A Game Theoretic Perspective for Enhanced Stakeholder Participation in Integrated Water Resource Management: A Kat River Valley Case Study

A thesis submitted in fulfilment of the requirements for the degree of

MASTER OF ARTS

RHODES UNIVERSITY

by

CYRIL MBATHA

Principal Supervisor: Prof. G.G. Antrobus

Co-Supervisor: Prof. C.G. Palmer

January 2005

ACKNOWLEDGMENTS

I would like to thank the following people and institutions for their assistance and personal help in completing this project:

Prof. G.G. Antrobus, supervisor (Department of Economics and Economic History, Rhodes University)

Prof. C.G. Palmer, co-supervisor (Institute for Water Research, Rhodes University)

The financial assistance from the National Research Foundation (NRF) and the Water Research Commission

The people who gave their valuable time, sometimes for no pay, to make it possible to complete the thesis

Opinions expressed and recommendations arrived at are those of the author and are not to be attributed to any of the above institutions.

I acknowledge that all references are accurately recorded and that, unless otherwise stated, all work herein is my own. I certify that this thesis has not been submitted for a degree at any other university.

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ABSTRACT

South Africa is a water poor region and yet, like in many other developing countries, water resources are a valuable production input in socially important industries such as agriculture and mining (Nieuwoudt et al., 2004:162-182). With a mean annual rainfall and runoff of 502mm and 42mm ($420m^3$ per hectare per annum) respectively, Briers and Powell (1993:1) speculate that water shortages will limit South Africa's economic development in the twenty-first century.

In response to the challenges of water resource scarcity and socio-economic inequalities, in 1997 the South African Department of Water Affairs and Forestry (DWAF), following international trends, formulated a National Water Policy (NWP) based on Integrated Water Resource Management (IWRM) principles (Palmer et al., 2003). The main objectives of the NWP (1997) are to protect national water resources from degradation, provide economically disadvantaged communities with access to water resources and promote economic development, through the devolution of water management responsibilities to locally established water institutions (NWP, 1997).

The pursuit of these objectives requires a thorough investigation of biophysical, socio-political and economic characteristics of the demarcated water areas. For such an investigation to provide accurate and locally relevant results, broad stakeholder participation is of paramount importance.

The thesis discusses economic measures required in pursuing enhanced stakeholder participation levels at local levels. A socio-economic survey investigation describing major participation trends against reported property rights and Willingness to Pay values was conducted in the Kat River Valley, Eastern Cape province. From the investigation, observed participation trends driven by economic interests were

identified and used in recommendations proposed for the policy implementation process.

Using game theoretic arguments as guidelines in soliciting cooperative behaviour in the use and consumption of common resources (Ostrom, 1990), the thesis proposes the introduction of water related public works projects as employment creating vehicles for individuals and communities targeted for economic empowerment and participation in the water policy. However, for sustainable stakeholder participation levels, it is argued that the employment positions created through the projects need to be designed in a manner that would encourage an evolution of long-term relationships between stakeholders and the water management institutions.

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ACRONYMS

ANC	African National Congress
BEE	Black Economic Empowerment
CB	Cooperative Behaviour
CBA	Cost Benefit Analysis
CCMA	Commission for Conciliation Mediation and Arbitration
CF	Catchment Forum
CGIAR	Consultative Group on International Agricultural Research
CIC	Community Indifference Curve
CMA	Catchment Management Agency or Area
CMAs	Catchment Management Agencies
CPR	Common Pool Resources
CV	Contingent Valuation
CVM	Contingent Valuation Method
NGO	Non Governmental Organisation
DBSA	Development Bank of southern Africa
DLA	Department of Land Affairs
DWAF	Department of Water Affairs and Forestry
EEU	Environmental Education Unit
EPP	Environmental Public Participation
GPP	General Public Participation
IAAF	International Amateur Athletic Federation
IWMI	International Water Management Institute
IWR	Institute for Water Research
IWRM	Integrated Water Resource Management
KRV	Kat River Valley
LCP	Land Care Project
MC	Mobility Constraints
MPC	Marginal Private Costs
MSC	Marginal Social Costs

NOAA	National Oceanic and Atmospheric Administration
NWA	National Water Act
NWP	National Water Policy
NWRS	National Water Resource Strategies
OVERPP	Overall Public Participation
PP	Public Participation
PPF	Production Possibility Frontier
PR	Property Rights
TWINSO	Third World Network of Scientific Organizations
UCT	University of Cape Town
WMA	Water Management Area
WRC	Water Research Commission
WSA	Water Service Strategies
WTA	Willingness To Accept
WTP	Willingness To Pay
WUA	Water User Association

CHAPTER ONE – INTRODUCTION

1.1 INTRODUCTION

Public resources, such as environmental resources, have always posed a challenge to classical economic models advocating a non-interventionist market approach to the management of the economy. Because markets for externalities associated with public resources do not always develop without intervention, such resources are sometimes used to their degradation or even extinction as the public does not fully pay for the rights to use or consume externalities (Dales, 1968:52-59 and 1994:174-182).

The public management of natural water, which is not only a public good but also a fluid, makes it even harder to divide into small enough and separable units on which property rights can be imposed for the exclusion of those without use or consumption rights (Dales, 1968:52-59). In chapter one, the South African research context of water resource management, the National Water Policy (NWP, 1997) and the outline of chapters are presented.

1.2 THE RESEARCH PROBLEM

Human sustainability and economic development are dependent on water availability. In many developing countries, agriculture forms the largest economic sector, which renders water availability in these countries of paramount importance. For these reasons, international organisations such as the Third World Network of Scientific Organisation (TWNSO) and the International Water Management Institute (IWMI) have embarked on scientific and social research that is concerned with water availability for food security and water management at a global scale (CGIAR, 2002). But not all developing countries are faced with similar problems of water resource shortages and degradation, because climatic and rain pattern variability, water resource shortages and degradation pose different challenges to different countries.

In South Africa, water is a scarce economic resource because of uncertain and low rainfall as well as skewed distribution patterns experienced, especially towards the

western parts of the country (Nieuwoudt et al., 2004:162 and Palmer et al., 2002:1). In 1997 the Department of Water Affairs and Forestry (DWAF) formulated a National Water Policy (NWP, 1997) endorsed by the cabinet and guided by the principles of Integrated Water Resource Management (IWRM). The NWP (1997) was enacted as the National Water Act (No. 36 of 1998), with "(t)he objective of managing the quantity, quality and reliability of the nation's water resources (by) optimum, long-term, environmentally sustainable social and economic benefit for society from their use" (NWP, 1997:12). The policy aims to concurrently a) protect water resources for sustainable use, b) promote equitable access to water resources and c) facilitate economic development in demarcated geographical regions referred to as Water Management Areas (WMA).

Broadly, IWRM can be defined as the management of "significant parts of land-use planning, agricultural policy and erosion control, environment management and other policy areas. It covers all human activities that use or affect fresh water systems. (And) briefly, (it) is the management of water systems as part of the natural environment and in relation to their socio-economic environment" (Mostert et al., 1999:3). Economically and politically, IWRM entails the delegation of economic management of resources to local populations and institutions. The funding required for water management and the administration of water institutions becomes a local responsibility. Moreover, after the establishment of local water institutions, the main objectives of the water policy (e.g. economic development) also become local responsibilities. Hence, it should be apparent that the success of the policy's implementation process is dependent on the economic, political and technical capacities of local institutions and individuals.

