A THEORETICAL FRAMEWORK FOR UNDERSTANDING BENEFIT SHARING ARRANGEMENTS WITH PARTICULAR REFERENCE TO THE WATER SECTOR

Report to the
Water Research Commission

by

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This report emanates from a project titled *A theoretical foundation for understanding and managing benefit sharing in social-ecological systems with particular reference to water resources* (WRC Project No K8/945).

EXECUTIVE SUMMARY

This report originates from a consultancy of the Water Research Commission (WRC) titled "*A theoretical foundation for understanding and managing benefit sharing in social-ecological systems with particular reference to water resources*." The main aim of the consultancy was to provide a sound theoretical foundation to enable researchers, funders and managers to understand and engage the process of benefit sharing in aquatic social-ecological systems. It was designed to assist the WRC research community and others to gain deeper insights into the theory and practice of benefit sharing as it applies to social-ecological systems in the water sector.

Over the past three decades, a plethora of literature has been published on a range of topics that relate to benefit sharing. These topics include the Millennium Development Goals (MDGs), the Millennium Ecosystem Assessment (MEA), Community-Based Natural Resource Management, Payments for Ecosystem Services (PES), and Access and Benefit Sharing (ABS), to mention a few. This report explores and interprets these topics and proposes a typology of benefit sharing arrangements within the common context of the governance of ecosystem services in an effort to set the context for developing the theoretical framework. The typology introduces the basic components of the framework as a key deliverable of the consultancy. Basically, the typology comprises three generic categories of benefit sharing arrangements: hierarchical, distributive and egalitarian. The three categories provide a basis for exploring the social structures and processes required for equitable, effective and efficient delivery of the benefits from ecosystem services. It is argued that if typologies of aquatic ecosystem services are to provide a useful foundation for developing effective frameworks for water resource decisions, they must also incorporate classifications of benefit sharing arrangements. The range of benefit sharing arrangements must be represented in any effective typology of aquatic ecosystem services that acknowledges the linkages between the services and human well-being. Accordingly, the typology proposed in the report offers an extended view of ecosystem services by focusing on how these services are dealt with once they enter the social system.

The report exposes the important role played by collective identity and property rights in egalitarian benefit sharing arranagments. It presents the argument that the concepts of collective identity and common property provide a useful premise for interrogating collective actions problems in the governance of aquatic ecosystem services in general and egalitarian benefit sharing arranagments in particular. It is suggested that the majority of the benefits that are collectively accessed from aquatic ecosystem services are governed as common pool resources through collective action. In so doing, the report offers a resilience perspective of egalitarian benefit sharing arrangements that illustrates how user groups can enable aquatic ecosystems to cope with discontinuous change and shocks based on the nature of collective identity and property rights. Such a perspective is instructive in that it shows how users groups can make decisions about how to shape the performance of egalitarian benefit sharing arrangements based on the two variables. Importantly, it highlights how user groups can either change or maintain forms of benefit sharing arrangements that buttress the common interests of participants. It is postulated that most egalitarian benefit sharing arrangements largely fail due to incompatibilities between the two variables.

The theoretical framework presented in the report provides an important foundation for understanding and managing benefits sharing arrangements in the water sector. It is premised on the rationale that the design and implementation of most benefit sharing arrangements have been conducted in the absence of strong theoretical foundations. It is argued that there are relatively fewer theoretical frameworks that can contribute to understanding the social dynamics of ecosystem services. Such frameworks are important in the context of applying systematic approaches to the governance and management of the use of ecosystem services. The framework presented in the report thus theoretically captures the different ways in which benefit sharing arrangements can be designed and implemented. Importantly, the framework is considered as a preliminary foundation for further research and conceptual development.

In conclusion, the report highlights the research and policy implications of the framework in light of the vision, mission and mandate of the WRC. In so doing, it acknowledges and emphasizes that research in the water sector has paid less attention to the issues of benefit sharing which are dominant in policy and management domains. This is attributed to the understanding that benefit sharing is strongly viewed as a normative concept. The report identifies some of the key research questions explored and addressed using the framework. These are:

- How do different constituencies define benefits?
- What kinds of institutions, including markets, have been established to allocate the benefits of ecosystem services?
- To what extent are these institutions viewed as legitimate by differing constituencies?
- To what extent can the flow and provision of benefits be changed by changing ecosystem services flows?
- What are the beliefs of varying constituencies about priority in access to and sharing of benefits deriving from ecosystem services?
- What policies and laws restrict or facilitate access to and sharing of benefits?
- What core principles underpin the design and operation of an effective and equitable benefit sharing process?
- How can strategic adaptive learning processes of benefit sharing foster collective identity and collective action directed at sustaining the resilience of Social-Ecological Systems (SESs)?
- How do benefit sharing arrangements contribute to the resilience of SESs?

The report further identifies some of the policy implications that can be explored and addressed using the framework. These are:

- The intentions of water resource policy are not being supported by research that will inform decision-making in respect of benefit sharing
- Informed decision-making on benefit sharing is not possible because of significant weakness in understanding of the concepts and in practical experience
- Collaborative and transdisciplinary research (social, economic, political, legal and ecological) will be required to develop the necessary understanding and competencies
- A programmatic rather than project approach to research on benefit sharing will be required to establish the necessary collaboration.

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LIST OF ACRONYMS

ABS	Access and Benefit Sharing
CBD	Convention on Biological Diversity
CBNRM	Community Based Natural Resource Management
CoP	Community of Practice
MDGs	Millennium Development Goals
MEA	Millennium Ecosystem Assessment
PES	Payments for Ecosystem Services
SES	Social-Ecological System
WRC	Water Research Commission

1 INTRODUCTION

The Challenge

Text Box 1: Some examples of social-ecological challenges faced by benefit sharing arrangements

How do we "deal with the problem that each person's use of the resource subtracts from the welfare of others" (Pollard and Cousins 2008, WRC TT 328/08)

Do we 'share rivers' or do we 'share the benefits that derive from rivers'? (WRC Shared Rivers Initiative)

The benefits that accrue from estuaries and other coastal/seascapes need to be shared more equitably by society (WRC K5/1705 and Integrated Coastal Management Act)

Aquatic ecosystem services provide tangible benefit to humans. In some instances these benefits are of a direct nature and easy to value, but in many instances these benefits are of an indirect nature and difficult to value (WRC K5/1644)

"It is striking when reading the literature that although references to benefit-sharing (or the like) are numerous, little substance is discernible beyond the catch-phrase level. In fact, most of what is termed 'benefit-sharing' falls into one of two traps: either it resembles the previously utilized concept of Integrated Water Resource Management; or it consists of idealistic appeals for what should be done, without entering into a discussion on the real-world viability of such visions" (Philips et al., 2006).

We feel that benefit sharing has to also consider a range of benefits (not only economic) and our view is that when you do that, we have a greater need to understand benefit sharing as a social process involving collective identity and collective action." (Philips et al., 2006).

"….collective action in the commons is more complex than conventionally assumed…." (Araral 2009).

The extracts above (Text Box 1) illustrate some of the complex social-ecological challenges faced by benefit sharing arrangements both in South Africa and internationally. These challenges have in the last three decades formed the core basis of international debates on the governance and management of ecosystem services, particularly in developing countries. On one hand, this is because ecosystem services are considered to play an important role in offering a wide range of benefits that support human well-being (MEA, 2005; Wallace, 2007; Daily et al., 2009). On the other hand, it is because in most developing countries the sharing of benefits continues to be contentious and challenging (Philips et al., 2006; Turton, 2008; Winickoff, 2008). In sub-Saharan Africa, for example, ecosystem services are considered to be probably of greater importance to human well-being than anywhere else (CBD, 2000, Brockhaus and Botoni, 2009). This is largely attributed to the relatively huge proportion of the rural poor people whose livelihoods depend directly and heavily on ecosystem services (Beijer Institute, 2009). Given the enormous social differentials in the levels of economic, political and information power, sharing issues in sub-Saharan Africa are usually considered in contexts in which the majority of the people face the most serious and immediate risks from loss of the benefits deriving from ecosystem services. In such contexts, achieving sustainable allocation of ecosystem services and promoting improvements in the human well-being of the rural poor presents formidable challenges.

It is envisaged that sharing issues will continue to form the core basis of debates about the governance and management of the use of ecosystem services in the water sector. Given that the supply of and demand for aquatic ecosystems services are so variable in time and space (Koch et al., 2009), there are widely differing opinions on how to respond to the complexity surrounding benefit sharing arrangements. Complexity in turn is fuelled by heightened uncertainty about the likely consequences of both collective and individual choices. As demands for access to and use of aquatic ecosystem services become more diverse and grow, relative scarcity will increase fostering competitive rather than cooperative behaviors necessary for sustainable allocation of the associated benefits. In such complex contexts, governing and managing the use of the benefits of aquatic ecosystem services is not simply a matter of setting a utility function and selecting the alternative leading to the preferred set of consequences. On the contrary, it requires a systemic framing of key determinant variables which define the effectiveness, efficiency, equity and sustainability of benefit sharing arrangements. Knowledge about benefit sharing must be scientifically reliable and evolve to remain contextually relevant.

This report emanates from a consultancy of the Water Research Commission (WRC) titled "*A theoretical foundation for understanding and managing benefit sharing in social-ecological systems with particular reference to water resources*." It was prepared by a small group of multi-disciplinary experts working under the lead organization called *Charles Breen and Associates*. The main aim of the consultancy was to provide a sound theoretical foundation to enable researchers, funders and managers to understand and engage the process of benefit sharing in aquatic social-ecological systems such as rivers and wetlands. The consultancy was designed in such a way that it contributes to the strategic vision and mission of the WRC. The stated vision of the WRC is to be a globally recognized leader in providing innovative solutions for sustainable water management to meet the changing needs of society and of the environment. Its mission is to function as a dynamic hub for water-centered knowledge, innovation and intellectual capital. It provides leadership for research and development through the support of knowledge creation, transfer and application. This it does by engaging stakeholders and partners in research studies directed at finding solutions for water-related problems which are critical to South Africa's sustainable development and economic growth, and by committing to promote a better quality of life for all. Accordingly, the consultancy was designed to assist the WRC research community and others to gain deeper insights into the theory and practice of benefit sharing as it applies to social-ecological systems in the water sector. The core intention was to strategically position WRC and its research community in the discourse around benefit sharing and collective action. It was envisaged that this would be achieved by way of improving understanding of how the concept of benefit sharing is woven into the fabric of current WRC funded research projects with a view to both proposing a research project whilst at the same time enabling other researchers to take benefit sharing into consideration in their research.

