' (which contribute to achieving ends), to 'ends objectives'. Subsequently, quantification can offer additional insights, for example by identifying measures indicating the degree to which end objectives are achieved – this process highlights important value judgments.

For the purpose of our study we take both held and assigned values to manifest themselves when stakeholders articulate their 'means' and 'ends' value objectives. As discussed in Section 2.1, assigned values emerge in the specific context of choice and preference, for example when a preference for a particular remediation technology is to be expressed or when a stakeholder is confronted with a choice from a suite of possible value outcomes from the remediation process. Our intent is to elicit *held* remediation values with a view to better understand how stakeholders *assign* value to (express preference for) particular remediation options and outcomes. Section 4 below describes in further detail the methods that were employed to achieve this goal.

Having addressed the nature and use of value in the context of remediation decision-making, we now turn to institutional theory to address the context of remediation value.

3. The Institutional Context of Remediation Value

The brief for remediation policy is to provide clear guidance as to what needs to be measured, how measurements are to be carried out, which technical solutions will be acceptable, what institutional controls need to be applied, whether these controls will provide an acceptable level of safety, and how society is to gain acceptance of these new solutions. All dimensions of this policy brief thus involve acts of valuation that are embedded in institutions (Dewey, 1939; Vatn, 2005). Institutions can be defined as the prescriptions that humans use to organise all forms of repetitive and structured interactions including those within families, neighbourhoods, markets, firms, sports leagues, churches, private associations, and governments at all scales (Ostrom et al., 2005). Institutions range from informal (norms) to formal (rules) and vary in scale from local to global.

Institutional theories from political science, sociology and economics have widely been used to explain a variety of aspects of public policy and management (Vatn, 2005). Whilst a full treatment of institutional thought is beyond the scope of the current paper, we differentiate between two major perspectives: the rational choice perspective in 'new' institutional economics (i.e., the bounded rationalism of the Ostrom approach, drawing from neo-classical economics and political science) and the sociological perspective (Hall and Taylor, 1996), also known as the 'cognitivist or 'social constructivist' position (Rutherford, 1994; Vatn, 2005). The first strand focusses on rules and structures based on individual preferences and how they limit certain actions. The second strand focusses on how socially accepted norms and standardised practices shape human behaviour (Heikkila and Roussin Isett, 2004). Neither perspective is readily compatible with our conception of remediation value as laid out in subsection 2.2. We therefore adopt a hybrid institutional approach that

draws from both new and classical institutionalism by bringing together institutional analysis and development (IAD, per Ostrom, 2011) and volitional pragmatism (VP, per Bromley, 2006). The IAD framework, which is grounded in new institutionalism, provides a language that permits systematic, comparative analysis (Ostrom, 1990; Ostrom et al., 1994) of how stakeholders participate in the collective action that we term the 'remediation decision-making process' (RDMP). Volitional pragmatism offers an alternative lens for collective action based on insights from the philosophical tradition of pragmatism (Rescher, 2012). We briefly introduce each theory below.

3.1 Institutional Analysis and Development

The Institutional Analysis and Development (IAD) framework (Ostrom, 1990, 2011; Ostrom et al., 1994; Ostrom et al., 2005) has been used extensively to design policy experiments, empirically test theories and models linking institutions and the sustainability of common pool resources (Coleman and Steed, 2009; Rudd, 2004; Smajgl and Leitch, 2009). The framework (see Figure 2) starts with the action situation as the unit of analysis and focus of investigation. Our action situation is the remediation decision-making process (RDMP) - a "social space where participants… interact, exchange goods and services, exchange in appropriation and provision activities, solve problems, or fight" (Ostrom et al., 1994, page 28).

«FIGURE 2 HERE»

The IAD framework allows stakeholder behaviour in the RDMP to be explained in terms of a set of contextual factors: the nature of the good or physical /material condition; the

attributes of the communities within which participants are embedded; and the rules that create incentives and constraints for certain actions. These three contextual factors are referred to as exogenous variables that act on, and within, the RDMP.

Ostrom (1990) notes how 'rules-in-use' determine who is eligible to make decisions, what actions are allowed or constrained, what procedures must be followed, what information is or isn't provided, and what payoffs will be made between participants. As such, understanding 'rules-in-use' provides an important starting point for understanding how remediation values function within RDMPs. Our focus is on stakeholders' held and assigned values as expressed in the emphasis that they place on particular value outcomes within the RDMP. The IAD framework juxtaposes these dynamics against a backdrop of formal and informal rules-in-use.

The IAD framework describes multiple levels of action: operational, collective choice, and constitutional choice (Kiser and Ostrom, 1982; Ostrom et al., 1994; Ostrom et al., 2005). Given the site-specific nature of site remediation, our analysis focusses primarily on the *operational* level, involving the day-to-day decision-making activities that affect the remediation outcomes directly.