1.3 THE CHALLENGES FOR THE WATER POLICY IN SOUTH AFRICA

The water policy implementation process has been slow in the sense that eight years after the formulation of the NWP (1997), only one Catchment Management Agency (CMA) out of a possible nineteen had been established in 2004 (DWAF, 2004 and EEU, 2003). On the other hand, the participation of poor farming communities in local water bodies, such as Water User Associations (WUAs), has been limited (Faysse, 2004). It can be argued that many of the demarcated Water Management Areas (WMAs) lack the required capacities for establishing and managing local institutions.

At a national and provincial level, DWAF has been faced with technical challenges in formulating appropriate economic strategies for institutional funding as proposed by the policy. For instance, in 2004 DWAF was still in the process of reviewing economic tools in setting charges for water uses and consumption (e.g. for multi source point pollution) as well as envisaged catchment charges. In South Africa, it is only the National Treasury that is constitutionally allowed to raise funds through the taxation system, therefore DWAF cannot impose community taxes for non-point source pollution.

Besides the challenges of formulating the appropriate economic instruments to charge for resource use and consumption, DWAF has not been successful in effectively mobilising *broad* and representative public participation, for the establishment and/or management of water institutions (EEU, 2003). To this effect, in 2003 a need for solicited research to document challenges regarding nationwide stakeholder participation was recognised by the Water Research Commission (WRC), and in 2004 such research was being conducted by the Environmental Education Unit (EEU) at Rhodes University (EEU, 2003). The lack of broad stakeholder participation, especially among specific groups targeted by policy (e.g. black women), means that the policy's aim to achieve equitable access to water resources would be impossible to realise.

How broad stakeholder participation is achieved, using economic approaches, depends on the economic gains to be made by individuals from their participation. To date DWAF has not devised working economic incentives in eliciting participation for establishing water institutions. Based on the KRV results as well as broader anecdotal evidence from DWAF workshop discussions (on 15/16 of April 2004), it would appear that South African public is not generally aware of the NWP (1997) and its objectives, and therefore has not been involved in its implementation.

The primary aim of this thesis is to describe context specific methods in which participation for the implementation process can be enhanced using neoclassical economic methods, which are based on assumptions that individuals are selfish and utility maximising. The formulation of the methods is informed by economic data collected from the Kat River Valley (KRV).

It is argued that individuals' selfish behaviour for utility maximisation in open and private markets leads to socially rational and efficient market outcomes (Fryer, 2003:1-15). However, according to game theory, in the use and consumption of common resources, selfish individuals have to cooperate for socially efficient market outcomes. In the prisoner's dilemma, discussed in chapter two, cooperative behaviour maximises social benefits, but selfish behaviour maximises individual benefits, at least in the short term (Ostrom, 1990). On the other hand cooperative behaviour becomes a preferred individual strategy where higher social benefits from cooperation are more apparent to selfish individuals locked in long-term relationships (Ostrom, 1990:1-20). Therefore, it is vital for public policy to devise long-term economic incentives and create institutions that promote cooperative behaviour in the use of common resources. These economic and game theoretic assumptions form the theoretical foundations for achieving the primary goal of devising useful economic methods for policy implementation. Economic incentives entrenched in institutional governance need to be worked out so as to achieve public cooperation and participation in the policy implementation process.

To this end, the relationships between the variables: property rights (used as proxy indicators for long-term local investments), environmental economic values (used as proxies for cooperative behaviour) and broad stakeholder participation are explored in chapter five. The information used in creating these variables was gathered through a household survey using a questionnaire that asked questions based on game theory assumptions discussed in chapter three. The qualitative information used for the interpretation and discussion in chapters five and six was gathered through interviews with officials from local and national agencies such as DWAF, the Department of Land Affairs (DLA), the KRV Water User Association (WUA), the KRV Catchment Forum (CF), the Institute for Water Research (IWR, Rhodes University), etc. In chapter six, the development of models and formulation of economic methods to establish long-term, economic and local investments in the KRV is discussed. According to economic and game theoretic hypotheses, the establishment of long-term economic investments should lead to enhanced public participation for local policy implementation aimed at common resource management.

In the following section, the NWP (1997) and its objectives are laid out for the discussion of policy recommendations for the implementation process specific to the KRV context.

1.4 A BRIEF DESCRIPTION OF THE NATIONAL WATER POLICY AND ITS OBJECTIVES

The NWP (1997) aims to politically and economically empower previously disadvantaged water users such as rural subsistence farmers and rural women, and to give water access to the previously disempowered South African population in ways that protect the natural water resources from overuse and degradation (NWP, 1997). In order to achieve these objectives, according to DWAF, the management of water resources should be delegated to locally established institutions. This also entails the decentralisation of economic water management to WMAs as demarcated by central government (Appendix 1). The use of economic tools, such as water permits and waste discharge charges, has been proposed to achieve a decentralised management of water resources, which would curb resource overuse and pollution as well as generate adequate revenues for the CMAs' financial viability.

The proposed institutional arrangement is that Catchment Management Agencies (CMAs) should be created and be responsible for the overall management of water resources in each WMA (NWP, 1997). Figure 1.1 illustrates the possible relationships between local institutions such as Catchment Management Agencies (CMAs), municipalities, WUAs, Catchment Forums (CFs), Businesses, water users, etc.

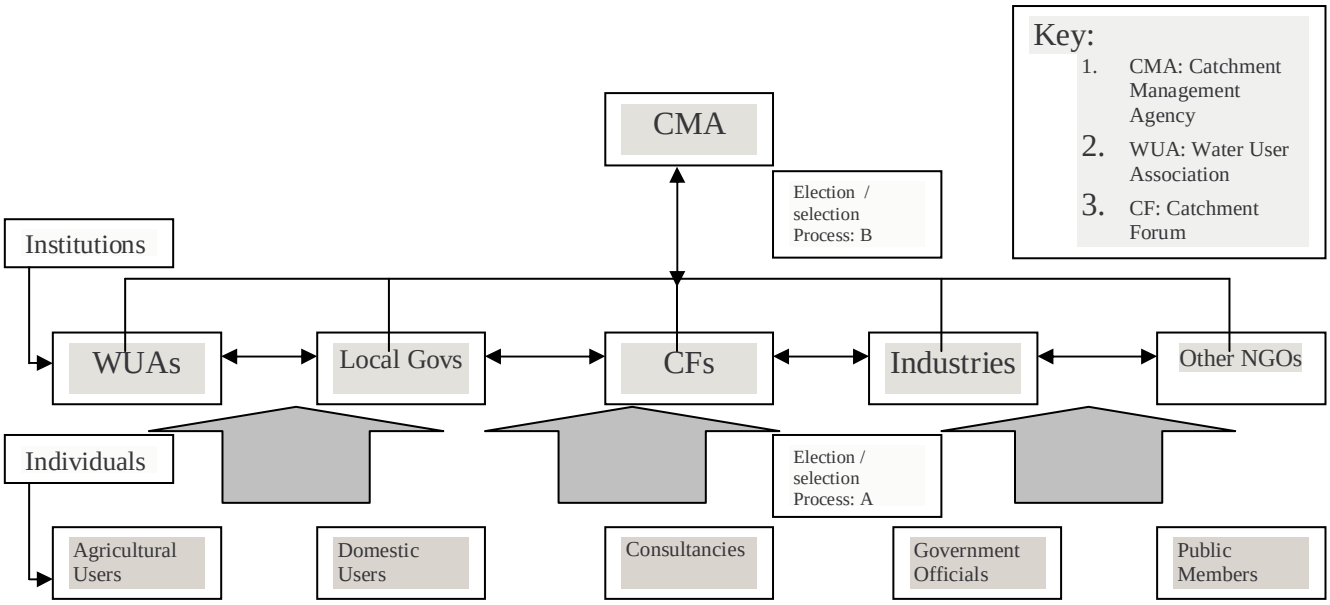

Fig 1.1 Institutional arrangement[1] at Water Management Area level (Adapted from: DWAF, 2004)

Individual stakeholders and water users in IWRM are represented by institutions like WUAs, CFs, etc., and in turn the institutions are represented in CMAs. This means that CMAs are the overarching administrative institutions in demarcated WMAs. Well-defined political procedures are required to elect stakeholders to local institutions and to CMAs, which still need to be clearly defined in the National Water Resource Strategy (2002) document (Palmer, 2004).