Understanding the Concept of Benefit Sharing

The concept of benefit sharing has over time taken hold in a number of research and policy domains, from forestry, wildlife, pharmaceutical, oil, and mineral 'prospecting' to human genetic research and transboundary water management. Essentially, the concept denotes a form of societal commitment to channel some kind of returns, be they monetary or non-monetary, back to a range of designated participants. In practice, benefit sharing arrangements have been linked to a whole range of natural resource sectors including fisheries governance (1890s), forest governance (1920s), water governance (1970s) & wildlife governance (1980). It was not until 1992 that the Convention on Biological Diversity (CBD) formalized the concept of benefit sharing in international environmental law and governance. The formalization of the concept culminated in 2005 into the Millennium Ecosystem Assessment (MEA) which has since generated massive policy enthusiasm in the role of ecosystem services in providing benefits that support human well-being. In terms of research, the concept of 'benefit sharing' has mostly been addressed within the interdisciplinary field of policy analysis. For example, one major focus in the current works on ecosystem services is related to the theme of 'Access and Benefit Sharing (ABS)' particularly in the context of developing countries. Most studies around ABS Programs revolve around the need to take into account human rights and poverty issues. However, despite its prominence in the water resource policy and management domains, the concept has neither been satisfactorily studied nor defined.

In order for us to proceed with greater conceptual clarity in this report it is prudent that we attempt to provide an operational definition of the term. We adopt the approach of Schroeder (2007) by first analyzing the two concepts from which the term is derived: benefit and sharing. The concept of benefit, as with most concepts in social and behavioral sciences, has so many meanings that its significance has at times been reduced to a vague slogan. While acknowledging the risk of coming up with yet another slogan, we propose that the word 'benefit' generally implies an advantage or gain from something. The Merriam-Webster dictionary defines benefit as "something that promotes well-being". Thus, a benefit denotes being made better off when one's condition or position is relatively improved.

In simple terms, we propose that to 'share' implies to provide a portion of something to another. While this is true at the most fundamental level, the concept of sharing connotes particular behaviors in response to particular societal arrangements. The production and flow of benefits result from both natural processes and human endeavors, but the way in which benefits accumulate to beneficiaries are governed by a complex system of social rules as set out in what we commonly define as law. Essentially, law represents a system of rules, which shape and reflect culture, politics and economics in numerous ways and serves as a primary social mediator of relations between people. Law thus governs the ownership of, and rights to, the resources which generate benefits. We recognize that this is a complex subject that comprises various aspects of law which goes beyond the conventional ambit of environmental law and includes aspects of property law, civil law, criminal law, constitutional law and international law. From a legal perspective, sharing is a technical term used in the context of access to and use of non-human genetic resources such as plants, animals, microorganisms as well as information. For example, sharing under the benefit sharing policy of the WRC refers to the commercial development of intellectual property works for public use and benefit as well as the equitable distribution of financial rewards and other benefits derived from intellectual property. Sharing in the context of intellectual property regimes is usually based on potential scientific and economic benefits from research discoveries, inventions, and other related developments. In a way, the term sharing describes in more general ways exchanges between those who provide access to resources and those who provide compensation or rewards for their use.

Thus, for the purposes of this report, we view benefit sharing as embracing complex, inter-linked and superimposed notions of social and ecological processes which combine in such a way as to highlight the gains that accrue to participants in socially designed arrangements, and the impact of those gains derived through collective action processes and social relationships among the participants.

Structure of the Report

This report aims at developing a theoretical framework for benefit sharing arrangements. In order to set the context for developing the framework, the following chapter (Chapter 2) will present a typology of benefit sharing arrangements for the governance of ecosystem services. The typology introduces the basic components of the framework that is developed in Chapter 6 as a key deliverable of this consultancy. Thus, Chapter 2 provides a basis for exploring the social structures and processes required for equitable, effective and efficient delivery of the benefits from ecosystem services.

Chapter 3 exposes the important role played by collective identity and property rights in egalitarian benefit sharing arranagments. It presents the argument that the concepts of collective identity and common property provide a useful framework for interrogating collective actions problems in the governance of aquatic ecosystem services in general and egalitarian benefit sharing arranagments in particular. While acknowledging that most of the benefits that people derive from aquatic ecosystem services can be accessed either privately or collectively, in Chapter 3 we offer a view that the majority of the benefits that are collectively accessed are governed as common pool resources through collective action.

In Chapter 4, we develop and present the theoretical framework for understanding and managing benefits sharing arrangements in the water sector. This is based on the understanding that the design and implementation of most benefit sharing arrangements have been conducted in the absence of strong theoretical foundations. We argue that there are relatively fewer theoretical frameworks that can assist us understand the social dynamics of ecosystem services. Such frameworks are important if we are to apply systematic approaches to the governance and management of the use of ecosystem services. The framework we propose in Chapter 4 theoretically captures the different ways in which benefit sharing arrangements can be designed and implemented. Importantly, the framework is considered as a preliminary foundation for further research and conceptual development.

Chapter 5 highlights the research and policy implications of the framework in light of the vision, mission and mandate of the WRC. The chapter acknowledges and emphasizes that research in the water sector has paid less attention to the issues of benefit sharing which are dominant in policy and management domains. This is attributed to the understanding that benefit sharing is strongly viewed as a normative concept. The Chapter further identifies some of the key research questions and policy implications that we feel might be explored and addressed using the framework we have developed.

2 A TYPOLOGY OF BENEFIT SHARING ARRANGEMENTS FOR THE GOVERNANCE OF AQUATIC ECOSYSTEMS SERVICES

Introduction

There is a growing trend both in South Africa and internationally to promote the concept of aquatic ecosystem services as a means of documenting the values humans place on ecosystems. This trend derives from the acknowledgement that services provided by aquatic ecosystems are socio-economically valuable and lead to a range of benefits that support human well-being. In South Africa, for example, the benefits that people obtain from aquatic ecosystem services (such as fish stocks, water quality, potable water, water regulation and recreation) are known to be a major contributor to local and national economic development. As part of the growing appreciation of the concept of aquatic ecosystem services, various typologies have been developed for classifying ecosystem services as a basis for comparisons and trade-offs among the relevant set of potential and actual benefits. It is usually argued that such typologies provide a foundation for sound decisions in water resource management. The rationale behind these typologies is that ecosystem values are usually not well accounted for in decisions concerning water resources and associated benefits. As such, most typologies for aquatic ecosystem services have been motivated by fundamental questions about the complex and dynamic interactions between nature and society.

One common feature of generic typologies for ecosystem services is that they do not view ecological and social systems in isolation, but as strongly coupled systems. For example, the MEA (MEA, 2005) offers a useful typology that has changed the way in which water resource research, policy and management take into account the human values of biodiversity and ecosystems. This typology provides an important way for examining the different roles played by aquatic ecosystem services in offering a wide range of benefits that support human well-being. According to the MEA typology, ecosystem services can be categorized into provisioning, regulating, cultural and supporting services. This generic classification of ecosystem services is representative of most typologies found in the current literature.

We acknowledge that the MEA approach has contributed to improving understanding of the structure and processes of aquatic ecosystems that are responsible for the generation of the services used and enjoyed by humans. Great strides have been made in understanding the series of events, reactions and interactions among biotic and abiotic elements of aquatic ecosystems that lead to services. For example, there is a better appreciation of how aquatic ecosystem elements and processes transfer and exchange matter and energy to generate multiple hydrological processes. Although there maybe some professional disagreements about the points at which linked aquatic ecosystem structures and processes deliver these services, there is generally improved understanding of the cause-and-effect relationships underlying most services. Surprisingly, despite years of concern with the ecological aspects of aquatic ecosystem services, we have not had a corresponding build up of knowledge about the different forms of benefit sharing arrangements through which these services are ‘structured’ and ‘processed’ once they enter the social system. While the MEA approach and other typologies (see also Sadoff and Grey, 2002) have advanced knowledge about aquatic ecosystem dynamics and the different forms of services they provide, there is still poor understanding of the different types of benefit sharing arrangements necessary for transforming aquatic ecosystem services into meaningful benefits.

In this chapter, we propose a typology of benefit sharing arrangements for the governance of aquatic ecosystem services. We argue that if typologies of aquatic ecosystem services are to provide a useful foundation for developing effective frameworks for water resource decisions, they must also incorporate classifications of benefit sharing arrangements. The range of benefit sharing arrangements must be represented in any effective typology of aquatic ecosystem services that acknowledges the linkages between the services and human well-being. For the purposes of this report, benefit sharing arrangements refer to the shared rules, norms, and organizational mechanisms that regulate the behavior of collective actors in the governance of ecosystem services. The typology we propose introduces the basic components of the theoretical framework that is later developed in Chapter 6 as a key deliverable of this consultancy. Specifically, the typology provides a useful means of exploring the social structures and processes required for equitable, effective and efficient delivery of aquatic ecosystem services. While closed linked to the MEA approach, our typology offers an extended view of ecosystem services by focusing on how these services are dealt with once they enter the social system.

Valuation of Benefits

This section provides a brief overview of valuation of benefits insofar as it is a useful tool for analysing benefits, costs and their accrual to beneficiaries. Environmental and resource economists have historically applied two approaches (stated and revealed preferences methods) to estimate the value of benefits derived from ecosystem assets and their services. In the stated preference method, economists ask people to place a value on ecological resources. In the observed behaviour (revealed preferences) method, economists study the actual choices of people to infer the value people place on ecological resources (Freeman, 2003; Pearce et al, 2002; Dasgupta, 2010). Both of these approaches however, have limitations. One of the limitations is that most valuation studies have focussed on a single dimension of a problem only, and has thus failed to adequately address the complexity inherent in ecosystem processes and functionality (Perrings, 2006). For many years, economists circumvented this problem by using the total economic value (TEV) framework (Pearce, 2002). Whilst this framework provides an adequate categorisation of both market and non-market ecosystem services, it failed to address ecosystem complexity. More detailed discussion on this can be found in Dasguta (2010), MEA (2007), Perrings (2006) and Winkler (2006).