3.2 Volitional Pragmatism

As Bromley (2006, page 145) highlights, "the standard economic approach is to identify the correct decision protocols for reaching the correct decision. The logic is that if the right decision protocols are followed, the resulting decision will, by definition be correct." He suggests that many economists have cause and effect confused, inasmuch as the identification of the correct decision is something that occurs *after* a consensus has been reached regarding what seems best to do. The recent theory of volitional pragmatism insists that public policy

cannot legitimately be held hostage to the *prescriptive truth claims* imposed on it by economists (or those from any other discipline). Volitional pragmatism holds that policy is simply choice and action whereby groups of individuals determine the most appropriate course of action *at a given moment in time*.

What matters is to understand the *reasons*, or motivations for choices (Slovic, 1995). This requires explicit understanding of the concepts, impressions and shared imaginings which can be found through an analysis of stakeholders' held values, or, as conceptualised for the remediation context, the dynamics of stakeholders' initial and emerging remediation value outcomes. Our focus on values and their role in the RDMP is an attempt at better understanding the reasons for choices (Cooper et al., 2004) and as such goes beyond the mere measurement of preference-based proxies (assigned values) of such reasons.

In terms of institutional change, there exists an opportunity for site remediation policy and legislation to foster and promote 'abduction', or hypothesis generation, in the action arena that we have termed RDMP. Whilst comprehensive treatment of abduction and its origins in Charles Sanders Peirce's pragmatism (Fann, 1970; Norton, 2005; Ribeiro et al., 1995) is not possible here due to space limitations, we briefly outline its possible application to site remediation. Environmental contamination confronts stakeholders with *doubt* caused by the risks and uncertainties about the environmental and corporeal fates of possibly toxic chemicals. This leads them, based on their held values, and within the rules set by the regulator, to embark on a search for *what to believe* about the future outcome of the remediation process. This quest, which can be thought of as a process of hypothesis generation (i.e. abduction), leads to 'sufficient reason' (Bromley, 2004, 2008) for newly warranted beliefs (rather than mere preferences) and thereby pushes stakeholders beyond merely utility-maximising behaviour (which accords with Sauer and Fischer, 2010). An

important aspect of abduction is the social context of the formation of beliefs: the *individual* (and/or representative) participates in the *collective* action in pursuit of shared values and associated outcomes (Norton, 2005).

4. Methods

This section explains the research design employed in four case study RDMPs. A case study approach (Byrne, 2009; Yin, 2003) was selected to enable investigation of a limited number of contaminated site remediation cases in depth. Data collection methods were primarily semi-structured and structured interviews. Due to differences in socio-cultural, geographical and institutional context, the degree of structure varied between Australian and Fiji sites. This is discussed further below. Three case studies were selected in Australia and one in Fiji[1]. A second international case study, located in Vietnam, was abandoned after a pilot revealed that its scale and scope were beyond the means of our grant funding.

4.1 Remediation case studies

The RDMP in Western Australia (WA) is a small-scale soil and groundwater remediation project in an urban industrial area. A corporation that inherited the remediation issues, as a result of a corporate takeover, owns the site. The RDMP is focussed on contamination that emanated from a single point source, and resulted in a plume of contaminants in groundwater under adjacent properties. This plume extends towards waterways. The New South Wales (NSW) RDMP is comprised of a series of interrelated RDMPs from various contaminants. Contamination associated with the NSW RDMP includes a groundwater plume, stores of chemicals, and various areas of contaminated soil. As with the WA RDMP, the groundwater

311 plume associated with the NSW RDMP extends under adjoining properties. The RDMP in
312 South Australia (SA) comprises a large landfill site bordering on a highly populated suburban
313 area. The close proximity of the neighbours led to detailed consultation processes.
314 The Fiji case study, the former Suva Council refuse dump site at Lami (Lami Dump),
315 represents one of the few contaminated site reuse examples in the Pacific region. Since its
316 establishment in 1945 over a mangrove swamp, pollution from Lami Dump has affected
317 human health, amenity and the general environmental condition of Suva Harbour and its
318 surrounding informal settlements. Negative impacts have included odour, toxic fumes from
319 fires, and leaching to coastal environments. During a transition period, starting from 2005,
320 Lami Dump was closed when a new landfill funded by the European Union was established
321 at Naboro. The EU granted a further €550,000 for the rehabilitation of the Lami site, with
322 rehabilitation design commencing in April 2009.
323

324 **4.2 Analytic Hierarchy Process**

325 The first method, applied to the Australian case studies, is an analytic hierarchy process
326 (AHP) grounded in decision theory (French and French, 1997). Decision theory has two
327 broad strands: normative and descriptive (Einhorn and Hogarth, 1981; Rapoport, 1998).
328 Normative decision theory studies how people 'ought to behave' and focusses on the
329 production of 'rational' decision models. Descriptive decision theory aims to understand how
330 people actually behave in real-life situations. As Rapoport (1998) elaborates, descriptive
331 decision theory is not a 'hard science' but rather a means to develop a sound theoretical basis
332 for decision making in practice.
333 AHP, a method associated with descriptive decision theory, was employed to allow
334 analysis of decisions regarding value objectives made by six discrete stakeholder types in the

RDMP. This typology included: *i)* Owners; *ii)* Specialists from the Environmental Protection Agency; *iii)* Auditors; *iv)* Remediation Consultants; *v)* Local Government officials; and *vi)* Neighbours affected by the contamination and subsequent remediation.