The WUAs and CMAs are classified as statutory water bodies in the National Water Act of (1998), while CFs are non-statutory bodies. The legal roles of local governments are also not clear in the water policy, except that as Water Service Authorities (WSA), they fall under the jurisdiction of CMAs with regards to water service provision. In terms of the NWP (1997), water users should be charged for water use and consumption and local governments for abstracting and polluting water resources. Wider community concerns have to be represented in CFs, whose scope of function is not only limited to water related activities. In fact, they can have other interest groups represented in their executive committees (EEU, 2003).

[1] Public officials are selected to positions on the CMA advisory board whereas public members and industry representatives are democratically elected.

Before the establishment of a CMA, which could be initiated either by DWAF or local stakeholders, DWAF performs all CMA functions. After a CMA has been established, dependent on local capacities, DWAF can continue performing some of the CMA functions (DWAF, 2004).

It is apparent that the implementation process of the water policy requires huge financial and human resource investments. It also requires widespread consultation and persuasion of local stakeholders to be involved. In 2004, eight years after the formulation of the NWP (1997), only one CMA had been established in the Inkomati WMA. In the Fish to Tsitsikama WMA, which encompasses the KRV and where a fully representative CF had not yet been established (Keke, 2004), the water policy implementation process had been slowest (EEU, 2003).

The difficulties encountered in the implementation of the policy provide the rationale for the research proposing a set of economic incentives as solutions that aim to enhance levels of public participation. To be successful, these should focus on serving the selfish economic interests of individuals and communities. This entails that most of the initial costs in establishing CMAs would be borne by DWAF and other relevant and well resourced agencies as illustrated in table 6.2 of chapter six.

1.5 THE PREVIEW OF CHAPTERS

The thesis is divided into seven chapters: a) an introduction, b) a review of literature, c) a theoretical discussion, d) a discussion of methods, e) a description of data, f) an interpretation and discussion of data and policy recommendations, and g) a concluding summary.

Chapter two is a literature review of:

a) international developments in IWRM policy,
b) the definitions of common resources,
c) the roles of property rights as remedies for internalising market externalities,
d) the politics of public choice and participation, and
e) economic valuation methods, with guidelines for developing countries.

In chapter three the contested definition and perspective on common property rights, as advocated by Dales (1968 and 1994) and Quiggin (1988), and the different varieties of game theoretic models with their relevance to private markets and governments' management of common resources are discussed with regards to their advantages and disadvantages.

Chapter four describes the methods of collecting and analysing qualitative and quantitative data. This data are analysed following guideline assumptions made in the theoretical discussions in chapter five. The interpretation of data are discussed and policy recommendations for a sustainable NWP (1997) implementation process are laid out in chapter six and seven.

CHAPTER 2 - LITERATURE REVIEW

2.1 INTRODUCTION

International trends in the use of scarce natural resources are presented in this chapter. Thereafter, the international context is used as a framework to discuss developments in the South African water resource sector (i.e. the National Water Policy (NWP) of 1997, the National Water Act (NWA) No. 36 of 1998 and the draft version of the National Water Resource Strategy (NWRS) of 2002).

Because natural resources like water have become scarce (Palmer et al., 2002:1) or polluted at a global scale, both ecological and economic approaches to saving them are needed (Constanza, 1996:978). Hence in South Africa, the NWP (1997) and NWA (1998) aim to protect and equitably redistribute water resources to economically disadvantaged communities. The tone set by the NWP (1997) has allowed for the formulation of models for water management that aim to encourage both resource protection and local participation (e.g. Palmer et al., 2003:44-50). Local participation is paramount, because water resources, like many environmental goods, are public goods whose equitable allocative use and consumption require public participation (Black et al., 1999:16-32).

This chapter also describes economic valuation methods that are useful in exploring the possibilities of achieving the water resource protection and public participation requirement objectives as well as public politics thereof. Finally, a case study from Madagascar (Ferraro, 2002:261-275), which provides an insightful and relevant example of an evaluation method undertaken in socio-economic conditions similar to the Kat River Valley, is presented.

2.2 GLOBAL ECOLOGICAL AND ECONOMIC PROBLEMS

As the world population grows, limited resources have come to include more environmental resources that were previously thought to be infinitely abundant, e.g. clean air and water (Dales, 1994:174-182). A number of economic development theories argue that positive correlations exist between population growth and the

deteriorating environment, both in industrialized and developing nations. With increasing global populations, environmental resources and quality are increasingly diminishing (Cropper and Griffiths, 1994:250-254). Environmental degradation has led to a global state of alertness on the need to begin creating efficient and sustainable ways of using and consuming natural resources (Janse van Rensburg and Paxton, 1998).

In neoclassical economics, it is argued that with diminishing environmental resources, economic markets for these resources will emerge. However, because of asymmetric information problems on the status of natural resources, and because of the public nature of many environmental resources (i.e. non-excludable and non-divisible goods), markets for many of these resources do not always emerge automatically. In fact, it is argued that the very public nature of environmental resources, without government intervention, has led to their complete depletion in human history (Dales, 1994:174-182 and Black et al., 1999:18-32).

Therefore, in recent years ecologists, environmentalists, governments, etc., have conducted awareness campaigns and convened conferences (e.g. The Rio Earth Summit in 1992 and the Johannesburg World Summit on Sustainable Development (WSSD) in 2002) to highlight the state of threat facing natural resources as well as to outline ways to protect them (Janse van Rensburg and Paxton, 1998; Calder, 1999). In fact, it can be argued that the international debate has since passed the awareness stage and entered discussion about appropriate and effective intervention methods for managing natural resources (Motteux, 2002:1).

On the other hand, partly because of global trends around environmental issues, economists and ecologists have realized that a need for a crucial dialogue exists between the disciplines of economics and ecology. A dialogue is needed to develop theoretical models, management methods and effective approaches reached through collaborative theoretical and empirical work (Constanza, 1996; Shafik, 1994; John and Pecchenino, 1994).

2.2.1 Environmental goods as public goods

Water is the basic element of human life and the environment (Palmer et al., 2002:1) and has played a significant role in the evolution of mankind on earth, therefore conserving it will directly impact on socio-economic development (Obisi, 2001:v). However, how water is used and consumed in a sustainable and economically efficient manner raises tricky questions, which are central to ongoing debates in economics and ecology. Some of the debate relates to which development approaches are appropriate to implement in developed vis-à-vis developing countries (John and Pecchenino, 1994:1394-1410, Ferraro, 2002:261-275 and Ribot, 2002:1-20).