In response to these, and other, valuation weaknesses, the MEA (MEA, 2005; MEA, 2007) introduced a radical new approach (or framework) to the analysis of the interface of the ecology and the economy. The key benefit of the MEA framework is that it allows investigators to systematically unpack a development problem into its biodiversity components and the ecosystem services dependent on them. Subsequent to the publication of the MEA, Perrings (2006) identified a number of challenges to the field of environmental economics in the post MEA era. Those challenges relate to the practical implementation of the MEA approach and framework. An important aspect of the MEA framework of ecosystem services is that it implicitly links biodiversity to the economy and to human well-being. The term ecosystem has been defined as a natural unit consisting of all plants, animals and micro-organisms (biotic components) in an area functioning together with all of the non-living physical (abiotic) factors of the environment (Christopherson, 1996). Biodiversity is the living component of the ecosystem. Accordingly, the ecosystem is interpreted in the MEA to represent a portfolio of abiotic and biotic assets that produce a specific set of ecosystem services, which are of benefit to human well-being. Biodiversity is described by Noss (1990) more than simply the number of genes, species, ecosystems, or any other group of things in a defined area. Noss (1990) rather favors a characterization of biodiversity that identifies the major components at several levels of organization which includes composition, structure, and function. Composition has to do with the identity and variety of elements in a collection, and includes species lists and measures of species diversity and genetic diversity. Structure is the physical organization or pattern of a system, from habitat complexity as measured within communities to the pattern of patches and other elements at a landscape scale. Function involves ecological and evolutionary processes, including gene flow, disturbances, and nutrient cycling.

An important consequence of the MEA is the need for developing an improved production function methodology. The theoretical foundations for the production function approach were pioneered by Mäler (1991). Production function approach studies quantify values for ecosystem services that contribute at least part of the shadow value of those resources. They apply knowledge of ecosystem functioning and processes to derive the value of supporting and regulating ecosystem services (Mäler, 1991; Perrings, 2006; Kinzig et al., 2007; Barbier, 2002; Barbier, 2003; Barbier et al., 2009). They do this through deriving the value of ecosystems and the services they provide as intermediate inputs into goods and services that are produced or consumed by economic agents.

The Typology

In this section, we propose a typology of benefit sharing arrangements for the governance of aquatic ecosystem services. Governance in this context refers to socio-political and economic structures and processes that enable society to define and accept or reject alternative water agendas (Boyle et al., 2001; Hall, 2006; Nkhata and Breen, 2010a). These structures and processes evince the interactions amongst social actors, of which government is just a part, and can be institutionalized at different levels of human interaction (global, national and local) to establish particular socio-political and economic regimes (Armitage, 2008). They are dynamically complex and comprise interconnected subsystems that are linked for the purpose of regulating social relationships among actors (Nkhata and Breen 2010a). In this way, the governance systems of aquatic ecosystems can be considered to provide the means of social coordination that engender collective action (Ostrom, 1990), ordered rule (Stoker, 1998), collective identity (Snow, 2001), and allow members of society to share power and make collective decisions (Imperial, 2005).

We specifically view benefit sharing arrangements as the implementation of governance systems for aquatic ecosystems at multiple levels of human organisation. Although governance systems are not viewed as a panacea for all water resource related problems, we suggest that the extent to which such systems are devolved will result in societal interests being advanced or hindered through benefit sharing arrangements.

We propose a typology that comprises three generic categories of benefit sharing arrangements: hierarchical, distributive and egalitarian (Table 1). These categories are developed with the understanding that most aquatic ecosystem services in South Africa and other developing countries are regarded as either public or common property. Our typology is essentially premised on 8 key attributes: governance objective, control/access, benefit flows, delivery structure, group composition, monitoring/enforcement, efficiency and implementation. However, it is important to note our typology is not designed to be a perfect one. Inherent limitations need to be acknowledged and appreciated. Thus, the three categories of societal arrangements we propose should be considered as ideal forms as in reality we expect to find elements of all the three in integrated or overlapping forms. While these categories are intendedly generic and broad, we acknowledge that as with most heuristics our typology may not necessarily represent or capture all forms of sharing arrangements.

Hierarchical benefit sharing arrangements

The other terms frequently used to describe this category of arrangements are bureaucratic or horizontal. In essence, this type of arrangements provides the means for local communities to share power with the state. This usually involves the delegation of government functions from the centre to the periphery in the process of allocating ecosystem services. While there may be several examples of hierarchical benefit sharing arrangements, for the purposes of this report we focus on one typical example of these arrangements: Community-Based Natural Resource Management (CBNRM) initiatives.

Table 1: A proposed typology of benefit sharing arrangements for the governance of ecosystem services

ATTRIBUTE	HIERARCHICAL	DISTRIBUTIVE	EGALITARIAN
Governance objective	Designed to regulate the relationships between state actors and local communities in the allocation of benefits from ecosystem services	Designed to address market failures where the value of benefits cannot be captured in monetary terms	Designed to address social injustices related to equitable access to and sharing of benefits from ecosystem services
Control/access	There is differential control over access to benefits	There is limited structured control over access to benefits	There is no structured control over access to benefits
Benefit flows	The flows of benefits are hierarchically structured	Multiple channels exist for flows of benefits	Flows of benefits do not follow specific channels
Delivery structure	Delivery of benefits is asymmetrical (local vs. national impacts)	Delivery of benefits can be symmetrical (producers vs. suppliers)	Delivery of benefits is perceived to be fair and equitable
Group composition	Participating groups tend to be mixed (homogenous/heterogeneous)	Participating groups tend to be heterogeneous	Participating groups tend to be homogeneous
Monitoring/ Enforcement	Monitoring and enforcement of agreements is usually difficult	Monitoring and enforcement of agreements is litigation driven	Monitoring and enforcement of agreements is based on social pressure
Efficiency	Efficiency in delivery is dependent on the structure of hierarchy	Efficiency in delivery is dependent on the structure of incentives	Efficiency in delivery is dependent on social cohesion
Implementation	Main implementation weakness is how to curtail the unyielding power of state actors	Main implementation weakness is to find willing buyers for ecosystem services	Main implementation weakness is to buffer the sharing schemes from external forces and shocks

Particularly in sub-Saharan Africa, most benefit sharing arrangements have largely been understood and associated with CBNRM initiatives. Principally, the term CBNRM represents a suite of benefit sharing arrangements that entail the involvement of rural communities in the allocation of ecosystem services and management of associated benefits. As a form of benefit sharing arrangements, CBNRM initiatives are premised on the assumption that the human well-being of communities can be improved if and when communities are allowed to participate in natural resource management. They are usually driven by strong statutory mechanisms and can be viewed as the operationalization of benefit sharing arrangements at local or community levels (Folke et al., 2005). These initiatives seek to devolve the authority and responsibilities for governance and management of the use of ecosystem services to rural communities, who are essentially not agents of the state (Barrow and Murphree, 2001). In this way, the need to understand the dynamics underlying the transfer of authority for benefit sharing from government to rural communities has great implications for the efforts aimed at assessing the performance of CBNRM as a form of benefit sharing arrangements.

Text Box 2: Performance of community-based natural resource governance for the Kafue Flats

A case study of a CBNRM scheme in the Kafue Flats of Zambia provides useful lessons on the performance of CBNRM in southern Africa. TheKafue Flats in central southern Zambia is a floodplain wetland between the Itezhi-tezhi Dam and Kafue Gorge and covers an area of about 6500 km2. One of the most important features of the Kafue Flats benefit sharing mechanism was its revenue-sharing system. The government had authority to collect revenue from the legal use of wetland resources in the Kafue Flats. The safari-hunting category, which involved international clients paying in USA dollars (US$), generated more revenue than the other categories. Within this category, the revenue generated was further classified as either statutory (licence fees and hunting permits) or non-statutory (hunting rights and concessions). The non-resident hunting category involved Zambian clients who were not local residents in the area and paid in local Zambian currency. Its revenue was classified only as statutory revenue (licence fees and hunting permits). Resident hunting involved Zambian clients who were local residents in the area and paid in local currency. Although the revenue generated from this category was also classified as statutory, it only covered licence fees. The revenues generated from the three hunting categories were shared amongst the central government, Department of National Parks (which was part of government) and local communities. The central government received the largest portion (50%) of the collected revenue. The remaining 50% was shared between the Department (40% to support wetlands management operations and 25% to support the administration of the CBNRM Policy and local communities (35%).

The CBNRM scheme was originally designed to devolve key components of a governance system, but efforts were largely unsuccessful because of the poor social relationships between government actors and local communities. Although there were some marginal benefits for local communities, the CBNRM scheme could not support the construction and execution of an effective governance system. Despite the government's stated intentions, issues surrounding the uneven sharing of revenues, non-transfer of revenue generation powers to local communities and non-remittance of agreed funds by the Department of National Parks demonstrate the continued dominance of government officials in benefit sharing arrangements, contributing to the marginalization and as yet partial integration of local communities in benefit sharing arrangement.

Source: Nkhata, B.A. and C.M. Breen (2010b) Performance of Community-Based Natural Resource Governance for the Kafue Flats (Zambia). *Environmental Conservation* 37 (3): 1-7.

Drawing on lessons from several CBNRM initiatives in southern Africa (Dzingirai and Breen, 2005), we were able to identify some of the key properties of hierarchical benefit sharing arrangements based on the 8 attributes of our typology (Table 1). The governance objective is usually designed to deal with the regulation of relationships between state actors and local communities. In terms of control and access, it is not uncommon to find that most CBNRM initiatives provide for differential control over access to the benefits from ecosystems services. Several studies have highlighted a range of issues and concerns related to differential control which include state dominance (Gibson, 1999), ineffective property rights (Murphree, 1996), inadequate devolution of authority and responsibility for nature resources (Murombedzi, 2000), and inadequate genuine participation by local communities in the distribution of benefits. Differential control in turn affects the flows and delivery of benefits which tend to be hierarchical and asymmetric. Overall, it is has been observed that the groups that participate in benefit sharing arrangements in most CBNRM initiatives tend to be have mixed interests and profiles. Thus, the participating groups can either be homogenous or heterogeneous in terms of their collective identity, geographic origins, and economic status. Depending on specific contexts, group profiles can have profound effects on the nature of monitoring and enforcement that take place under CBNRM initiatives. While the monitoring and enforcement of benefit sharing agreements in most CBNRM initiatives is usually difficult, there are claims that efficiency in delivery of benefits is largely dependent on the structure of hierarchy. It is for this reason that the main implementation weakness of this category of benefit sharing arrangement has a lot to do with how to curtail the unyielding power of state actors.

It is important to note that the performance of most CBNRM initiatives in sub-Saharan Africa has been constantly brought in the limelight in terms of their significance in contributing to the amelioration of conservation and rural development (see Text Box 2). While some authors have claimed high incidences of failure (Campbell et al., 2001; Fabricius, 2004; Dzingirai and Breen, 2005), others have suggested that because CBNRM has the attributes of a complex system, emergent forces continually challenge stability such that phases of success, collapse and reconstruction have defined the hallmarks of CBNRM (Nkhata et al., 2009). It has been argued that the depletion of vital natural resources and the excruciating effects of poverty have continued to be a glaring reality of rural communities in areas where CBNRM initiatives have been introduced. As such, it has generally been concluded within some sectors of society that most CBNRM initiatives have not met many people's expectations since their enthusiastic inception in the 1980s.