AHP uses pairwise comparison to relate cause and effect and, in our case, was used to shed light on stakeholders' held values by deriving an understanding of stakeholders' means and end value objectives. Our AHP model was developed using Expert Choice v11, a software application that allows analysis of pairwise decisions (choice, preference of one option over the other) to generate an evolved decision hierarchy based on participant responses. The software produces outputs that illustrate the relationships between goals, objectives, sub-objectives, alternatives and uncertainties (Saaty, 1996). Our AHP model's Goal was defined as an '*IAD action arena for value-based land remediation*', or the RDMP (Table 1). All choices in the model were sourced from the literature and were contextualised using pre-existing information about RDMPs at three Australian case study sites. The Goal node has two 'children' i.e. a question about value perception and another about process (Table 1). The latter question has four children of its own, each of which can be compared against one another in the process context, and also contrasted for four generic value objectives: 'Socio-ethical'; 'Environmental'; 'Economic'; and 'Aesthetic' (Table 1). These broadly correspond with the well-known trinity of sustainability values "planet, people, and profit", adding aesthetics to capture the urban development perspective of site remediation. These pre-specified value objectives can be considered as initial assigned values in the AHP model. The process of choosing between one value objective over another brings these held values into a preference relationship with a respondent's held values.

«TABLE 1 HERE»

Each participant was required to assign weights (priorities) to these alternatives in the AHP model. This resulted in a structured output reflecting the experience, behaviour and thought processes of the participant. The pairwise analysis enabled the use of words to compare qualitative factors and derive ratio scale priorities that can be combined with quantitative factors (Saaty, 1996, page 45). Given the complex mix of behavioural and strategic dynamics involved in the RDMP, the ability of the AHP model to measure qualitative and quantitative factors in a uniform manner across participants was a significant benefit.

The AHP model design was piloted with one stakeholder, resulting in a revision (and simplification) of the model engaged for the other participants. To ensure confidentiality, the preliminary data were processed in Expert Choice to obtain combined decisions of each of the six stakeholder types, as well as the combined response of all 17 participants from the three Australian remediation locations. This data was exported into Microsoft Excel. Conditional formatting was used to allow a visual as well as numeric representation of the data.

4.3 Ethnography

Grounded 'theory' is a methodological approach to analyse empirical data in order to derive explanations (Strauss and Corbin, 1990, page 23) without any particular *a priori* commitment to theory (Henwood and Pigeon, 1993). We employed grounded theory to complement the AHP model that we used as a catalyst for the purposeful conversations with participants, and which formed the basis of our ethnographic study for the three Australian case studies. Our interviews that followed the AHP allowed asking for explanations and clarification about the responses (Fink and Kosecoff, 1985), as well as a range of other related issues. Interview

transcripts were analysed within QSR NVivo 9 software using indexing, coding (open, axial and selective), analytic 'memoing', and theoretical sampling. The coding and analysis of the Australian case contrasted usefully with a more organic Glaserian grounded theory approach adopted in the Fiji case study (per Glaser, 1992).

Whilst we found that the AHP model offered a robust and workable method in the Australian context, it was found less appropriate for the cultural context of Fiji. As a consequence, the Fiji case study analysis evolved primarily through grounded theory, leading to a broad but internally consistent narrative rather than a quantified set of value relationships. The necessarily more organic nature of the interviewing process in the Fiji RDMP also led to a less structured interpretation of, and adherence to, the IAD framework. This applied both to the preparation of the questionnaire (i.e., piloting, as was done in Australia with the AHP model, was not possible) and the analysis of the interview data. The latter was conducted based on written notes made by the interviewers rather than transcripts from recordings, as the recording of interviews was inappropriate in the socio-cultural context of Fiji.

Having introduced our AHP model and ethnographic approach, the next section of the paper analyses the data that were collected using these methods.

5. Analysis

This section starts with a quantitative analysis of value expressions of respondents who had access to the AHP model. Following the quantitative analysis, the complementary ethnographic analysis elaborates on key issues that are relevant to the iteration of the model.

5.1 Analytic Hierarchy Process (Australian RDMPs)

The Goal ('*IAD action arena for value-based land remediation*') started with a question (child node, Table 1) that investigated the overall value perceptions influencing the remediation process. Its purpose was to obtain a general understanding of how economic, socio-ethical, environmental and aesthetic objectives have influenced the overall RDMP. The initial question allowed for an initial response and enabled respondents to understand and become comfortable with the AHP model. Summarised responses are presented in Table 2.

«TABLE 2 HERE»

Table 2 shows the pairwise comparison whereby four choice variables are weighted against each other. Each of the variables is rated against the other, and our pilot indicated that a verbal Likert scale (with numerate values behind it) was the most effective scale for the expert participants. The importance of each remediation objective was systematically compared. For example, 'Socio-ethical', was first compared against 'Environmental', 'Economic' and 'Aesthetic', then 'Environmental' against the other three variables, and so on, for each of the six respondent types. The 'Combined' response (rightmost column of Table 2) is the synthesised response from all 17 participants (from the six stakeholder types and the three Australian states) weighted against each other. Vertically, the four values total 1.00, and the bar graph shading for each weighting was generated in Microsoft Excel for ease of comparison.