The public nature of natural resources such as water and air, which are also diffuse substances (gas and fluid) (Dales, 1994:174-182), requires their social distributive allocation to be placed in the guardianship of public agencies such as national and/or local governments, private local institutions, etc., dependent on the capacity and legal appropriateness of these agencies (Ostrom, 1990:1-20).

In public economics, entities such as the collective (versus individual actors) and public institutions or agencies, formed by communities, are subjects of inquiry. The likely efficient allocation of limited public goods among potential voters through public agencies is investigated (Black et al., 1999:18-33). To achieve an efficient allocation of public goods by internalising economic externalities, public agencies require public voting or participation. Public participation can help in identifying aggregated preferences.

Participation is identifiable in actions such as public meeting attendances, signing of petitions, referenda, etc. On the other hand, public institutions "are officially committed to increasing public participation in (the) planning (and in the implementation stages of public policies)" (Laurian, 2004:54). In many modern and democratic states[2], one of the government's responsibilities is to ensure that the public participates in policy formulation and in its implementation. Barry (1989) in a book entitled *"An Introduction to Modern Political Theory"* gives an in-depth discussion

[2] One of the primary tenets of democracy is a transparent process in the formulation of public policy; however in reality not all states are committed to public participation.

on the state's political formation and thereafter its responsibilities once citizens have given it the mandate to carry out social contracts.

However, states and other agencies, in the guise of promoting and representing democratic and participatory practices, have also misused the notion of public participation as a concept and in practice. White (1996:5-15) describes participation models, where economic benefits and political ambitions, for public legitimacy, are an impetus for participants and public agencies. The argument emphasized by White (1996) is that valuable models should capture the dynamic political relations in the definition and expression of participation. In some cases, participation might be solicited for public empowerment purposes, but having achieved those goals, sustained participation may become subversive towards institutions that promoted it in the first place. With new information imparted to participants, agencies of empowerment may face rejection, and even hostility from the very sectors they have empowered (White, 1996:11).

For these reasons, the goals to achieve public participation and the kind of participation solicited may not be clearly stated or may even be misrepresented by agencies wishing to maintain their respective power positions. In White's (1996) arguments, it seems political tensions always exist when participation is defined, sought and expressed. It can be defined, sought or expressed as a negative or positive type, depending on whose perspective is expressed and to what ends.

Laurian (2004:53-64) in a paper on '*Public Participation in Environmental Decision Making'* explores different definitions and expressions of public participation based on psychological models, which relate to ways in which individuals respond to physical threat. In the models, *voice* for instance, represents a positive participatory response to threat. In participation, *voice* is manifested through actions like attending meetings, voting, etc., whereas, negative and non-participation are both labelled as *exit*. The latter can be expressed through individuals' plans to leave the borders of a community or state (i.e. emigration). Therefore, different political choices exist through which individuals, communities and public agencies manage public resources. Most of these choices are expressed within public institutions for the empowerment as well as disempowerment of parties. Hence, public choices form a

crucial component of the study focused on the economic allocation of public resources.

In the South African water policy implementation process, trends over the last eight years have shown that "(p)ublic involvement can range from simply seeking approval for processes that have been planned without consultation, to consultative processes, to full public involvement in actually running processes. Public participation is understood and played out in many different ways" (EEU, 2003:30). The contestable nature of participation definitions and expressions with ways through which participation can be empowering to local stakeholders and agencies are discussed in the Environmental Education Unit's (2003) research scoping document on '*A Critical Review of Participatory Practice in Integrated Water Resource Management (IWRM)'*. For instance, creating awareness can be understood as fundamental to public participation, and processes like handing out newsletters, press releases, etc., as part of the participatory processes. Capacity building may entail the "sharing of information", "holding meetings in local languages", and "holding briefing meetings with weaker groups", etc. (EEU, 2003:30-33). In chapter four, five and six property rights and willingness to pay values are discussed as variables against which public participation is examined for the Kat River Valley case study.

2.2.2 The South African National Water Act

Global awareness campaigns on environmental degradation and emerging trends of world states' policies championing best practices in the allocation of scarce resources have influenced the current South African public policies (Lindstrom, 1997:12-24). In 1998, the South African parliament ratified the National Water Act (NWA) (No. 36 of 1998) with environmental sustainability and equity as its grounding principles. The principles advocate the sustainable use and consumption as well as equitable access to scarce water resources for all citizens (NWA, 1998).

The historical background to the enactment of the NWA (1998) can be traced back to Apartheid laws, which promoted racial inequalities, and after 1994, to the African National Congress's (ANC's) Reconstruction and Development Programme (RDP) (ANC, 1994 and Motteux, 2002:2-3). The RDP's objectives were to eradicate poverty

and reverse inequalities of past laws through economic growth and redistribution (ANC, 1994). “Politically, the (RDP) document represented a consensus across different interests, (it) was successful in articulating the main aspirations of the movement for post-Apartheid South Africa, that is, growth, development, reconstruction and redistribution (of economic resources)” (Adelzadeh, 1996:66). Before 1994, access to basic clean water was not equitably afforded to all racial communities, and the most disadvantaged were black females in rural communities (Motteux, 2002:2-3). Not only did these communities suffer discrimination in terms of water access but, because the 1956 Water Act was based on riparian rights principles, where the rights to water use were based on land ownership, communities without land rights were denied access to other water related resources (Palmer et al., 2002:3-4).

Furthermore, what continues to complicate water allocations is that South Africa is a water poor region, with a mean annual rainfall and runoff of 502mm and 42mm ($420m^3$ per hectare per annum) respectively (Briers and Powell, 1993:1). Moreover, South Africa has “rainfall that is not distributed evenly (which makes it) difficult to get water to everyone” (Palmer et al., 2002:1). In the drier northwestern parts of the country, competition for water access is greater. Therefore, it was necessary for the post 1994 government to formulate the new National Water Policy with implementation strategies (NWRS, 2002). The policy requires that water resource management be delegated to local institutions (NWRS, 2002; Palmer et al., 2003). In demarcating Water Management Areas (WMAs) and developing implementation strategies, the NWA (1998:22) requires that the following guidelines be taken into account:

a) water catchments boundaries
b) social and economic development patterns
c) efficiency considerations; and
d) communal interests within the areas in question.

However, a critical study of the policy objectives and guidelines reveals that some may be contradictory or in conflict. For instance, some resource protection guidelines may conflict with aspects of economic development aspirations of communities. The conflicts may be magnified where scientific and economic projects are initiated by

outside agencies. Therefore, local participation in establishing water institutions and resource management, which promotes informed public choices is vital. In short, only participation that leads to stakeholder empowerment should be advocated (Motteux, 2002:1-10).

Because the NWA (1998) aims to promote the protection of ecosystems as well as economic development (Lindstrom, 1997:12-23), it is imperative that management solutions designed for water protection incorporate models for economic development and vice versa. The development of solutions that recognises the interdependency between ecological and economic challenges needs to be adopted. Such an approach will benefit the objectives outlined in the NWA (1998).