Distributive benefit sharing arrangements

Although this type of arrangements is also driven by conservation goals, it is largely designed to enhance the economic status and human well-being of participating groups. The economic rationale behind most of such arrangements is viewed as different from the traditional natural resource management approaches that, for example, focus on natural resources that are solely controlled by the state and managed by state functionaries. While there may be several examples of distributive benefit sharing arrangements, for the purposes of this report we focus on one typical example of these arrangements: payments for ecosystem services (PES) initiatives.

In most developing countries, PES initiatives represent a suite of voluntary benefit sharing arrangements that provide positive economic incentives to manage ecosystems and to sustainably produce ecosystem services. It is partly because of this reason that PES initiatives are increasingly being promoted as a major benefit sharing approach to conservation. These initiatives provide positive incentives to manage ecosystems and to produce the services that promote human wellbeing (Sommerville et al., 2009). They are basically designed to create economic incentives for the maintenance of ecosystems services. This is done by way of rewarding the people who are responsible for the provision of ecosystem services (Nelson et al., 2009). Such payments are usually made in contexts where traditional markets are underdeveloped and decisions to change land-use types fail to take into account the total costs of loss of ecosystem services. According to Wunder (2007), PES initiatives consist of voluntary and conditional transactions whereby an ecosystem service is purchased by at least one service buyer from at least one service provider. As such, these initiatives are usually considered to be based on economic incentives put in place to compensate providers of ecosystem services, on condition that the provider secures the provision of services.

Drawing on lessons from over 200 PES initiatives in Latin America involving carbon market projects, we were able to identify some of the key properties of distributive sharing arrangements based on the 8 attributes of our typology (Table 1). The governance objective is designed to address market failures where the value of benefits cannot be captured in monetary terms. In contrast with hierarchical arrangements, there is usually limited structured control over access to benefits from ecosystem services under this type of arrangements. While multiple channels exist for the flows of benefits, the delivery of these benefits can be symmetrical whereby the exchanges between the so-called ‘producers’ and ‘suppliers’ tends to be balanced. In many instances the participating groups tend to be largely heterogeneous. This affects the monitoring and enforcement of benefits sharing agreements which tend to be litigation driven. Given that efficiency in delivery under this category of benefit sharing arrangement is dependent on the structure of economic incentives, the main implementation weakness is to find willing buyers for ecosystem services.

Text Box 3: The Costa Rican Payments for Ecosystems Services Program

The Costa Rican Program of PES was created in 1996, as a national effort to set up a market for ecosystem services. This was aimed substituting the forestry subsidies for a more efficient performance based approach. However, this process can be seen as a result of an evolving national concept to use markets and payments to ensure the provision of the products and services that ecosystems provide to societies. The enforced Forestry Law established a PES definition that not only became a national model but also set an international milestone for the development of policies that promote the economic value of ecosystem services, transforming them into financial incentives targeted on the providers of such services. The National Forestry Financing Fund (FONAFIFO) was created by the same forestry Law in the framework of a national PES program. At the beginning, the central government committed itself to finance the scheme with five percent of the revenue from the tax on fossil fuel, but later on a diversification of funding sources took place to cover the vast request of landholders (or providers) to join the program. New sources of funding include the private sector and the international community. At present, the main financial resources are coming from: 3.5 percent of the fossil fuel tax, forestry taxes, hydropower companies, a national private brewery, a World Bank loan and a contribution of German Financial Cooperation (KfW).

The PES scheme pays landowners to enforce specific land uses that provide the four ecosystem services which are recognized by the law. Costa Rica approved its third Forestry Law (7575), which recognizes four forest ecosystem services, namely: carbon sequestration, water protection, biodiversity conservation and landscape beauty. To join the scheme, landowners must submit their titles (or legal land possession documents), and a sustainable forest management plan should be approved. Afterwards, specific practices (e.g. timber plantation, forest management, forest conservation) must be adopted. Initial disbursement can be requested upon contract signing, but all subsequent annual payments require verification for compliance, and payment varies according to the type of activity carried out (e.g. landowners receive about 65 US dollars per hectare and year for conservation). FONAFIFO acts as an intermediary, buying ecosystem services from forest and landowners and selling them to interested parties (buyers) at international, national and local levels, depending on the service. Farmers can access the program on their own (directly) or through local (private) facilitators. Despite the official attempt to create a market for environmental services, voluntary private agreements were made between particular companies and landowners, like the voluntary contract between La Esperanza Hydropower Project and the Monteverde Conservation League. Another example is the PES scheme for watershed services run by the Heredia Province Water Utility (Empresa de Servicios Públicos de Heredia – ESPH) owned by three municipalities. In 1999, they included an environmental component in the drinking-water tariff to compensate forest owners and finance forest restoration to maintain water quality in the long term.

The stability of the PES program in Costa Rica is based mainly on: financial sustainability, legal framework, capacity of institutions to administer the program, political support from the highest to the lowest levels, participation of civil society, transparency and credibility of institutions and actors regarding

the administration and implementation of the scheme.

Source: Kosmus, M. and Cordero, D. 2009. Payments for Environmental Services: An Instrument to Maintain Global Ecosystems. *The International Journal for Rural Development* 43(1):12-17.

It is important to acknowledge that there are two main reasons advanced for sharing financial returns under this category of benefit sharing arrangement. Firstly, the need to create resource management incentives is considered to be an important means of rewarding individuals, communities, organizations and businesses for actions that change resource-use patterns. This reason entails offering benefits in excess of the costs incurred in the process of changing 'ecosystem-degrading behaviors'. The second reason is to build sustained legitimacy for benefit sharing initiatives. It is argued that if too many people benefit from something they have not actively contributed to or have no legitimate claims to, the associated incentives may be diluted on a per person basis. This would lead to weaker incentives and lower overall benefits to share. Alternatively, if the benefits are given only to certain groups, actions or geographical areas, people may feel unfairly treated and turn against the initiative as they define it as illegitimate. Thus, distributive benefit sharing arrangements seek to garner legitimacy by way of focusing on those people that are directly affected by the benefits.

Egalitarian benefit sharing arrangements

For the purposes of this report, we focus on one typical example of these arrangements: access and benefit sharing (ABS) initiatives under the Convention on Biological Diversity (CBD). The CBD is an international treaty that seeks to advance three interrelated goals: the conservation of biological diversity, the sustainable use of the components of biological diversity, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources (CBD, 1992). Essentially, the treaty provides a multilateral framework for harnessing the values of biodiversity and ecosystem services. One major way in which the treaty provides for such harnessing is by establishing mechanisms for ensuring that some of the benefits of industrial exploitation of genetic resources are allocated to producer nations and communities in the form of royalty sharing, technology transfer, scientific capacity-building. The ABS initiatives are commonly discussed and implemented under the rubric of 3 themes: appropriate access to genetic resources, appropriate transfer of relevant technologies as well as appropriate funding.

Benefit-sharing under the ABS initiatives is usually framed as a matter of social justice. According to the Secretariat of the CBD (CBD, 2000:4), "an important part of the biodiversity debate involves access to and sharing of the benefits arising out of the commercial and other utilization of genetic material, such as pharmaceutical products". The CBD requires that the benefits of non-human genetic resources be shared among stakeholders. It emphasizes the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components. The CBD thus institutionalizes the call for equitable returns to producer countries and communities as a multilateral principle of social justice in conservation. In this context, benefit sharing revolves around tradeoffs between access to genetic resources and fair and equitable sharing of the associated benefits. Such sharing also includes the use of a wide variety of monetary and non-monetary mechanisms, ranging from profit sharing or equitable stakes in the bioprospecting business, as well as technology transfer, training and collaborative research. In this context, bioprospecting is the systematic search of new sources of chemical compounds, genes, proteins, microorganisms and other products that have economic potential and can be found in biodiversity. The process of getting resources from the use of biodiversity related commercial products includes the negotiations and contracting that goes on between industrialized enterprises and local communities.

Using the 8 attributes of our typology, we reviewed ABS case studies from 4 developing countries (Tonga, South Africa, Mexico and India) that focused on the involvement of indigenous people in bioprospecting and genetic research. The review suggested that the governance objective of ABS initiatives tends to focus on the need to address the social injustices related to equitable access to and sharing of benefits from ecosystem services. In contrast with the other two types of arrangements, we observed that there is usually no structured control over access to benefits and that the flows of benefits do not follow specific channels. While obviously debatable, the delivery of benefits under ABS initiatives is in most instances perceived to be fair and equitable by participating groups, which tend to be homogeneous. It is instructive to note that the monitoring and enforcement of agreements under this form of arrangements is usually based on peer social pressure. As such, efficiency in delivery of benefits is dependent on social cohesion. However, it is has been observed that the main implementation weakness usually has to do with how to buffer the sharing schemes from external forces and shocks.

Text Box 4: The Kani Access and Benefit Sharing (ABS) case study

This case study relates to access and benefit sharing arrangements arrived at between Tropical Botanical Garden and Research Institute (TBGRI) and the Kani tribals of Kerala for the development of a drug called 'Jeevani' based on the knowledge of the Kani tribe. 'Jeevani' is a restorative, immuno-enhancing, anti-stress and anti-fatigue agent, based on the herbal medicinal plant *arogyapaacha*, used by the Kani tribals in their traditional medicine. Within the Kani tribe the customary rights to transfer and practice certain traditional medicinal knowledge are held by tribals healers, known as *Plathis*. The knowledge was divulged by three Kani tribal members to the scientists of TBGRI who isolated 12 active compounds from *arogyappacha* (*Trichopus zeylanicus*), and developed the drug 'Jeevani'. The technology was then licensed to the Arya Vaidya Pharmacy Ltd., an Indian pharmaceutical manufacturer pursuing the commercialization of Ayurvedic herbal formulations. A Trust Fund was established to share the benefits arising from the commercialization of the TK-based drug 'Jeevani'.

This case study brings to light the need for multi-stakeholder framework for discussing the scope of access and benefit sharing. The case illustrates that while intellectual property rights play a crucial role in generating benefits from biological resources and traditional knowledge, their role should be balanced with the conservation as well as institutional objectives. The Kani experience has provided insights for formulating policy and legislative measures for access and benefit sharing arrangements in India. India has enunciated its National Policy and Macrolevel Action Strategy on Biodiversity in 1999 whose primary objective is to ensure benefits to India as country of origin of biological resources and to local communities and people as conservers of biodiversity, creators and holders of indigenous knowledge systems, innovations and practices. Local communities and people have over the years developed lifestyles, innovations and practices conducive to conservation and sustainable use of biodiversity. They have developed a body of knowledge regarding the use of resources including food, medicines, and pesticides. Considering the dependence of the lifestyles of communities and local people on biological diversity, practices of utilization conducive to conservation is encouraged. Such practices, innovations and knowledge are protected and propagated for wider use subject to ensuring benefits to these communities/people for utilising such knowledge and practices. Any commercial use of such knowledge, innovations and practices is permissible only after ensuring a due share of the community in the benefits realised from such knowledge, innovations and practices.