Preliminary ranking of the four values assigned through the AHP model highlights potential inconsistency between the rankings of different value objectives due to intransitivity. The resulting level of inconsistency relating to each of the six combined

participant types is shown along the bottom of Table 2. Inconsistency levels of 10% or less (i.e., 0.100) are not considered significant. The objective is to make 'good' decisions rather than attempt to minimise the inconsistency ratio (EC2000, 2002). Kumar (2005, page 122) suggests that "unless the observer is extremely confident of his/her ability to assess an interaction, he/she may tend to avoid extreme positions on the [Likert] scale using mostly the central part". The only inconsistent set of judgments in Table 2 relates to the 'Neighbour' participant category (i.e., >10%, a factor that was repeated in subsequent analysis in Tables 2 and 3). We have no clear explanation for this – rather than relating to overconfidence, it may be due to a bias against the remediation process that has been compounded by there being only two 'Neighbour' respondents.

In the preliminary question, 'Owners' and 'Experts' (EPA) prioritised environmental objectives, whilst 'Auditors', 'Local Government', and in particular (perhaps not surprisingly, and indeed at 50% significantly) 'Remediation Consultants' prioritised economic value objectives. 'Auditors' gave the highest priority to socio-ethical objectives (above environmental objectives) whilst 'Neighbours' and 'Owners' prioritised this value objective below environmental and economic value objectives. Throughout the data collection and analysis, aesthetic value objectives did not emerge as significant within the IAD action arena (i.e. the AHP model Goal). The 'Expert' preference pattern as a whole differs somewhat from that of the other participant types, especially with respect to environmental and economic value objectives. 'Experts' gave these nearly the same priority (0.378 and 0.359, respectively). This pattern differs clearly from that in the 'Neighbours' and 'Owners' groups, where environmental value objectives were given preference over economic value objectives.

453 The second question (child node) related to the overall remediation decision making
454 process (Table 1). This question sought to obtain a general understanding of the way in which
455 four specific aspects of the RDMP influenced overall decision-making at the project site. The
456 question compared the four alternatives of: 'Technology'; 'Duration'; 'Stakeholders'; and
457 'Risk'. Each of these subcategories was then interrogated in terms of the four value
458 objectives. Summary results are shown in Table 2.
459
460 «TABLE 2 HERE»
461
462 Whilst 'Owners' were most concerned about the 'Duration' (Table 2) of the remediation
463 process, and the desire to clean up efficiently and quickly (with resultant corporate image and
464 economic benefits), the other stakeholder types prioritised 'Technology' (selecting
465 technologies) over the temporal, risk, and community engagement alternatives. Again, the
466 'Neighbour' responses should be treated with caution given the inconsistency which, in this
467 case, was 25%. When the 17 responses were combined, the importance of selecting
468 technologies became particularly apparent at 48.5%.
469 We then asked participants to consider which value objectives (Table 1) most greatly
470 influenced each of the four aspects of the remediation decision making process. We started
471 with 'Technology'. Over the past few decades a broad range of remediation technologies
472 have emerged (Khan et al., 2004), such as in-situ, dig and dump, and bio-remediation
473 processes. The same values were tested against project duration ('Duration'), referring to the
474 foreseeable amount of time that the project will take from start to finish. Those managing
475 remediation are increasingly seeking to involve diverse community stakeholders within these
476 processes - these may include members of local, national, international communities or a

combination of these. This was captured in a question about stakeholders (Table 1). Finally, a question was asked addressing risk associated with the level of contamination, both in terms of the chemical nature of the contaminant and its concentration, in the context of the foreseeable land uses of the remediated site.

The responses to these four subsidiary questions, weighted per the prioritisation of influence (Table 3) are presented in Table 4. This combination of influences and value judgments is more complex than the initial responses demonstrated in Table 2, and is grounded on many more pairwise decisions and related calculations. They represent a deeper synthesis of held and assigned values in the IAD action arena (i.e. the AHP model Goal).

«TABLE 4 HERE»

The summary findings in Table 4 point to the importance of environmental and economic value objectives. Perhaps the most surprising response is that, when weighted for 'Technology', 'Duration', 'Stakeholders', and 'Risk', the 'Local Government' participants strongly emphasise economic value objectives (54.7%), whereas there may be an expectation towards socio-ethical value objectives. A possible rationale for this may be the political economy of remediation which implicitly, rather than explicitly, engages with socio-ethical value dimensions. Likewise, 'Owners' and 'Remediation Consultants' emphasised environmental value objectives significantly more highly than economic value objectives, whereas they have potentially more assumed economic pressure than the other stakeholders. This is a particularly important finding for the IAD action arena (i.e. the Expert Choice Goal).

The next section elaborates these findings by means of further ethnographic analysis of the interview data.

