CRITERIA FOR ACHIEVING INTEGRATED WATER RESOURCE MANAGEMENT: A CRITICAL REVIEW.

ANTHONY LAVERS
Centre for Environmental Policy,
13-15 Prince’s Gardens,
Imperial College London,
SW7 1NA
Email: anthony.lavers10@imperial.ac.uk

ABSTRACT

Integrated water resource management (IWRM) is a holistic approach to managing water resources. It is part of a family of management approaches that are best described as integrated environmental management. Integrated environmental management encourages collaboration and communication between decision-making agencies, other stakeholders and the general public. It also promotes coordination between these groups, in order to avoid fragmented decision-making and poorly defined responsibilities.

The international community has endorsed IWRM enthusiastically, and there is an extensive academic literature on the topic. However, despite this support, IWRM has proved difficult to implement and operate. Here, a critical literature analysis and semi-structured interviews with two environmental management practitioners were carried out to identify criteria that contribute to achieving IWRM. Arguably, knowledge of these criteria will assist in the implementation and operation of IWRM.

Various criteria emerged from the literature review and the interviews. Many, if not most criteria relate to the institutions and organisations required for IWRM. For instance, a number of researchers discuss the importance of an enabling legislative and policy environment for IWRM. Others focus on the need for high quality data and adequate resources (whether financial or human). There is also an emphasis on intangible criteria like leadership and stakeholder commitment.

From the results produced, two main conclusions are drawn. The first is that researchers should place stronger emphasis on developing specific tools that organisations can employ for IWRM, an agenda that is especially important in the context of the European Union’s Water Framework Directive. Existing research identifies criteria that are generalisable to decision-making and management across a variety of fields, rather than being specific to IWRM. These general criteria are not as immediately useful as techniques and tools developed with IWRM expressly in mind. Secondly, the emphasis on institutions and organisations in the criteria identified suggests that institutions and organisations play an important role in achieving IWRM. However, the IWRM literature does not usually define institutions and organisations precisely. Here, a definition from the widely cited economics literature is used.

Keywords: ecological assessment tools, institutions, organisations, implementation.

1. INTRODUCTION

In his paper evaluating global freshwater resources, Peter Gleick (2003) argues that the way in which water is developed, managed and used is undergoing a major transition. Integrated water resource management (hereafter, IWRM) is, arguably, part of that transition. IWRM is a concept and process that has its origins both in dissatisfaction with traditional approaches to resource management (Bellamy, 1999) and in the work of the international community, particularly the United Nations system (Biswas, 2008, Mitchell,
2005, Rahaman and Varis, 2005). It is an approach to water management that is growing in popularity.

Nonetheless, IWRM has proved difficult to define and challenging to implement (Biswas, 2004, Mitchell and Hollick, 1993). This paper attempts to provide an insight into the latter problem by identifying specific criteria that contribute to achieving IWRM. Two approaches are used to identify these criteria: an in-depth analysis of whole papers; and semi-structured interviews with environmental practitioners. Brief observations are also made from a systematic review of paper abstracts.

2. WHAT IS INTEGRATED WATER RESOURCE MANAGEMENT?

IWRM lacks a universally accepted definition. It is a pseudocognate term - intuitively easy to grasp but difficult to define precisely. Nonetheless, a number of researchers have offered specific definitions. The Global Water Partnership’s version is frequently cited: IWRM is a ‘process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems’ (GWP, 2000). However, what is perhaps more important than an unambiguous definition are the principles that IWRM promotes. Most notably, IWRM specifically (and integrated environmental management generally) is a holistic approach to managing water and natural resources (Margerum, 1999a). IWRM therefore considers a system in its entirety and recognises its interdependencies, rather than focussing on sub-components (Margerum, 1999a, Bellamy and Johnson, 2000). Indeed, ‘integrated’ (as in ‘integrated’ water resource management) refers in one sense to holistic thinking of this kind.

IWRM also emphasises the need for collaboration, cooperation and participation between individuals and organisations concerned with water resources (Hooper et al., 1999). This is another principle encompassed by the word ‘integrated’. Here, ‘integrated’ refers to bringing together a variety of stakeholders and their opinions when developing a management plan.

The final principle promoted by IWRM is the prevention of fragmented decision-making and fragmented responsibilities (Mitchell, 2005). This implies that organisations coordinate such that their objectives do not conflict and their efforts are not duplicated (Mitchell, 2005). It also suggests the development of common goals or a shared vision, in order to avoid the pursuit of separate, often mutually exclusive, interests (Mitchell, 2005). Again, the term ‘integrated’ conveys something of this coordinated approach to decision-making and management.

3. METHODOLOGY

Two methodological approaches were used for this study. The first approach was an in-depth analysis of 20 papers examining IWRM schemes. Each paper was read in its entirety. Papers were selected by snowball sampling – that is, the references of one paper led to the identification of additional relevant papers. This in-depth analysis produced a qualitative summary of criteria that appear to help achieve IWRM.