Source: Jayaraman K. S. (1996) Indian Ginseng brings royalties for tribe." *Nature* 381

Although both hierarchical and distributive arrangements will be critical and indispensable in specific social-ecological contexts, egalitarian arrangements are of particular importance to this report based on their potential to enhance collective identity among participants to a benefit sharing scheme. Under collective identity conditions, the prospects of engendering collective action and building social relationships are greatly increased. Benefit sharing arrangements founded on collective identity have the advantage of functioning through relational processes rather than legal authority and sanctions. As noted earlier, relational processes such as social cohesion and mutual reciprocities bring about compliance with societal and group norms largely through peer social pressure. In addition, relational processes are important in giving rise to what is referred to as a community of practice (CoP). From a water sector perspective, we consider a CoP as an association of individuals acting with common cause in their intentions to use or influence the state of a common property resource (Van Wyk et al., 2009). Members of such an association align their competencies in ways that enable them to collectively learn how to connect effectively with society and a common property resource. Thus, a CoP is associated with aspects of collective learning that are fundamental prerequisites for sustainable allocation of the benefits derived from aquatic ecosystem services. We postulate that collective identity and collective learning are critical variables in the design and execution of egalitarian benefit sharing arrangements.

Conclusion

The above discourse has provided a preliminary review of the major categories of benefit sharing arrangements insofar as the governance of aquatic ecosystem services is concerned. Although simplified, these categories represent a set of important strategies that can used to promote effective water resource management as well as efficient, effective and equitable allocation of aquatic ecosystem services. Perhaps surprisingly, these categories have in practice been more often than not narrowly employed as a way of soliciting support from participants who have been associated with ‘resource-degrading behaviors’. While the term ‘benefit’ has in most cases been understood in its broadest sense, focus has been on the assortment of inducements that would buttress the efforts aimed at attaining sustainable utilization of natural resources. In the context of distributive arrangements, for example, benefit sharing initiatives have largely focused on the economic returns that are channeled back to rural groups resulting from the legal use of natural resources. Such returns have included direct cash or revenue, basic infrastructure as well as other categories of consumptive gains.

Although it is logical to argue that such financial benefits are vital to the success of water resource management initiatives, we argue that on their own they are not sufficient to enhance the long-term sustainability of ecosystem services. In fact, we feel that benefits so defined reflect very narrow articulations of the benefits so derived from the full range of aquatic ecosystem services. This narrow definition leads inevitably to market based arrangements for allocation of the benefits of ecosystem services, arrangements that may not even lead to a sense of sharing at all. However, it is important to emphasize that valuation of ecosystem services related costs and benefits is a useful analytical tool for planning, decision-making and to analyse people’s behaviour with respect to benefits accrual under various benefit sharing typologies and/or property rights regimes. Economic valuation could thus, where applicable, provide additional management information, to support decision-making with respect to the management actions required to sustain benefits and to distribute benefits. Yet, economic valuation of water resources requires careful application as it is a developing science.

3 COLLECTIVE IDENTITY AND PROPERTY RIGHTS IN EGALITARIAN BENEFIT SHARING ARRANGEMENTS

Introduction

In this chapter, we seek to expose the important role played by collective identity and property rights in egalitarian benefit sharing arranagments. With the advent of democracy in South Africa and a growing appreciation of water scarcity, there has been a shift away from the notion of ownership to rights of use. For the most part, a significant erosion of private property rights to water has been observed. This shift marks explicit acknowledgement that water and the associated ecosystems need to be understood and managed as common pool resources. Collective use of aquatic ecosystem services is usually susceptible to externalities that make difficult their governance and management in a sustainable, efficient and equitable manner. We argue that the concepts of collective identity and common property provide a useful framework for interrogating collective actions problems in the governance of aquatic ecosystem services in general and egalitarian benefit sharing arranagments in particular. While acknowledging that most of the benefits that people derive from aquatic ecosystem services can be accessed either privately or collectively, we are of the view that the majority of the benefits that are collectively accessed are governed as common pool resources through collective action. Common pool aquatic ecosystem services are those from which it is difficult to exclude other users from accessing associated benefits, and where access to benefits by one user reduces the amount other users can access (Ostrom, 1990). On the other hand, collective action refers to situations where a group of people act collectively to govern access to benefits by its members. It requires involvement of a group of people with shared interests and some kind of common action, which should be voluntary (Meinzen-Dick et al., 2004).

Collective Identity

We suggest that the collective identity of resource user groups provides an effective basis for collective action in egalitarian benefit sharing arrangements. Usually, collective action is not possible where people do not have a collective identity (Melucci, 1996; Snow, 2001; Polletta and Jasper, 2001; Holland et al., 2008). In this report, collective identity denotes the shared meanings and interests that individuals of a user group hold as members of the collective. The shared meanings and interests define the collective and differentiate it from other collectives. They are expressed through multiple media such as organizational goals and objectives, symbols and statements about the condition of the ecosystem. Collective identity thus gives the members of a user group of ecosystem services an inclusive identity based on those shared meanings, interests and experiences around which they coalesce (Snow, 2001; Cerulo, 1997). For the purpose of this report, we view these variables as being important in the execution of egalitarian benefit sharing arranagments.

Collective identity is developed through relational processes in which group members influence each others' behavior over a period of time to advance common interests (Melucci, 1996). In the implementation of egalitarian benefit sharing arranagments, for example, such processes would manifest in form of social bonds, shared activities and access to common resources. The bonds dimension would denote the various ways in which members of resource user groups perceive and respond to each other either socially and professionally. The shared activities dimension would refer to the connections among the activities of the members and how such connections affect choices about how to share activities. The common resource ties dimension would evince how the resources used by the group are tied together and how such ties evolve as actors exchange or access the common resources. These relational processes would allow members of a user group to negotiate the meanings related to a particular aquatic ecosystem. The process of negotiating the meanings helps in constructing the collective 'we' sense of identity, which in turn becomes the collective identity. The meanings are continuously under negotiation as relational processes change and the state of the aquatic ecosystem evolves. Thus, collective identity serves important psychological functions for members of a user group. Change in identity has the potential to cause a collapse of collective action needed in egalitarian benefit sharing arranagments.

We contend that collective identity makes 'free-riding' less attractive in collective action situations in egalitarian benefit sharing arranagments (Klandermans et al., 2002). This is because we reckon that collective identity provides sufficient rationale for people to participate in collective action without free riding. In this context, collective identity would influence a person's willingness to participate in decisions regarding the sustainability of an aquatic ecosystem as well as the welfare of the user group. Willingness to participate created through collective identity would in turn strengthen the capacity for collective action. The sense of belonging and identification with a particular group influences the nature and degree of participation in collective action (Gupta et al., 1997).This is particularly important when dealing with some of the problems usually encountered when trying to exclude non-members from benefiting. Such free-rider dilemmas have been known to cause the collapse of many common pool resource systems (Ostrom, 1990). While collective identity is essential in avoiding the collapse of common pool resource system, the sustainability of an aquatic ecosystem may not be guaranteed in the absence of effective property rights.

Property Rights

We argue that property rights to aquatic ecosystem services play a significant role in the execution of egalitarian benefit sharing arranagments. The incentives, rules and responsibilities attached to these rights are vital to sustainable allocation of the benefits derived from aquatic ecosystem services. The term 'property' as used in this report does not refer to the services themselves, but to the societal rules or institutions a group has in place to control access to and use of the services. These institutions or 'property regimes' can be one of five basic types: private, state, public, common or open-access. For the purpose of this report, property rights regimes are complex institutional structures and rules (formal and informal) that include both rights to access as well as rights to exclude from access (Schlager and Ostrom, 1992). A property right is an enforceable authority to undertake particular actions in specific social contexts. Property to which a group of users may rightfully claim access and use constitutes a common property. Because there are usually rules governing how members of the user group access and use the common property or resource, property rights 'encompass a diverse set of tenure rules and other aspects of access to and use of resources' (Meinzen-Dick et al., 1997:1303).

Property rights have been explored as a potentially efficient means of regulating certain kinds of activities, such as polluting. For example, in carbon trading, environmentally friendly companies could profit from by selling their pollution credits to less efficient companies. Thus, well-defined and enforced property rights are increasingly viewed as a critical institutional prerequisite of economic growth—an issue with continued relevance in the developing world, where it implies the need for accompanying political and institutional development. The specification of private property rights also usually necessitates clearer rules for other forms of property, such as public or common property. These face different challenges. Common-property rights imply no exclusive use, no right of transfer, and, in the most conservative case, no net gain of income. Typical examples of property subject to common-property rights include public beaches, marine fisheries, and common grazing grounds for cattle. Here, the economic principle of dissipation of rent implies that excessive use of the common resource may have deleterious effects. Such a situation is referred to as the "tragedy of commons." As a result, common property is usually regulated to ensure the long-term viability of the resource. Modern forms of communal and cooperatively owned property nonetheless thrive in some circumstances, for instance in cooperatives.

Water resources are public goods. Two characteristics distinguish public goods from private goods: public goods have low rivalry of consumption, and they are not excludable. Rivalry of consumption refers to the degree to which one person's consumption of a good or service prevents another from consuming it. For example, one person's use of water prevents others from using them, while a person's enjoyment of outdoor recreation prevents no one else from enjoying it. Freshwater fishing opportunity may be regarded as a public service that does possess rivalry characteristics. It may have low rivalry, provided that demand for fishing is limited. Beyond a certain point, however, congestion begins to impose a cost on users and the non-rivalry characteristic no longer applies.

An ecosystem service is said to be excludable when individuals can be prevented from using it. Often, public goods are non-excludable as well, but not necessarily. A classical example of a pure public good is national security: it is impossible to exclude individuals of a country from benefiting from national security, and the consumption benefits of each individual do not depend on the consumption benefits of others. Water quality may be an interesting case here: when public goods or services are non-excludable, they are unlikely to be adequately supplied by the marketplace. No firm can earn money if consumption does not depend on purchasing the good or service. The socially efficient level of production, in this case, would be far greater (and at a far lower price) than a private firm would find profitable. As a result, public goods are traditionally provided by the government, and financed with tax money. Civil society has a key role to play to hold government agencies accountable for the provision of such goods and services.