5.2 Interview Analysis (Australian and Fiji RDMPs)

Participants in the Australian RDMPs noted how the preconceptions that they brought to the remediation decision-making process (the initial outcome sought) evolved over the life of the respective remediation project. All participants noted that when they initially became involved in the action situation, they brought preconceived ideas (reflecting their held values) about the outcomes they said they valued (i.e. their assigned values) to the process – their '*initial outcome sought*'. All participants also noted that the scope of the outcomes they valued shifted, most often expanding as a result of their interactions in the action situation - '*emergent outcome sought*' (e.g. contributing to scientific knowledge, demonstrating innovation, enhancing environmental value as opposed to simply protecting it). Table 5 shows the distribution of initial outcomes sought and emergent value sought across the six participant types. In terms of Brown's conception of value the dynamics between initial and emergent outcomes sought reflect that actors valued the remediation outcomes differently at different stages in the remediation project.

«TABLE 5 HERE»

All participants aspired to a socially robust decision-making process, with a 'people first' paradigm being essential to a broad spectrum of what may be termed 'sustainable' outcomes. Participants in all three Australian RDMPs highlighted the lack of information flow and restrictions placed on opportunity for effective communication between stakeholders. These

barriers limit the ability of participants to pursue their initial outcomes, forcing them to adjust these within the scope of their held values. This insight was echoed in the Fiji RDMP (Lami Dump), where community members were not traditionally proactive in engaging in decision processes until policy had been implemented. In part this barrier was seen to stem from an overwhelming amount of information about projects, with remediation companies only releasing that which they think relevant (politically, environmentally, socially), whereas the community often doesn't know what to ask for.

The Fiji case study did not employ a formalised implementation of the AHP; hence insights were developed using a grounded theory approach only. Empirical data interpretation evolved along the lines of Barney Glaser (1992) rather than those of Strauss and Corbin (1990) in that we employed organic evolution and iteration. As with the Australian RDMPs, a range of held values also emerged from the Fiji interviews. Stakeholders' valued outcomes did not change substantially in the course of the remediation process, as was the case in the Australian case studies. As such, no emergent outcomes sought were identified over and beyond the initial remediation outcomes sought. This can arguably be attributed to the power relationships that shape the institutional context for the Fiji case study: participants did not move across the three degrees of power (concern, influence and control) that were identified during the interviews. The participants, their remediation outcomes and relative degree of power are summarised in Table 6 below.

«TABLE 6 HERE»

Following the closure of Lami Dump, there was considerable interest in the community and amongst businesses about the potential of the site in terms of commercial and financial reuse value. However, most interviewees were unaware that a decision to convert the site into a recreational park had already been made. The two municipal councils involved in the Lami Dump RDMP held divergent views. Whilst the site was under the jurisdiction of Lami Town Council, Suva City Council originally held jurisdiction and had leased the site for many decades. Suva City Council, concerned about waste transport costs, preferred the site to be developed into a waste transfer station. In contrast, Lami Town Council, representing its constituents, strongly opposed any potential waste management activity occurring at the Lami site post closure. The Department of Environment is the Fiji national government agency with primary responsibility for oversight of the rehabilitation of Lami Dump. In practice, this responsibility was implemented through the European Commission Delegation to the Pacific contracting a project manager from an EU-based consulting business to oversee the rehabilitation and help build capacity within the Department. The Fiji Environmental Management Act (2005) ('EMA') represents a significant legislative development to protect and enhance environmental quality in Fiji. At the time of interviewing, one public meeting had been conducted as part of an environmental impact assessment for the site. Interviewees generally noted that consultation processes were focussed on providing information rather than engaging the public in the decision-making process. Both a government and private sector participant observed that in Fiji community members were not traditionally proactive in engaging in decision processes until well after the decisions had been made, noting that "people in Fiji react when there's a problem rather than go to consultation" and that "we have a culture of accommodating – people wait and see first, and then react".

571 The European Commission was the participant with the greatest effective influence over the
572 reuse decision process. This level of influence arises from the European Commission's
573 determination of the "size of the envelope" - the amount of funding - available for the site. In
574 practice, this only enabled rehabilitation (site stabilisation), rather than site remediation.

575 **6. Discussion and Conclusion**

576

577 To date, site remediation and its more comprehensive forms of stakeholder engagement have
578 largely been oblivious to how 'held' and 'assigned' values operate within the RDMP. Pollard
579 et al. (2004, page 24) have articulated the challenge of addressing values in the context of site
580 remediation as follows:

581

582 "[We are] [l]ikely to have a complex range of values associated with a contaminated
583 site. [There is] [p]otential for inadvertent scientific and professional bias in risk
584 assessments; [One challenge is the] consideration of broader stakeholder values with
585 respect to remedial objectives. Early discussion of varied agendas is important".

586

587 Two main policy-relevant insights emerge from our RDMP case studies:

588

589 i. Stakeholders' own beliefs about what they seek as remediation outcomes are not
590 static but are likely to change in the course of the RDMP: 'means' values can become
591 'ends' values; initial outcomes sought can be superseded by emergent outcomes
592 sought; doubt, uncertainty and ignorance about the presence and probable
593 human/environmental impacts of chemicals play a key role in the shifting of
594 stakeholders' beliefs and values.

ii. The institutions (i.e., conventions, informal norms and formal rules) governing the RDMP determine both whose value outcomes are incorporated (who is allowed a seat on the table?) and how remediation value outcomes are expressed (e.g., is there institutional opportunity for learning and information sharing?)