2.3 THE PROVISION OF A PUBLIC GOOD LIKE WATER

In economic theory, different views exist about socially efficient ways of providing public goods and the best ways to internalize externalities associated with them (Quiggin, 1988:1071-1085). Ostrom (1990) discusses how over the years economists, using different theory frameworks, either advocated government intervention or private markets as the most efficient way of removing market externalities in public goods markets. Quiggin (1988:1071-1085) in a discussion of the historical development of property rights debates around the provision and protection of common resources, criticises what he describes as limitations of neoclassical assumptions about human behaviour, i.e. as ultimately rational and utility maximising (Fryer, 2003:1-15). He further criticises, as an ideological bias entrenched in neoclassical assumptions, the assumed emergence of private property rights as logical and effective solutions in the natural development of efficient free market systems.

2.3.1 Towards a private good

Before discussing the potential merits and demerits of Quiggin's (1988:1071-1085) arguments, the definitions of public and private goods should be presented. From the definitions, it can be decided whether and how much of a public good environmental resources like water resources are.

In neoclassical economics, for a *pareto* efficient equilibrium position (for consumption or production) to be attained, consumers should reveal their true preferences. This revelation should lead to the emergence of competitive and efficient consumption or production equilibrium levels (E) on the production possibility frontier, in figure 2.1 (Black et al., 1999:16-33 and Fryer, 2003:150-155).

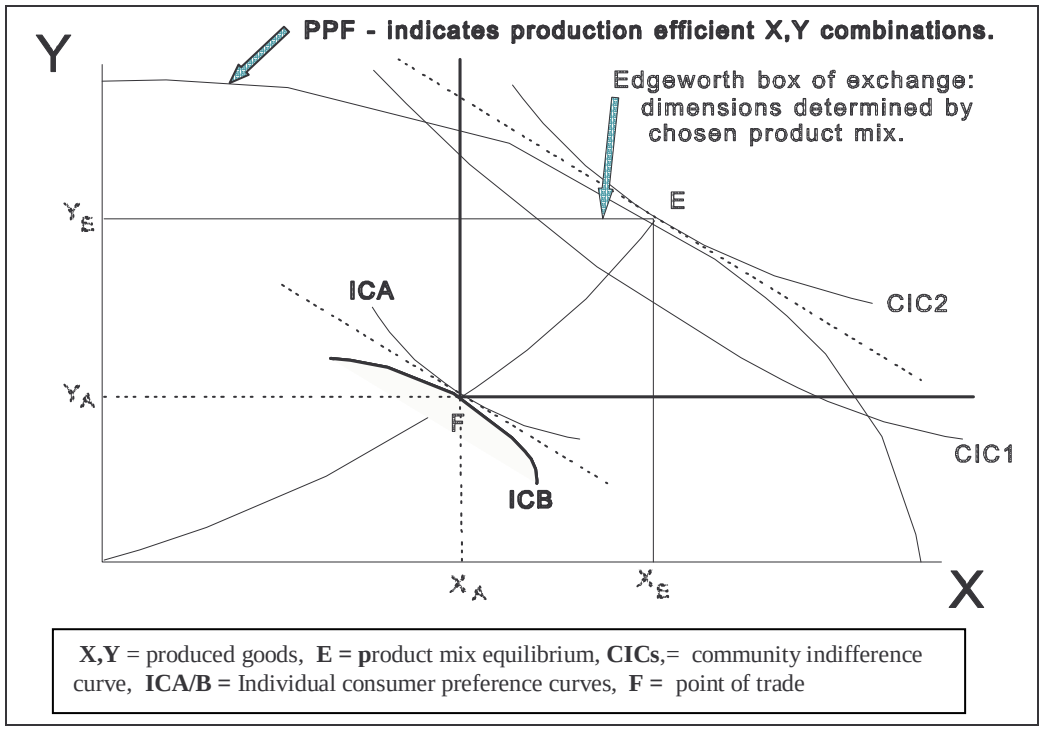

Fig. 2.1 The production possibility frontier (PPF) and the community indifference curve (CIC) (Edgeworth box fitted under the PPF).
(Source: Fryer, 2003:153)

In figure 2.1, the Production Possibilities Frontier (i.e. the community's budget constraint) is the PPF curve and the CICs represent Community Indifference Curves (i.e. aggregated community preferences). The conventional Edgeworth diagram (with preference curves) is embedded in a PPF curve. The equilibrium consumption or product mix between good X and Y should be a common point between the PPF and highest CIC curves (i.e. point E). At point E, all consumers have reached the exchange equilibrium (because point E is on the trade or contract line (EF)), and

consumption or production occurs on the community budget constraint (PPF). The trade line (EF) represents the bargaining equilibrium points among community members. X and Y represent the two goods available for consumption or production in the community (Fryer, 2003:153-155).

The community equilibrium position E, is attained without costs if complete trader preference information exists. This information is readily available where the traded goods are full private goods. However, for public goods, information on consumer preferences (CIC curves) can be concealed easily by free riders. This is because public goods are characterized by non-rivalry and non-excludability attributes (Black et al., 1999:18). The attributes make it easier for trading consumers to hide their true preferences. On the other hand, private goods are both rival and excludable. Therefore, the efficient allocation of public goods among trading consumers is more challenging in open markets than for private goods.

A rival good can be divided into saleable units (e.g. land). When a rival good has been consumed it is no longer available to another consumer. But goods such as atmospheric air and street-light are more non-rival in nature, and their consumption by one consumer hardly limits their availability to other consumers (Dales, 1968:50-59 and Black et al., 1999:16-18). If a good is exclusive, a consumer or group of consumers that own exclusive rights to the good's consumption or use can limit access to or prevent potential consumers from using that good.

Property rights enhance the excludability attribute of goods (Quiggin, 1988:1071-1085 and Dales, 1968:50-59). If a good's attributes are full excludability and rival, the good is said to be a pure private good. On the one hand, if a good lacks one of the two attributes it is a mixed good. At the other end of the scale, if a good lacks both attributes it is said to be a pure public good (Black et al., 1999:18-19). However, in real life few goods are pure public or pure private goods; many are defined along a continuum of pure private to pure public good.

More critical to the discussion is the fact that over time a good's definition is not constant. For instance, technological innovation may decrease the non-rivalry and non-excludability attributes of a light-house, if electronic wave devices are used

instead of visible light (Black et al., 1999:18-23). This means that, historically, the nature of property rights may change as the nature of attributes and the surrounding environment change. A shift in the definition of a good along the continuum of pure private to public good and vice versa is possible (Quiggin, 1988:1071-1085).

In short, it is difficult to leave the efficient provision of pure public goods to open market systems, as this requires that consumer preferences are explicitly stated for the equilibrium position (E), in figure 2.1, to be identifiable. Consumer preferences for pure public goods are not always revealed, therefore these goods are susceptible to 'free-riding' problems. Some consumers in society may chose not to pay for their use of pure public goods, because their exclusion from consumption is hard to enforce. Furthermore, if consumers are free-riding, the social costs of providing pure public goods are greater than private costs. This illustrates a negative externality for pure public goods as illustrated in figure 3.1 (Black et al., 1999:27).

Because the provision of pure public goods normally gives rise to negative externalities, Dales (1994:182) concludes that, "it seems to me that it is unrealistic to view (public good) management as a problem (of trying to solve open market failures), and that the question of how (public goods) should be (managed) is purely a matter of *collective* decision making". Dales (1994) advocates institutional political solutions to public goods' management, where neoclassical economic solutions advocate the creation of pseudo markets. He concludes that trying to create open markets for public goods cannot work, precisely because pure public goods are non-rival and non-excludable (Dales, 1994:174-187).