The manner in which property rights are organized in terms of access to benefits is of importance to the governance of aquatic ecosystems services. Water resource based ecosystem services may be characterized by a variety of property rights regimes, and thus their trade-offs are expected to have legal implications for a variety of beneficiaries. Subsequently, by inference, a chain of causality and supporting evidence are required to support such decisions. The rules governing particular benefit sharing arrangements can potentially be used as leverage points through which the behaviors of user groups can be modified and managed. As Ostrom (2009) observes, the possibility that users would find ways to organize themselves has not been seriously considered in much of the policy literature. Organizing so as to create rules that specify rights and duties of participants creates an effective foundation for governing common pool resources. Anyone who is included in a group of users benefits from the common resource, whether they contribute or not. When the benefits of organizing are commonly understood by the users to be very high, users lacking many of the attributes conducive to the development of self-governing benefit sharing arrangements may be able to overcome their liabilities and still develop effective agreements. The crucial factor is not whether all attributes are favorable but the relative size of the expected benefits and costs they generate as perceived by users.

Several reasons can be advanced to justify scholarly attention to the linkages between property rights and egalitarian benefit sharing arranagments in the water sector. In terms of efficiency, it is usually argued that secure property rights are needed to provide incentives to user groups to invest in the use of a resource. The concept of efficiency of property rights takes into account the costs of negotiating rights, the costs of policing, the costs of establishment, and the costs of litigation. Efficient property rights therefore provide incentives to protect the resource in the long term. Often it has been observed that water resources become degraded in the absence of secure property rights that are enforceable. The security of tenure is also related to the sharing of associated benefits from aquatic ecosystem services particularly in terms of equality of access and the distribution of rights in proportion to the investments that users make. This is important as the manner in which rights are defined usually determines whether people are included or excluded in the control of a vital resource. In this way, property rights can be said to influence the choices that are available to water users and the extent to which the impacts of water resource use on third parties will be taken into account.

Enhancing the Resilience of Egalitarian Benefit Sharing Arrangements

In the previous Chapter, we suggested that the main implementation weakness of egalitarian benefit sharing arrangements is usually related to the ability to buffer the arrangements from external forces and shocks. To that extent, we are of the view that the nature and substance of governance systems affect the resilience of egalitarian benefit sharing arrangements through collective identity and property rights. Collective identity is an outcome of dynamic relational processes that are evinced in collective action situations. Such processes change over time and from situation to situation. The collective identify of a user group does not exist in a stable state and therefore needs to be nurtured and sustained to correspond with the dynamics of complex adaptive aquatic ecosystems. Effective governance of access to aquatic ecosystem services is dependent on the efforts aimed at building resilience in egalitarian benefit sharing arrangements. Cumming et al. (2005) and Cumming and Collier (2005) have argued for the significance of understanding identity change in the resilience of complex dynamic social ecological systems. The authors suggest that identity and change in dynamic complex systems should be defined in terms of: (1) the components that make up a system (2) the relationships between components; and (3) the ability of components and linkages to maintain themselves continuously through space and time.

Enduring common or public property resource management institutions are determined by the nature of rules as well as the processes of rule making and enforcement. Enduring in this context does not simply imply that there is some idealized or steady state of a system but rather that the institutions for egalitarian benefit sharing arrangements are resilient. For example, security of tenure is central to the resilience common property rights as it denotes an individual's capacity to call upon the collective to stand behind his or her claim to a benefit stream (Bromley, 1991). Resilient institutions for egalitarian benefit sharing arrangements are able to adapt to continually changing circumstances, thereby sustaining the structure and function of an aquatic ecosystem. In other words, resilience confers an ability to maintain desirable governance system properties despite fluctuations in structure and function.

Therefore, a resilience perspective of egalitarian benefit sharing arrangements is important in illustrating how user groups can enable aquatic ecosystems to cope with discontinuous change and shocks based on the nature of the two variables: collective identity and property rights. Such a perspective is instructive in that it shows how users groups can make decisions about how to shape the performance of egalitarian benefit sharing arrangements based on the two variables. Importantly, it highlights how user groups can either change or maintain forms of benefit sharing arrangements that buttress the common interests of participants. We postulate that most egalitarian benefit sharing arrangements largely fail due to incompatibilities between the two variables. When these variables are not effectively managed, misunderstandings and disagreements users emerge. Whereas change in governance systems may come about as a result of behavioral processes involving the two variables, such change may also feed back to influence the behavioral processes. As such, the two variables not only provide a wide range of possible pathways for the future development of benefit sharing arrangements, but also enable collective learning through the building of resilience.

Conclusion

The complexity of water resource systems requires sophisticated adaptive governance systems rather than simplified bureaucratic prescriptions in form of legal authority and sanctions. Water users who try to govern a complex water resource system face a variety of incentives that often complicate collective action efforts and subsequent outcomes. The more complex a water resource system is in terms of the types of benefits that are derived the more challenging it is to craft a well-tailored set of benefit sharing arrangements. Thus, a resilient egalitarian benefit sharing arrangement must recognize the multi-scale aspects of water resource governance as well as the presence of collective incentives. In this context, collective learning focuses on groups of resource users who orient their behaviors towards some shared problems and goals in egalitarian benefit sharing arrangements. It entails a relational process of building, upgrading and enriching of the knowledge and skills of resource user groups which necessarily operate as CoPs. In this way, collective learning denotes the learned ways of behaving in CoPs by aligning and fostering the competences of resource users to deal with emergent systemic issues and problems in egalitarian benefit sharing arrangements.

It is important to emphasize that collective learning shapes egalitarian benefit sharing arrangements through relational processes that define collective identity and property rights. Importantly, collective learning shapes the users' ways of behaving in a governance system by aligning and fostering their capacity to deal with complex social-ecological change. The amount of social-ecological change that an egalitarian benefit sharing arrangement can undergo is important in determining how users cope with the change when it is almost impossible to predict with accuracy the future states of the arrangements. Multiple states of benefit sharing arrangements provide the substance of a dynamic governance system. To that end, a resilience-building approach enables users to categorize forms of benefit sharing arrangements and to identify those behaviors that exert negative influence on collective action processes. Such an approach allows users to determine where remedial interventions may be required. Importantly, the approach does not only allow users to understand consistent behavioral patterns, but also it provides a premise on which collective decision-making processes can be managed in benefit sharing arrangements.

4 A FRAMEWORK FOR BENEFIT SHARING ARRANGEMENTS

Introduction

We have argued in this report that the design and implementation of most benefit sharing arrangements have been conducted in the absence of strong theoretical foundations. While ecological studies have helped us to understand the structure and processes of ecosystems that are responsible for the generation of the services used and enjoyed by humans (Constanza et al., 1997), there are relatively fewer theoretical frameworks that can assist us understand the social dynamics of ecosystem services. We need a variety of theoretical frameworks to explore and interpret the changing nature of the interactions between ecosystems and social systems. Such frameworks are important if we are to apply systematic approaches to the governance and management of the use of ecosystem services. Given the potential vulnerability of benefit sharing arrangements (Winickoff, 2008), it is necessary that the allocation of ecosystem services is systematically governed and managed. The state (or configuration) of any particular benefit sharing arrangement is key in determining success or failure in the allocation of ecosystem services. That state has to be explicitly understood and managed. It would be risky to just let a particular benefit sharing arrangement evolve without purposeful and systematic governance and management. Allowing a benefit sharing arrangement to 'self-drive' can be extremely dangerous, particularly in societies characterised by marked differences in socio-political and economic influence, such as we have in southern Africa. In these situations, it becomes clear that several factors have significant bearing on the performance of benefit sharing arrangements.

The main objective of this chapter is to develop a theoretical framework for benefit sharing arrangements. Our aim is not to present a definitive framework, but to spark debate and engage ongoing dialogue on benefit sharing, particularly in the water sector. We aim to inform deliberations within the WRC community on the theory and practice of benefit sharing as it applies to aquatic social-ecological systems. We intend to theoretically capture the different ways in which benefit sharing arrangements can be designed and implemented. This framework should be considered as a preliminary foundation for further research and conceptual development.

Complex context of benefit sharing

The complex context of benefit sharing can be better understood through a mental model of social-ecological systems presented in Figure 1. Gentner and Stevens (1983) define a mental model as a representation of reality that corresponds to significant aspects of physical and social systems. They explicate that it is based on cognitive fundamentals for understanding how people make sense of how the world works. The theoretical framework we propose in this chapter is derived from a mental model of social-ecological systems that was developed by Anderies et al. (2004). The Anderies model is a representation of an ecological system inextricably linked with subsystems of a social system. Following Anderies et al. (2004), the term social-ecological system denotes social subsystems in which human interactions are mediated through coupled connections with the ecological system. Whereas the ecological system refers to an interdependent system of biological and physical units, the social system represents interdependent human relationships that form as a result of cooperative behavior.

The mental model depicted in Figure 1 is generic in the sense that it can find application in any social-ecological system that draws on ecosystem services, whether the ecosystem is aquatic or terrestrial. This explains its adoption in a number of research initiatives funded by the WRC (Eastern Cape Estuaries Research Programme, Wetlands and Livelihoods and the Review of the Shared Rivers Initiative are three examples).