The second methodological approach used in this study was semi-structured interviews with two environmental practitioners. One practitioner was developing an integrated catchment plan for the River Wandle in south-west London. The other practitioner had worked in a leading capacity on New York City’s Watershed Protection Programme, which has become a paradigm for IWRM. Over the course of three interviews (two with the former and one with the latter practitioner), ideas from the literature on the criteria and
conditions necessary for successful IWRM were tested against their extensive practical experience.

The author initially planned using a third methodological approach to complement the critical literature analysis and interviews, namely a systematic review of 1,000 abstracts from papers found on Science Direct. The abstracts of papers that met specific search terms were analysed for criteria that the authors had explicitly identified as playing a key role in IWRM projects. 43 such papers were found, and the criteria they identified were recorded verbatim in an Excel spreadsheet and subsequently categorised. The systematic review was inspired by quantitative meta-analyses common in the medical and social science literature (see, for example, Stanley (2001)). It aimed to produce results from a large sample of papers that were also amenable to quantitative analysis. Quantitative approaches are noticeably absent in the existing IWRM literature.

However, the systematic review did not produce consistent results. Most problematically, the categorisation was so subjective that different people would likely place the same criteria into different categories. Indeed, this author would categorise the same criteria differently during various attempts at categorisation. In addition, the number of papers that met both the search criteria and had criteria specifically identified by the authors was quite small. As a result of both of these difficulties, meaningful quantitative analysis was impossible. However, it was possible to make interesting qualitative observations from the systematic review.

4. RESULTS
The results presented here are divided into two sections, one for each methodology used. Table 1 below lists the criteria identified in the in-depth literature analysis. Sixteen criteria were identified from the literature. Each of these criteria is listed on the left-hand side of table 1. A tick is placed below the papers in which particular criteria were identified. The results from the semi-structured interviews are presented below the results of the in-depth analysis.
### Table 1. Criteria identified from the literature.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate institutional arrangements</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Common/strategic goals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication/participation mechanisms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conflict resolution mechanisms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision-making</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education/outreach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empowerment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enabling legislative and policy environment</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financing</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legitimacy</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local governance/government arrangements</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organisational culture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder commitment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The results of the critical literature analysis shown in table 1 are noteworthy for the range of criteria identified. The papers examined suggest that everything from common goals to stakeholder commitment play an important role in achieving IWRM. However, there is a notable emphasis on appropriate institutional arrangements, an enabling legislative and policy environment, data, financing, legitimacy and leadership. All of these criteria were identified in at least six different papers. Here, ‘appropriate institutional arrangements’ refer to the institutions necessary for IWRM. That criterion is closely related to the ‘enabling legislative and policy environment’ criterion that describes the regulations that make IWRM possible. ‘Data’ refers to data availability and the ability of organisations to collect and analyse data; ‘financing’ to the funding available to organisations involved in IWRM; ‘leadership’ to organisational and political leadership; and ‘legitimacy’ to the legitimacy of the institutions that influence IWRM.

In addition to these ‘key’ criteria, the literature review also identified common and/or strategic goals, communication and participation mechanisms, conflict resolution mechanisms, education and outreach, empowerment, local governance or local government arrangements, organisational culture, resources and stakeholder commitment as important criteria for achieving IWRM. Communication, participation and conflict resolutions mechanisms include memoranda of understanding, coordinating committees and informal exchange. Empowerment deals with the power asymmetries that exist between stakeholders. Resources refer to human and technical resources.

Conversely, the criteria discussed during the semi-structured interviews fell into two broad categories. One interviewee identified institutional culture and leadership as key criteria not just in IWRM specifically but environmental management generally. In particular, the interviewee argued that leadership was needed to ‘bring people together under new innovations’. The interviewee also mentioned the difficulties associated with creating or redesigning institutions. Institutional culture, leadership and difficulties with institutional change are all criteria that are recognised, directly or indirectly, in the literature. They therefore overlap with some of the criteria listed in table 1.

The same interviewee also referred to the importance of a ‘sense of opportunity’ in IWRM specifically and environmental management generally. None of the papers in the critical literature review discuss this criterion, although it is perhaps associated with leadership. The interviewee also mentioned barriers to IWRM like a fear of change and poor training in environmental issues.

The other environmental practitioner interviewed for this paper focussed much less, if at all, on institutional culture, leadership, a sense of opportunity and a fear of change. Instead, the interviewee identified the need for ‘detailed guidance’ on specific ecological assessment tools and ecological restoration techniques, rather than ‘large-scale abstract thinking’. Expertise in data analysis was crucial, as was ‘catchment specific’ information - that is, detail on the ecology, geology and hydrology of particular catchments or types of catchments. These criteria are similar to those identified in the critical literature review that concern data and resources.

5. DISCUSSION

There are two observations to make with respect to the results presented here. The first is that the criteria identified in the literature and in the interviews are not necessarily specific to IWRM. For instance, appropriate institutional arrangements are important not only to IWRM but, for instance, to the performance of economies (North, 1990). Likewise, leadership is a key criterion in the success of, say, a football team or multinational business. Indeed, the criteria identified in the literature are generalisable to
management in many disciplines. This is not to say that these criteria are unimportant to IWRM; they are important, but they are not specific to IWRM.