The types of public goods that Dales (1994) identifies as most unreceptive to open market solutions are fluids like water and atmospheric air. River water is especially more difficult to manage using pseudo markets because it is moving, and upstream pollution and abstraction may affect downstream users without compensation. For such goods, Dales (1994) feels that the creation of open markets by introducing *private* property rights is most difficult. Therefore, he proposes that solutions for managing close to pure public goods like natural water and atmospheric air should be

political, and economic instruments like water permits should only be viewed as complementary to political decisions[3].

On the one hand, Quiggin's (1988:1071-1085) views that the management of public goods has always been political, requiring collective decision making processes, are closely aligned to Dales' (1994). But Quiggin (1988) further believes that the introduction and use of *collective* property rights should be the first choice solution to common resource management. For Quiggin (1988:1071-1085), when economic solutions are used, private property rights should not be thought of as superior to collective property rights. The creation of open markets as advocated in neoclassical economics should not always lead to the introduction of private property rights. However, Dales (1994:1974-187) on the other hand, still believes that for some public goods, like common land, introducing private property rights as management solutions is superior. He argues, it is easier to divide land into saleable units and easier to exclude potential free riders from using it. However, for goods like water and atmospheric air, Dales' (1994) and Quiggin's (1988) conclusions, that collective management is the efficient solution, are the same.

Collective decision-making often entails an assignment of a publicly established institution, like the government, with the responsibility to manage public goods. In dealing with the market externalities, a public institution can be vested, for instance, with powers to collect pigovian taxes to bridge the difference between social and private costs. In this approach, all citizens are forced to pay equally for the provision of a public good. However, this is not the most efficient solution, firstly because unknown public preferences are aggregated into the same price as a flat rate tax that is paid by all (Black et al., 1999:29-30). Secondly, this approach is biased by neoclassical assumptions that an open market system is superior (Quiggin, 1988:1071-1085).

In administering a pigovian tax system, the tax collection is seen as a corrective measure in some failed open market. The tax aims to restore a failed open and

[3] For Dales (1968 and 1994), natural water resources are close to a pure public good, but this does not mean that economic instruments to their management cannot be used. In fact, he lists a number of available economic tools with their pros and cons as complimentary to the social contracts around the management of public goods.

competitive market, as though open markets are the ideal. This is contrary to Quiggin's (1988) arguments that efficient common resource management does not always need to happen in open and competitive markets.

Other tools for enforcing collective-decisions by public agencies as discussed by Dales (1994:174-187) include: *regulating* the good by issuing quotas for its use, *subsidising* dischargers to reduce their pollution, because of falling production costs, and *charging* firms for their pollution volumes by issuing permits. However, regulation in the form of quotas is administratively costly, therefore not efficient. Both charges and subsidies have associated problems of uncertainty, where only experts (e.g. water scientists) have close to accurate information about the biophysical states of resources. Therefore, setting the right amounts of subsidies or charges is prejudiced by uncertainties. Such information, even for scientists, is costly and often impossible to provide.

Across the board subsidies, on the one hand, are problematic as they tend to benefit bigger polluters more than smaller polluters. When subsidies are offered, higher benefits accrue to bigger firms than to smaller ones. Hence, subsidies do not create incentives for technological advancement in bigger firms. Therefore externalities, like pollution levels, do not decrease over time (Dales, 1994:184-187). In this regard, Dales (1994:184-187) concludes that charges across the board remain the best economic solutions when enforcing collective decisions for public goods' management. In addition, Ostrom (1990:10-20) argues that the amount of these charges must be locally decided for a binding social contract. What this means is that, instead of having a national government as the agent in which decision making powers are vested, a local body like a municipality or a Catchment Management Agency (CMA) as proposed in the National Water Policy (1997) is more appropriate.

2.3.2 The common versus private property rights debates

In concluding that across the board charges are the best available economic solutions for public resource management, Dales (1994:184-187) also accepts the important function of *collective and exclusive* property rights. For Dales (1994:184-187) these types of rights can only exist and be enforceable when a democratically and legally

established institution like the government is vested with the authority to make decisions on behalf of users. Hence, for Dales (1994:174-187) *collective and excludable* property rights are not the same thing as common property rights, because a responsible and legal institution does not exist for common property rights' management[4]. What this means is that traditional common properties, outside the realm of modern states, have no legal rights associated with them and such common properties are not exclusive according to Dales (1994). This resonates with 'the tragedy of the commons' thesis and that 'common property is no one's property' (Hardin, 1968:1243-1248).

In contrast, Quiggin (1988:1071-1087) and Sethi and Somanathan (1996:766-787) argue that common property, including traditional common property, is governed by *collective and exclusive* user rights. Quiggin (1988:1071-1081) further objects to neoclassical economic assertions that the use of common property rights is an inferior solution to managing common resources. He states that catch phrases such as "common property is no one's property" (Dales, 1994:185), "the tragedy of the commons" (Hardin, 1961 cited in Quiggin, 1988:1073) are all imbued with ideological stances that see common property rights as less efficient and infantile forms of private property rights.

Quiggin (1988:1071-1087) also argues that, besides assumptions that humans are selfish and utility maximising, neoclassical economic discussions of private property rights are characterized by internal contradictions. Assumptions about selfish human behaviour are not always accurate, especially when individuals are studied as members of traditional communities. Neoclassical discussions about property rights are inconsistent because they view property rights only from a static equilibrium perspective, whereas it was argued that property rights' definitions are not constant. In the neoclassical perspective, for private property rights to be *pareto* efficient they must be well defined and stable. However, if they were stable they would not respond to technological and consumer preference changes. The perspective ignores the historical dimension of environmental change, i.e. the change of the environment in

[4] For Dales (1968 and 1994), common property is open property and does not belong to any person or state, which means that no institutionalised rights are associated with it, whether in modern or feudal states. However, other theorists like Quiggin (1988) define common property differently and not as open access for all.

which goods are defined and property rights are applied (Quiggin, 1988: 1075). If the historical change was accounted for, the argument that economic efficiency depends on *well defined property rights, which are stable* over long periods of time would be redundant.

Historically, the private - public nature of goods has always changed (e.g. land resources have become more private with growing populations). Hence, rights to property have also evolved. Where rights to property have not adapted to environmental changes, rights have undergone gradual attenuation, and property to which they apply, in numerous instances, is threatened with extinction.

However, the counter argument to Quiggin (1988:1075) is that when common resources like land become less abundant, e.g. because of population increases, competition for land use has led to an emergence of private property rights to land (Dales, 1994). Therefore, perhaps the economic efficiency of private property rights as the solution becomes obvious only when a public good has become a scarce good. In this sense, this is merely a linear historical account of how private property rights have evolved, but not an argument about their efficiency or appropriateness in all environments or historical periods.

What is clear in Quiggin's (1088:1073) thesis is that he does not distinguish between a linear and non-linear historical evolution of rights. Quiggin's (1988) account of the history of property rights seems to be less driven by consumer competition for limited resources, but more driven by cultural needs and social norms. Therefore, in different cultural contexts the historical evolution of property rights takes less predictable forms or directions.