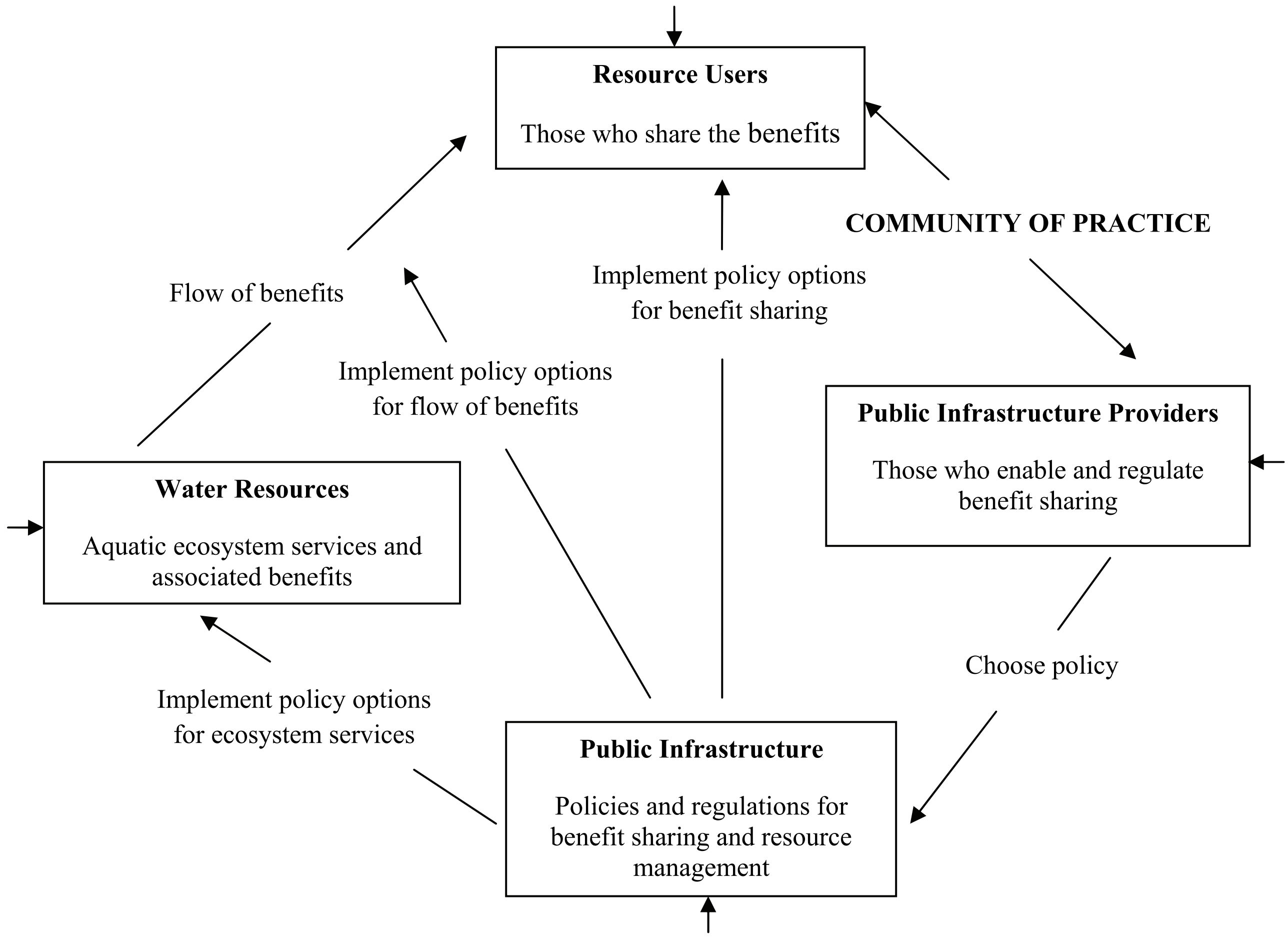

Figure 1: A mental model illustrating the institutional arrangements that enable social-ecological systems to survive in highly variable environments. The small arrows indicate external influences on the social-ecological system.

We use the Anderies model to illustrate the institutional arrangements that enable social-ecological systems to survive in highly variable environments. Particularly, we use the model to illustrate the links between the resource defined as aquatic ecosystem services; the resource users who derive benefits from the aquatic ecosystem services; the public infrastructure providers who enable and regulate benefit sharing; and the public infrastructure that facilitates use and control. The social-ecological system in Figure 1 is susceptible to various disturbances. Biophysical disturbances may include floods, droughts, earthquakes, landslides, and climate change that may affect the resource as well as the public infrastructure. Changes in the public infrastructure and socio-economic conditions may also affect a social ecological system through variables such as human population fluctuations, economic adjustments, and major political changes. The perspective of complex social-ecological systems provides us with a better understanding of the dynamics that underlie the structures and processes inherent in benefit sharing arrangements. It was within this motivational context that we were able to construct the theoretical framework.

The theoretical framework

In Figure 2, we propose a theoretical framework for understanding and managing benefit sharing arrangements in the water sector. The framework should be viewed as a theoretical construct that represents some aspects of reality in benefit sharing arrangements. It signifies our organized way of thinking about the complex context of benefit sharing. We conceive it as comprising a coherent set of interconnected concepts organized in a way that makes it easier for us to communicate with readers. We should understand the framework as being probabilistic and not deterministic. As a theoretical construct, the framework is founded on a set of explicit assumptions about collective learning in benefit sharing arrangements. Whilst we acknowledge that our assumptions are inherently incomplete, this however does not diminish the core scientific value of the framework; that of providing a hypothetical model for applying logic which can be independently tested by others.

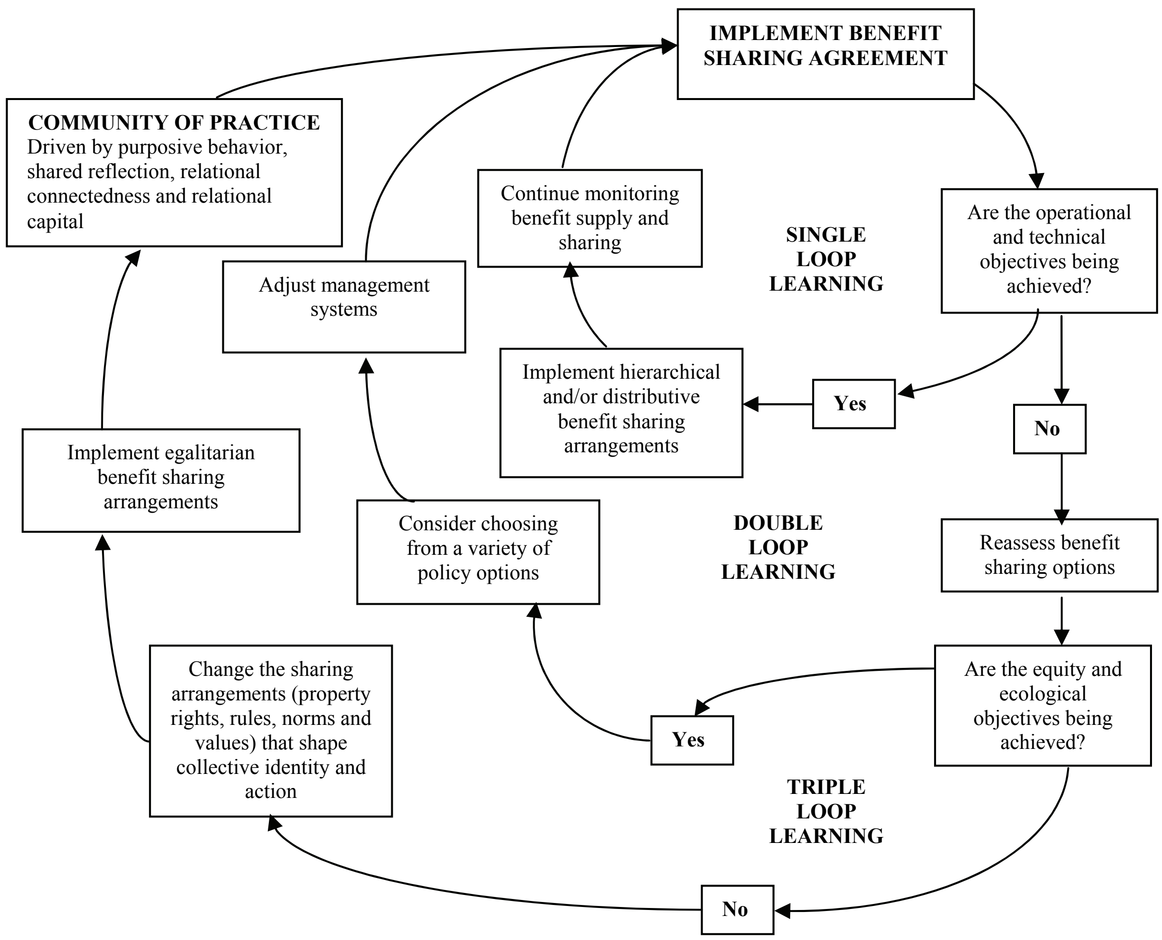

Figure 2: A theoretical framework for understanding and managing benefit sharing arrangements

Without detailing step-by-step how the framework works, it is important to highlight that the benefit sharing arrangement as depicted in Figure 1 resolves around three attributes of collective learning: single-loop, double and triple learning loops. Single loop learning involves situations where participants in a benefit sharing arrangement consider whether the operational and technical objectives are being met. We reckon that it corresponds with the perquisites of hierarchical and distributive benefit sharing arrangements. It helps in assessing the responsiveness of a benefit sharing arrangement to operational and technical demands. It is usually characterized by continuous monitoring of benefit supply and sharing. This form of learning provides periodic checks and balances in order to detect deviations over time. As such, it is based on the identification of determinant variables which affect the nature and type of management strategies as well as the consequences of particular interventions.

Double loop learning involves situations where participants in a benefit sharing arrangement are able to reflect on whether the equity and ecological objectives are being achieved. Participants are able to consider choosing from a variety of policy options, not only to check whether deviations have occurred or not, but rather to attempt to 'think outside the box.' It helps to integrate equity and ecological objectives to analyze the consequences of policy actions for successful benefit sharing. In a way, double loop learning involves creativity and critical thinking. It can help participants understand why a particular solution works better than others so as to solve a problem or achieve a goal.

In a sense, triple loop learning involves 'learning how to learn' by reflecting on how we learn in the first place. It involves situations where participants in a benefit sharing arrangement reflect on how they think about the institutions (property rights, rules, norms and values) that shape collective identity and action. It compels participants to consider how these institutions ought to be changed. This form of learning helps participants to understand a great deal more about themselves and others regarding beliefs and perceptions. It is for this reason that we reckon that triple loop learning corresponds with the prerequisites of egalitarian benefit sharing arrangements. We posit that four key drivers of triple loop learning affect the nature of egalitarian benefit sharing arrangements. These key drivers revolve around purposive behaviour, shared reflection, relational connectedness and relational capital. We argue that these drivers have often been overlooked in studies that address the linkages between learning and benefit sharing. We now discuss how triple loop learning affects the nature of egalitarian benefit sharing arrangements.

Triple loop learning in egalitarian benefit sharing arrangement

The effects of social relationships on benefit sharing arrangements are well documented. Social relationships enable participants to negotiate meanings in order to establish a collective identity that forms the basis of collective action. It is through social relationships that CoPs in egalitarian benefit sharing arrangements are able to establish channels of information flows required to create and share knowledge. In this context, CoPs are established around purposive behavior, shared reflection, relational connectedness and relational capital. These four variables embody the knowledge and capabilities that make up triple loop learning in an egalitarian benefit sharing arrangement.