This observation is particularly striking when compared to the need for ‘detailed guidance’ on ecological assessment techniques identified by one of the interviewees. Evidently, there is a lack of widely available and focussed advice and information on best practice and specific tools for IWRM. This lacuna may stem in part from IWRM research focussing on the ‘large-scale abstract thinking’ mentioned by the interviewee, rather than particular tools and techniques. There is, perhaps, a need to encourage research on specific tools that organisations can employ in integrated management schemes. Developing these tools and disseminating them widely will strengthen the organisational capacity needed to implement IWRM.

The second observation is that many of the criteria identified in the literature concern institutions and organisations. For instance, 6 out of the 16 criteria identified during the in-depth literature analysis related in some way to institutions. Likewise, 8 of 20 papers discussed ‘appropriate institutional arrangements’. Here, institutions are defined as they are in the economics literature – the ‘humanly devised constraints that shape human interaction’ (North, 1990). They are distinct from organisations, which are ‘groups of individuals bound by some common purpose to achieve objectives’ (North, 1990). In the context of IWRM, organisations include coordinating committees and political parties; conversely, institutions might comprise the regulations that determine land use or water quality standards.

Some criteria like ‘appropriate institutional arrangements’ are direct references to institutions. The indication by one interviewee that ‘institutional culture’ was a key part of IWRM is also a direct reference to institutions. Other criteria like an ‘enabling legislative and policy environment’ allude to the regulations and rules that shape IWRM and other environmental objectives. More subtly, ‘conflict resolution mechanisms’ and ‘communication/participation mechanisms’ refer in part to regulations or rules (that is, constraints) that formally or informally influence IWRM outcomes. For instance, voting procedures or memoranda of understanding contain rules that shape the way people involved in IWRM interact. Likewise, ‘decision-making’ is a criterion of which constraints are a component.

The criteria identified in the literature also relate to organisations. Again, there are direct references – ‘organisational culture’, for example. In addition, ‘local governance/government arrangements’ concern government organisations. Criteria like ‘leadership’ – mentioned both in the literature and in one of the interviews - or ‘stakeholder commitment’ arguably relate to organisations because they are important to an organisation’s success. It is also striking that data and financing were identified in several papers. Data availability and analysis are key if organisations are to make sense of the resources with which they are concerned. Equally, data allows organisations to evaluate the impact of management interventions. Financing is, of course, crucial to the continued operation of an organisation and its management schemes.

The literature’s emphasis on institutions and organisations suggests they play an important role in achieving IWRM. If other criteria – data and resources, say – were more important, then logically there would be greater focus on those criteria. The results presented here indicate otherwise: many of the criteria identified do allude to institutions and organisations.

The focus on institutions in particular raises two interesting questions: is institutional reform needed to achieve IWRM? And if it is necessary, how quickly can we expect
institutions to change until they are appropriate to IWRM? Neither of these questions have clear answers. However, a tentative suggestion is that institutional reform is indeed a prerequisite for achieving IWRM. The difficulties associated with IWRM’s implementation, and the importance of institutions to IWRM, suggest that existing institutions are a barrier to IWRM (although some authors like Medema et al. (2008) argue that there is insufficient evidence to support this contention). In addition, rapid institutional reform is unlikely. As North (1990) points out, most institutions change slowly.

Given the importance of institutions and organisations in IWRM, it is surprising that many papers in the IWRM literature – including those used in the in-depth literature analysis – do not define institutions and organisations. The definitions used here are an attempt to give further discussion a solid intellectual foundation based on the widely cited economics literature. Of course, many papers discuss institutions and organisations colloquially. Although this is not of itself problematic, it does mean that institutions and organisations are used synonymously. Using specific definitions like North’s reflects the difference between organisations and the framework of regulations and behavioural norms (that is, institutions) within which organisations operate. This difference is real and should be reflected in the IWRM literature.

6. CONCLUSIONS

Two clear conclusions follow logically from these observations. The first is that research is needed to develop specific techniques and tools for IWRM. As seen, the criteria for successful IWRM identified in the literature are frequently generalisable to decision-making or management in all kinds of organisations. Although this does not detract from the criteria’s importance, it does suggest that future research should focus on developing techniques and tools that will help organisations with the practical elements of IWRM. This research agenda is particularly relevant in the context of the European Union’s Water Framework Directive (WFD), which makes significant demands of data availability, data analysis and data collection (Mostert, 2003). The development of these techniques could therefore contribute to member states’ efforts to implement the WFD.

The second clear conclusion is that institutions and organisations are fundamentally important to achieving IWRM. That in itself raises interesting questions about institutional reform and the speed at which institutions change. More generally, the IWRM literature does not define terms like institutions and organisations as precisely as it should. By grounding the IWRM literature’s treatment of institutions and organisations in terminology from the economics literature, it is hoped that this paper will encourage definitional precision in future IWRM research.

7. REFERENCES