Our first insight hardly comes as a surprise if one is prepared to reject the notion of *homo economicus* as a rational, utility-maximising agent with perfect foresight. As we have explained through the general theory of volitional pragmatism, stakeholders' settled beliefs about what they seek as remediation outcomes are likely to shift as soon as doubt comes into play. This shift is caused by learning and developing understanding of the technical, societal and economic aspects of remediation. The desire to learn or know more is caused by doubt which, in the case of remediation, is often triggered by scientific and technical uncertainty. Contamination of land and groundwater resources reflects a specialised area where unknowns and unexpected findings during remediation, for example previously unknown chemical compounds or additional leaching pathways, occur almost continuously. Indeed, the continuous uncertainty that unexpected findings pose are rule rather than exception. This uncertainty is likely to instil (philosophical) doubt that changes the attitude among stakeholders towards issues of chemical risk, safety, and failure of technology. Along similar lines but with a rather different entry point Gross and Bleicher (2013) have argued that ignorance is not necessarily detrimental and that specified ignorance (which they term 'non-knowledge') can actually turn out to be a productive 'resource'.

Decisions involving technological risk and the 'associated 'value-articulating institutions' (Vatn, 2005, pages 301-303) that reveal societal value preferences have extensively been debated in the literature (Beck, 1986; Giddens, 1999). A 'sociology of ignorance' approach

(Barnes et al., 2002; Gross, 2010) could complement our notion of stakeholder doubt and belief by further exploring the inadvertently misleading role of scientific risk assessment in land remediation. When clear knowledge about probabilities and outcomes are not available, the limits to knowledge and associated dynamics of stakeholder remediation values are to be openly acknowledged in the RDMP (Beck and Wehling, 2012).

Our second insight is illustrated by the rather different dynamics in stakeholder value outcomes between the Australian and Fiji cases. Stakeholders' valued outcomes in Fiji did not change substantially in the course of the remediation process whilst several shifts were found in the Australian case studies. This difference may be attributed to the power relationships that shape Fiji's institutional context.

This insight parallels the discourse about institutional change that can accommodate a variety of value-articulating institutions This discourse questions the use of neoclassical theory and methods – which indeed reflect but one possible value-articulating institution - within environmental decision-making processes (Niemeyer and Spash, 2001; Spash, 2008). Their embedded truth claims are believed to restrict possible outcomes and stakeholders' ways of being (ontologies) and ways of knowing (epistemologies) within these processes. Vatn (2001, page 665), approaching the problem from a property regimes perspective, has argued that "[..] what is efficient depends on the institutional structures themselves and the interests they defend". Vatn (2001) has argued that preferences that form the basis for efficiency evaluations depend upon the chosen property rights regime. O'Neill (2001) has added to this discourse from the perspective of stakeholder representation, arguing that the representativeness of small-scale deliberative (value-articulating) institutions depends on normative questions about their political and ethical legitimacy. Furthermore, Lovett (2001)

643 has offered a critical perspective on the use of opportunity cost as a means of compensation
644 for lost rights to environmental values, arguing that the value-articulating institution of
645 opportunity cost raises issues of equity.
646
647 Our research, designed as a small pilot, has employed a range of theoretical and
648 methodological approaches to eliciting stakeholder values. This has allowed us to elicit how
649 stakeholders' remediation values, outcomes and objectives operate in the context of
650 institutions that currently govern the RDMP. Application of our approach in two different
651 socio-cultural situations (Australia and Fiji) has highlighted that, at least as an analytical
652 perspective, it is highly flexible and has potential to be replicated in a diverse array of
653 jurisdictional settings. Although the combined use of quantitative (decision theory, AHP) and
654 qualitative ethnographic approaches undoubtedly produces the richest and most robust
655 picture of how stakeholder values link to RDMP outcomes, there are very real practical
656 constraints as to their implementation.
657 Furthermore, although the Institutional Analysis and Development (IAD) framework was
658 found useful by the transdisciplinary research team as a shared language to discuss
659 institutions and as a reference frame for case study design, we question its practical use by
660 remediation policy makers. Where adoption of a theoretical frame such as our hybrid of IAD
661 and volitional pragmatism is imperative for the type of analytical work presented in this
662 paper, policy makers and remediation practitioners are likely to benefit more from a
663 'codified' implementation of the suite of tools and methods that we have used, for example in
664 the form of a legally enforceable guideline (an institutional arrangement in itself) or a less
665 formal guide or handbook. Institutional theory, essentially, offers useful frameworks for
666 developing research questions and identifying appropriate models and methods to answer