We envisage that purposive behavior is one of the key mediating variables in the function and structure of an egalitarian benefit sharing arrangement. In the context of this report, purposive behavior simply means that the behavior of participants in an egalitarian benefit sharing arrangement is guided by specific values and preferences (Coleman, 1990). As Coleman (1990) explains, the concept of purposive behavior denotes that we are able to understand the behavior of collective actors as being driven by collective goals. It also implies that we are able to comprehend how their actions contribute to those goals. While we assert that participants in an egalitarian benefit sharing arrangement are purposive, we acknowledge that such rationality is bounded, however. We make this assertion based on the concept of bounded rationality, which is defined as aspects of human behavior that are "intendedly rational but only limitedly so" (Williamson, 1985). Such behavior derives from the human limits to cognitive competence and inhibits the capacity of actors to predict the future. Implicit in this statement is the notion that parties to an integrated learning system are subject to imperfect information. As such, even though participants may be purposive, they can never truly determine with precision the outcomes of particular governance and management interventions. For that reason, we suggest that the ability of participants to deal with inherent uncertainty depends on the extent to which they collaboratively learn how to create shared knowledge to foster shared reflection.

The process of shared reflection in an egalitarian benefit sharing arrangement is important in guiding the behavior of participants as they go about to formulate effective responses to unexpected events. This process, as part of triple loop learning, can foster the capacity of participants to deal with a wide range of 'surprises' within an egalitarian benefit sharing arrangement. Shared reflection in an egalitarian benefit sharing arrangement is necessitated by the complex and dynamic nature of the relationships in this type of arrangements. Managing relationships in this type of arrangements is not a linear process of moving them in one direction towards some ideal state. It involves participants coping with discontinuous change and uncertainty in different circumstances at different times as they interact with each other. Multiple interactions between participants generate multiple operating states for an egalitarian benefit sharing arrangement. Share reflection can thus have the effect of fostering the capacity of participants to cope with uncertainty, and thereby extend their capacity to deal with emergent relational issues and problems. Such a process incorporates enquiry and reflection into the interactions of participants in an effort to deepen their shared understanding.

Purposive behavior and shared reflection in turn help to establish relational connectedness and relational capital which are important in sustaining a collective identity. Whereas relational capital refers to the stock of socio-psychological attributes of social relationships (Cullen et al., 2000), relational connectedness refers to the degree to which actors in social relationships are linked (Hakansson and Snehota, 1995). The two relational attributes are cardinal insofar as the overall performance of an egalitarian benefit sharing arrangement depends on collective identify and the nature of property rights. In this way, successful governance of aquatic ecosystem services is contingent on how participants collectively establish and execute a shared purpose within a context defined by social relationships. Based on relational connectedness and relational capital, social relationships help to transform information into shared knowledge (Nkhata et al., 2008). It is through social relationships that information flows in an egalitarian benefit sharing arrangement help create shared knowledge, which in turn facilitates the convergence of individual identities. As such, one can argue that an analysis of an egalitarian benefit sharing arrangement must thus be able to facilitate identification of the nature and quality of the social relationships that constitute CoPs.

Conclusion

We have developed a theoretical framework for understanding and managing benefit sharing arrangements. The framework provides an understanding which is essential if we are to successfully promote learning as an integral component of benefit sharing arrangements. It shows how knowledge creation occurs in a dynamic context of information flows which link multiple actors in a benefit sharing arrangement. The framework illustrates that the creation of shared knowledge is a social process that caters for adaptability. Such a process links information and social relationships in the dynamic creation of shared knowledge. While this understanding is premised on the sharing of information, it is important to recognize that the relational aspects of learning compel us to distinguish the creation of shared knowledge from the related concepts of information management. The creation of shared knowledge is strongly related to the relational skills of participants, whereby the nature and quality of social relationships influence the effectiveness of an integrated learning system. As Malhotra (2002) argues, human beings are better at skills required for knowledge creation, while machines are more adept at information task. Similarly, we contend that humans – as opposed to machines and other technologies – occupy a central role in the creation of shared knowledge within a benefit sharing arrangement. Thus, the framework facilitates understanding of the process of strategic adaptation for the governance of aquatic ecosystem services that is important in guiding the behavior of participants as they go about to formulate effective responses to unexpected events.

5 IMPLICATIONS FOR THE WATER RESEARCH COMMISSION

Introduction

This report sought to develop a theoretical framework for benefit sharing arrangements particularly in the water sector. The intention was to improve understanding of how the concept of benefit sharing is woven into the fabric of WRC funded research projects. Whilst benefit sharing may seem to be a 'new' issue in the WRC stable of projects, this is so only because it has been taken for granted. Somehow we live comfortably with the assumption that there is an effective benefit sharing process operating within society. Yet, all the evidence suggest otherwise: we see stress fractures within society in the allocation of water whether for domestic, industrial or environmental use, across scales from local to international. Much of the strident debate is not about sharing but rather about rights to benefit. It appears to us that in this context many research projects across the WRC Key Strategic Areas make the tacit assumption that society understands the concept of benefit sharing and has the institutional arrangements to facilitate equitable sharing of benefits. We argue that the literature suggests otherwise and that it is opportune, perhaps even urgent, that we change the discourse in society through engendering a deeper understanding of benefit sharing and the institutions that are required to promote it. In particular, we need theoretical frameworks that can provide coherent theory that explains why particular benefit sharing arrangements are in the state they are, and describes the factors affecting such arrangements in the water sector. In this section, we seek to highlight the research and policy implications of the framework developed in Chapter 4 in light of the vision, mission and mandate of the WRC.

Key Research Challenges

We wish to acknowledge and emphasize that research in the water sector has paid less attention to the issues of benefit sharing which are dominant in policy and management domains. Partly, we attribute this situation to the understanding that benefit sharing is strongly viewed as a normative concept. Some researchers usually question the rationale of possibly applying science to the benefit sharing concept which is usually considered by some to be a normative concept. In other words, these researchers challenge the possibility of scientifically interrogating benefit sharing which is something that some sectors of societies tend to desire and others despise Indeed, some sectors of societies generally consider benefit sharing to be a good thing while others do not. As such, the concept involves questions of values, whose values and how they are measured. Sharing and anti-sharing positions are usually presumed to be irreconcilable (Schuklenk and Kleinsmidt, 2006), with no scientific means available for reaching conclusions on questions about what is right or wrong. Although we do not necessarily refute the perceived normative approach adopted by this report, we propose that it is not essentially our intention to engage such philosophical and ethical questions in this report.

Many scholars believe that it is possible to avoid the common pitfalls of a normative approach by drawing on the inherent properties of science such as logic and empiricism; thus suggesting that science can be plausibly and meticulously applied to normative concepts (Bevir and Rhodes, 2001). Such scholars argue from the premise that any attempt to engage social phenomenon through science necessarily entails a normative approach. However, with the use of scientific systems of logic, such as explicit hypotheses and analytic frameworks, most common pitfalls associated with a normative approach can be addressed. Given that most enquiries into social phenomenon embody logical theories about the nature of the objects being studied, use of scientific systems of logic ensures that the common pitfalls of a normative approach take a particularly benign form (Bevir and Rhodes, 2001). Of course, some may argue that a normative approach may keep out scholars who use different concepts and discourage the emergence of new voices. On the contrary, we are of the view that by way of promoting the use of common scientific systems of logic, the framework we propose in this report will allow for and even encourage use of multiple perspectives and support engagement with divergent and new voices.

We acknowledge and recognize that our framework will not be used to define specific criteria for benefit sharing for particular societies. We realize that the process of determining the degree of sharing that is necessary to ensure legitimacy is context dependent and relies on specific national policies, legislation, as well as the stakeholders involved. Decisions regarding why benefits should be shared, under what conditions should they or should they not be shared, and who participates in such sharing essentially involve value judges, which are a preserve of political systems. On the other hand, however, we recognize that the process of comprehending, describing and explaining the complexity of benefit sharing arrangements poses considerable changes to both the policy and management domains.

Given that by their nature benefit sharing arrangements cannot be captured in a single model, science can be used to facilitate understanding about the complex realities of particular societal arrangements of benefit sharing. Once society decides on the form and direction that it wants particular benefit sharing arrangements to take, key questions arise about how to build processes to make that happen and how to understand the diversity of values that would bring that together. To that end, gaining an in-depth understanding of the processes that would produce or prevent the socially acceptable outcomes of particular benefit sharing arrangements is all the more important. Accordingly, we feel that our framework will go a long way in develop understanding about the various benefit allocation options, the tradeoffs and uncertainties involved, and the various strategies available for influencing what happens in particular benefit sharing arrangements.

The following are some of the key questions that we feel might be explored and addressed using the framework we have developed:

- How do different constituencies define benefits?
- What kinds of institutions, including markets, have been established to allocate the benefits of ecosystem services?
- To what extent are these institutions viewed as legitimate by differing constituencies?
- To what extent can the flow and provision of benefits be changed by changing ecosystem services flows?
- What are the beliefs of varying constituencies about priority in access to and sharing of benefits deriving from ecosystem services?
- What policies and laws restrict or facilitate access to and sharing of benefits?
- What core principles underpin the design and operation of an effective and equitable benefit sharing process?
- How can strategic adaptive learning processes of benefit sharing foster collective identity and collective action directed at sustaining the resilience of SESs?
- How do benefit sharing arrangements contribute to the resilience of SESs?

Policy Implications

The South African Department of Water Affairs logo *"Some for all forever"* reflects an intention for equitable sharing of the benefits from access to and use of the services deriving from aquatic ecosystems. This intention is carried forward in the Preamble to South Africa's the National Water Act (Act 36 of 1998) and the inherent complexity that attends benefit sharing is acknowledged in the observation that:

"Water allocation, while founded on sound water resources management approaches, is therefore profoundly a social, political, economic and legal process." (DWAF, 2005).

Decisions on benefit sharing are made in the context of complex and dynamic social-ecological systems in which both the supply of and the demands for benefits from ecosystem services are uncertain and vary in time and space. The challenge this poses is that if allocation is "....is done too quickly, or haphazardly, the country may suffer economic or environmental damage as emerging users struggle to establish productive and beneficial uses of water. Conversely, if water re-allocations take place too slowly, social and political pressures will force a quicker pace for water reform, which could destabilize the process" (DWAF, 2005).

To achieve the intent of water resources policy in South Africa it will be necessary that decisions are supported by understanding of relevant social and ecological processes. Developing this understanding and the related competencies falls within the mandate of the WRC whose aim is to "….develop and support a water-related knowledge base in South Africa which is both representative and sustainable, with all the necessary competencies and capacity vested in the corps of experts and practitioners within academia, science councils, other research organizations and government organizations (central, provincial and local) which serve the water sector." (http://www.wrc.org.za).

Within this context the policy implications of this research are:

- The intentions of water resource policy are not being supported by research that will inform decision-making in respect of benefit sharing
- Informed decision-making on benefit sharing is not possible because of significant weakness in understanding of the concepts and in practical experience
- Collaborative and transdisciplinary research (social, economic, political, legal and ecological) will be required to develop the necessary understanding and competencies
- A programmatic rather than project approach to research on benefit sharing will be required to establish the necessary collaboration

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