In addition, Quiggin (1988:1073) seems to be more concerned about the definition and meaning of common property rights, which he does not view as 'zero-rights' or 'open access', where access for all exists. To him these are exclusive rights applicable in certain cultural conditions and they are also sensitive to historical and environmental changes (Quiggin, 1988: 1073).

"The meaning of the concept "common property" is well established in formal institutions such as the *Anglo-Saxon* common law, the German land law, the Roman law and their successors. It is also well-established in informal institutional arrangements based on custom, tradition, kinship and mores. Economists are not free to use the concept "common property resources" or "commons" under conditions where no institutional arrangements exist. Common property is not "everybody's property". To describe unowned resources *res nullius* as common property *res communes*, as many economists have done for years in the case of high sea fisheries, is self-contradiction" (Ciriacy-Wantrup and Bishop 1975:714 in Quiggin, 1988:1073).

Ultimately, the distinction made by Dales (1994:174-187) between common property rights and *restricted* common property rights, according to Quiggin (1988) is redundant. Dales' (1994:174-187) distinction revolves around the arguments that by any law, *restricted* common property rights are delegated to some communal institution. If a government or local institution, for instance, through legal and collective decision-making processes, can enforce exclusion from consuming common goods to some members of society, only then can the goods be defined as *restricted* common property. Ostrom (1990:1-18) also advocates the establishment of legal institutions for effective common resource management.

According to Dales (1994), *restricted* ownership is also a status of fixed tenure ownership. Therefore, restricted common property rights can be transferable, for instance, through the use of 'across the board charges'. The transferability of common property rights means that pseudo open markets can be created for common resource management, but the restrictions would stem from political processes and democratic choices.

The political process for expressing public choices, is not an economic process (Dales, 1994:174-187). Ostrom (1990:10-18) discusses the political process in terms of bargaining actions towards establishing and maintaining a socially binding contract. Sethi and Somanathan (1996:766-783) argue that the process of expressing public choices must be sensitive to local histories and the types of property rights that already exist, be they traditional or communal.

Allocative efficiency is reached only when the process in deciding the management and enforcement of environmental resources is both sensitive to all existing local rights, and this will in turn ensure that transaction costs are low (Quiggin, 1988). In chapter three these bargaining transaction costs will be discussed in more detail and as the value (e) (Ostrom, 1990:10-18). In sum, being sensitive to all property rights that already exist in local contexts will reduce potential conflicts among bargaining parties.

2.3.3 Public choice

Assuming that individuals as community members are selfish and utility maximising, and that economic markets are not always competitive enough, where they sometimes fail to solve for competing needs of individuals in a *pareto* efficient manner, it can be concluded that potential conflicts would exist within communities (Quiggin, 1988:1080-1082). It is for the potential, and sometimes actual, conflicts in the allocation of scarce resources among community members that institutional management systems evolve or are established with their procedures open to review over set time intervals (Ostrom, 1990:10-18). In the end, property rights are some of the variables or factors of political bargaining processes for establishing and managing common resource institutions.

Transaction or bargaining costs in political processes can at times be too costly when compared to benefits for some community members. This may even lead to some members' voluntary abstinence from participating in public choice expression processes (CIS, 2001). As already mentioned, when this happens it constitutes what Laurian (2004:53-64) calls exit; however, this is only one of many possible outcomes. Sethi and Somanathan (1996:766-783), based on a number of case studies, argue that communities can display cohesion bound by social norms and common property rights, and "the tragedy of the commons is not the general characterization of social behavior when applied to commons such as forests, pastures, and inshore fisheries". On the contrary, "the general pattern emerging from such studies is restraint in the use of the commons enforced by communities through means ranging from total reliance on norms, to more centralized mechanisms which involve some kind of local government" (Sethi and Somanathan, 1996:767). Their thesis is based on the

evolutionary game theoretic framework. However, in other cases, an outside agent can *intervene* to set up a local institution also using a game theoretic framework (Ostrom, 1990:1-20). The game theoretic framework is explained through the prisoner's dilemma game presented in chapter three. The prisoner's dilemma game can be extended to more than two prisoners and to more than a single interaction. If, for instance, there were more than two prisoners and one of the prisoners defects or does not cooperate, his or her gains would be higher than if there were only two prisoners in the game. On the other hand, if a prisoner defects in a game with more than one interaction, the chances that his or her defection is detected and punished are higher, which means s/he would receive lower gains from defection. The point is that, it is more beneficial to free ride in a bigger community than in a smaller community, where free riding can be easily noticed and punished. However, when there are an infinite number of interactions (i.e. the members of a community have to live together for a long time) the gains from free riding are lower, because in due time free-riding behaviour would be detected and deservedly punished (Kuhn, 2003).

The game theoretical framework can therefore explain what roles long term and local property rights can play in deterring community defections or misuse of common resources. Existing property rights may serve as one of many incentives for establishing well working local institutions and resource management. Hence, one of the aims of the thesis is to explore this hypothesis in the case study of the Kat River Valley. That is, whether communities are more likely to cooperate where members possess a relatively higher number of defined property rights.

In Sethi and Somanathan's (1996:766-783) game theoretic framework, other factors in addition to the number of players and time spent together by community members, changing technologies, changing prices and social cohesion (homogeneity) are also important variables in predicting public behaviour. Their conclusion is that when common property rights, based on long term social norms, are appropriately enforced, cooperative and efficient behavioural outcomes are possible. Efficient outcomes have been possible in many traditional societies throughout history. This conclusion by Sethi and Somanathan (1996:782-783) contradicts the pervasive 'tragedy of the commons' thesis as advocated, for instance, by Dales (1994).

However, aggregating public choices through political processes has limitations (Pindyck and Rubinfeld, 1988:629-635). Some of the limitations stem from the 'principal-agent' and the 'moral hazard' problems. When, for instance, an institution like a government (*the agent*) is elected or established to make decisions on behalf of a large group of people (*the principal*), a service provision relationship is entered into. But if the principle is dispersed over a wide geographical area, it may lack the information and/or means to effectively monitor the agent's work. For this reason, it is wise to use or establish locally representative institutions for effective bi-directional monitoring as envisaged in the NWP (1997). Furthermore, the degree and type of stakeholder representation in the established institution is also crucial, as it would determine the political legitimacy and the mandate of an agent to effectively perform its tasks, with better cooperation.

The 'moral hazard' problem surfaces where government representatives and policy guidelines become short sighted, because representatives work within time constraints, dictated by the time length of political tenure or the maximum number of years in political office. Within these time constraints, the agents' representatives experience pressures to deliver on tangible political promises (CIS, 2001). For these reasons the creation of non-political institutions is a better solution for avoiding 'moral hazard' problems, especially where environmental resources are concerned, because these resources often require long-term foresight and investment for their management.

After local institutions are created, *to completely* remove moral hazards, central governments must therefore cede all administrative duties to institutions operating under limited *political* pressures. This also happens to be one of the neoclassical economic conclusions, pointing out the supremacy and better economic efficiencies achieved through open market economies as opposed to centrally controlled economies. In any case, according to the National Water Resource Strategy (NWRS, 2002), DWAF will always have the final say in the management of water resources, especially on the reserve and issues of strategic and international importance (Lindstrom, 1997:12-23), which means that the moral hazard problem may not be completely removable in the South African water policy case.