667 these questions. However, the aspects of institutional theory that we have employed in our
668 remediation pilot is, perhaps, less amenable to providing straight answers and practical policy
669 guidance.
670
671 One area for future research is the further testing and application of our approach in
672 RDMPs with different 'action arenas'. This could pertain to different types of contamination,
673 different suites possible remediation technologies, different regulatory systems, and different
674 (current or future) community structures.
675 Establishing clear causal links between individual value dynamics in the RDMP and the
676 resulting aggregated social value of the RDMP as a whole is a second important area for
677 further research.
678 A third area for further research is institutional change towards 'value-based' land
679 remediation. This research challenge revolves around policy and legislation that can foster
680 deliberation, learning and collective action. Stakeholder deliberation is a common way of
681 eliciting people's held and assigned values (e.g., O'Neill, 2001), however incorporating these
682 into remediation decision-making remains challenging (Heath et al., 2010; Pollard et al.,
683 2004). Whilst a discussion of decision-support tools (Gasparatos and Scolobig, 2012) is
684 beyond the scope of this paper, we conclude here by noting that such tools, too, often exhibit
685 the characteristics of value articulating institutions (Vatn, 2005) in the sense that they
686 explicitly or implicitly state roles in the decision-making process, data requirements, and
687 information and communication processes.
688

Notes

[1] An elaboration of certain aspects of the Fiji Lami Dump remediation and rehabilitation case can be found in Chong et al. (2013).

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LIST OF TABLES AND FIGURES

Table 1: Analytic Hierarchy Process Model Design

Goal	***IAD action arena for value-based land remediation***			
Child node	***Overall Value Perceptions Influencing the Remediation Process***			
Question 1	'*Over the life of the remediation decision-making process, what values influenced the overall decision making process the most?*'			
Objectives	Economic	Socio-Ethical	Environmental	Aesthetic
Child node	***Overall Remediation Decision Making Process***			
Question 2	'*Over the life of the remediation decision making process for the project what influenced the overall decision making process the most* [...]?'			
	Technology	Duration	Stakeholder	Risk
	Technology			
Subsidiary Question 1	'*Over the life of the remediation decision making process for the project, when consideration was given to* ***what remediation technologies to use****, what influenced the selection of the remediation technologies the most*?'			
	Economic	Socio-Ethical	Environmental	Aesthetic
	Duration			
Subsidiary Question 2	'*Over the life of the remediation decision making process at the project site, when consideration was given to the* ***foreseeable project duration****, what influenced the decisions the most*?'			
	Economic	Socio-Ethical	Environmental	Aesthetic
	Stakeholder			
Subsidiary Question 3	'*Over the life of the remediation decision making process at the project site, consider the key reasons that* ***broader community stakeholders*** *have been involved within the remediation decision making processes, what influenced the decisions the most*?'			
	Economic	Socio-Ethical	Environmental	Aesthetic
	Risk			
Subsidiary Question 6	'*Over the life of the remediation decision making process for this project, when consideration was given to* ***the level of risk*** *associated with the contamination, what influenced the decisions the most*?'			
	Economic	Socio-Ethical	Environmental	Aesthetic

Table 2: Overall Value Perceptions Influencing Remediation Process

	OWNERS	EPA	AUDITORS	REM CON	LOCAL GOV	NEIGHBOUR	COMBINED
Socio-ethical	0.195	0.211	0.313	0.221	0.216	0.148	0.221
Environmental	0.447	0.378	0.231	0.229	0.324	0.410	0.335
Economic	0.289	0.359	0.373	0.500	0.393	0.348	0.376
Aesthetic	0.069	0.052	0.083	0.050	0.067	0.094	0.069
Inconsistency	*0.006*	*0.100*	*0.030*	*0.060*	*0.010*	*0.140*	*0.006*

Table 3: What influenced the overall remediation decision making process the most?

	OWNERS	EPA	AUDITORS	REM CON	LOCAL GOV	NEIGHBOUR	COMBINED
Stakeholders	0.102	0.229	0.237	0.156	0.389	0.205	0.197
Risk	0.171	0.141	0.132	0.136	0.107	0.087	0.141
Duration	0.383	0.101	0.085	0.185	0.097	0.274	0.176
Technology	0.343	0.529	0.547	0.524	0.408	0.433	0.485
Inconsistency	*0.010*	*0.070*	*0.100*	*0.020*	*0.060*	*0.250*	*0.020*

Table 4: Merged influences and values in the IAD action arena for Value Based Land Remediation

	OWNERS	EPA	AUDITORS	REM CON	LOCAL GOV	NEIGHBOUR	COMBINED
Socio-ethical	0.136	0.358	0.261	0.274	0.186	0.079	0.183
Environmental	0.491	0.348	0.308	0.471	0.227	0.423	0.350
Economic	0.296	0.215	0.338	0.185	0.547	0.413	0.390
Aesthetic	0.076	0.078	0.093	0.071	0.041	0.085	0.077
Inconsistency	*0.010*	*0.070*	*0.100*	*0.020*	*0.060*	*0.250*	*0.020*

Table 5: Initial (I) and Emerging (E) outcomes sought by type of participants in the Australian RDMPs.

Outcome Sought	Participant Type						
	Owner	Regulator	Auditor	Neighbour	Local Government	Remediation Consultant	
Minimising natural environmental risk	I	I	I	I	I	I	
Minimising human health risk	I	I	I	I	I	I	
Removing or neutralising the contamination so it poses no significant risk of harm	I	I		I	I	I	
Fulfilling regulatory and contractual requirements	I	I	I			I	
Removing blight on land caused by the contamination	I	I	I	I			
Removing legacy issues	I						
Maintaining and enhancing symbolic capital/ reputation	I			I		I	
Extracting economic value from the remediated land via sale/ redevelopment	I						
Achieving effective remediation with minimal costs	I		I			I	
Enhancing the natural environment	E	E	E	E	E	E	
Contributing to industry-wide scientific and technical knowledge	E	E	E	E		E	
Building trusting relationships between	E		E	E	E		

participants						
Improving existing and future decision-making processes	E	E	E	E		
Minimising levels of perceived risk held by community (increase sense of safety and security)	E	E	E	E	E	E
Learning new perspectives and approaches to remediation	E					
Empowering and building capacity in the community so they can engage with the remediation decision	E		E	E	E	
Developing effective collaborations and communication between participants	I,E	I,E	I,E	I,E	I,E	I,E

Table 6: Selected outcomes and degree of power over the decision-making process.

	Participant	Lami dump rehabilitation: outcomes valued (greyed cells marked 'X').							
		Health & amenity	Environmental quality	Access to site to grow & collect food	Commercial potential	Fiji autonomy over use of donor funds	TOR met for EU technical contractor	Low cost of waste transfer	Effective waste management throughout Fiji
Concern	Squatters	X		X					
	Developers				X				
	Civil Society NGO	X							
	University staff	X	X		X			X	X
Influence	Lami residents	X	X		X			X	
	Suva residents	X	X		X			X	
	Suva City Council	X	X					X	
	Lami Town Council	X	X					X	
Control	Dept of Environment	X	X				X		X
	Ministry of Finance					X	X		
	EU technical contractor	X	X				X		X
	EU Pacific Delegation (as representing EC)	X	X			X	X		

Figure 1:Theoretical continuum of value-focussed thinking (VFT) (Keeney, 1996), institutional analysis and development (IAD) (Ostrom et al., 2005) and volitional pragmatism (VP) (Bromley, 2008).

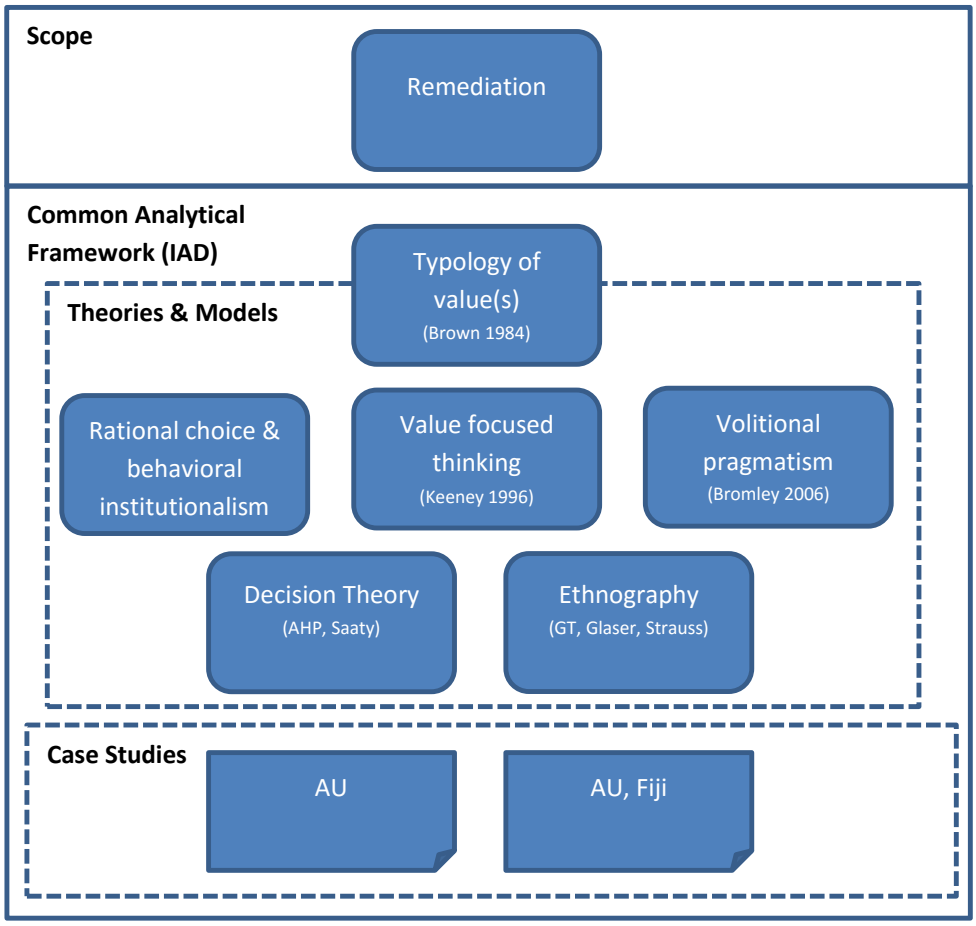

Figure 2: The Institutional Analysis and Development (IAD) Framework (adapted from Ostrom et al. (2005, page 13))