2.4 THE SOUTH AFRICAN NATIONAL WATER RESOURCE STRATEGY

In 1997 in the South African water policy formulation process, Prof Kader Asmal, the Minister of Water Affairs and Forestry, in the introduction to the White Paper on National Water Policy (NWP, 1997:2), stated that there was a need for productive use of water in the South African economy. Because there is a limit to the amount of water that can be impounded, just like there is a limit to government funds for borrowing, economic conservation programmes, controlling land use practices and managing demand through the application of appropriate tariffs should be South Africa's water management policy for the 21st century (NWP, 1997).

The policy, as already argued, in many aspects is an adaptation of international trends in Integrated Water Resource Management (IWRM), although the definitions of IWRM in the literature are varied. Some definitions tend to focus more on decentralised management and some on natural resource protection. Mostert, et al. (1993:3) broadly define IWRM as management of "significant parts of land-use planning, agricultural policy and erosion control, environment management and other policy areas. It covers all human activities that use or affect water systems. Briefly it is the management of water systems as part of the natural environment and in relation to their socio-economic environment". Hooper and Margerum (2000:510) define IWRM primarily as a method of rehabilitating ecosystems and maintaining biodiversity and they put a limited emphasis on the management of socio-economic activities that occur within the ecosystems.

Developing counties like South Africa, as argued by Shah et al. (2001:90), for the past ten to twenty years have been adopting lessons of institutional reform for IWRM from developed counties like Australia. They argue that "(a) textbook case of institutional reform for (IWRM) in recent times has been the Murray-Darling basin in Australia, where sweeping changes have been made and enforced since 1990. And transferring the lessons of success in (IWRM) from Murray-Darling to Mahaveli, and Mississippi to Mekong – has emerged as a growth industry" (Shah, et al, 2001:90).

In South Africa, the National Water Act (NWA), was enacted in 1998 and the draft of the first edition of the National Water Resource Strategy (NWRS) was formulated in

2002. The aims of the NWRS (2002) are to assist the implementation process of the NWA of 1998. The NWRS (2002) envisions the creation of 19 Water Management Areas (WMA) and the establishment of Catchment Management Agencies (CMAs) to govern the use and equitable allocation of water recourses among stakeholders, while protecting the natural environment at the same time.

According to Hooper and Margerum (2000:511) some of the responsibilities devolved to stakeholders in CMAs include:

a. Education and information
b. Monitoring and planning
c. Permitting
d. Soil conservation
e. Flood control
f. Management at strategic regional scales.

In South Africa, local responsibilities, from the water quality perspective, also include setting up resources directed measures and source directed controls for the protection of water resources, among many other controls, as discussed by Palmer et al. (2003:43-44). From the socio-political and economic perspective, the policy dictates that the determination of 'some' economic and social specifications are also investigated (DWAF, 2004:3-4), however, in the NWRS (2002) the definition of these socio-economic specifications and the methods to investigate them are not clearly laid out.

The CMAs should be locally based governance structures incorporating local structures and individuals, for full local representativeness. Presently identified local structures and stakeholders include interested Non Governmental Organizations (NGOs), local governments, Water User Associations (WUA), Catchment Forums (CF), government officials, businesses, individuals, researchers, etc. Local representation, it is hoped, will facilitate one of the important objectives of the National Water Policy (1997), which is full stakeholder participation institutional management (NWRS, 2002).

However, the success of the implementation strategies depends on how clearly defined, how context sensitive and how flexible to local environmental changes they are (Palmer et al., 2003:44-66). A generic model, figure 2.2, that emphasises a water quality perspective of IWRM is laid out and discussed for the flexible implementation process (Palmer et al., 2003:43). In the model three stages for *planning, doing and monitoring,* each stage with its own water quality and socio economic demands, are conceptualized. The model is cyclic, which means that at five year intervals, strategies can adapt to changing environmental and information demands.

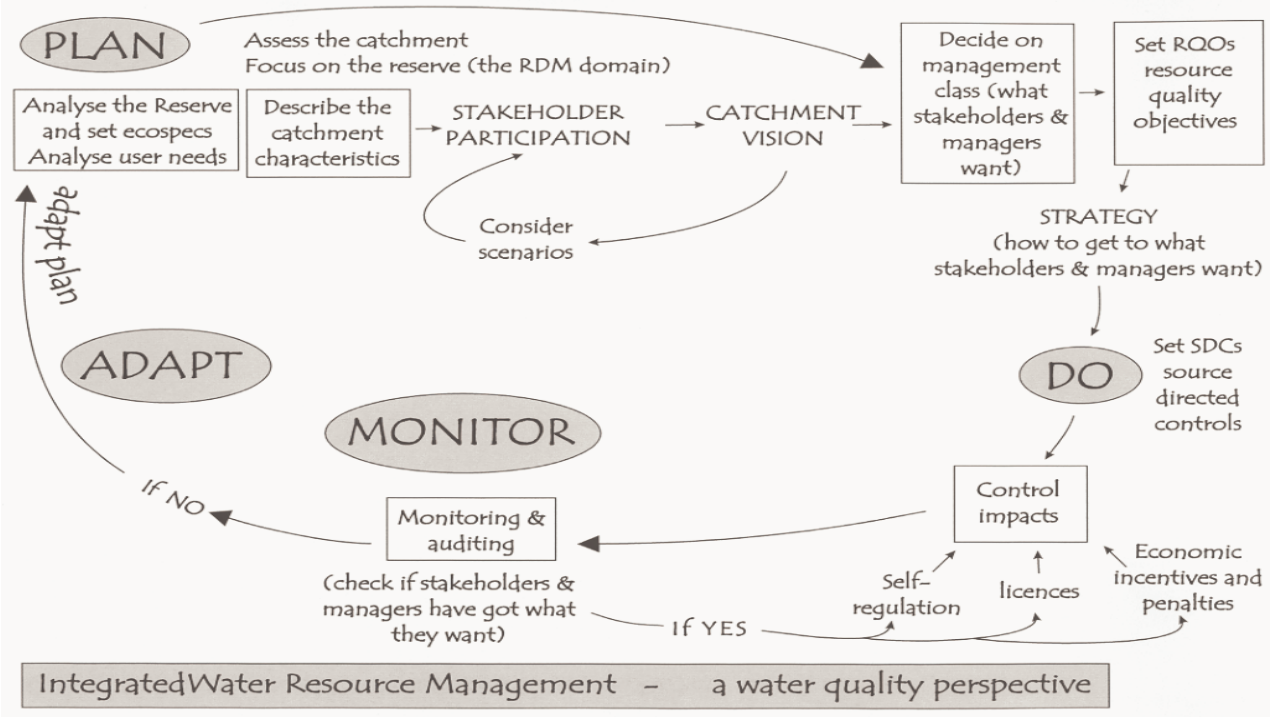

Fig 2.2 IWRM – Water Quality Perspective
(Source: Palmer, et al. (2003:44-45)

One of the model's objectives is to balance the emphasis put on quantitative water reserves with those put on qualitative water reserves in the establishment of a Catchment Vision. However, the model pays limited attention to the following political aspects of public management strategies:

a) from the beginning, and later for the political legitimacy of the Catchment Vision, it is imperative that local participation is elicited in analyzing both

ecological specifications (as there might exist useful indigenous knowledge and practices for factoring), but

b) more importantly local stakeholders should help experts in describing local user-needs and local socio-economic activities around natural resources (Ferraro, 2002). Moreover, the transfer of skills and knowledge among stakeholders should always been seen as bi-directional. Commercial farmers, for instance, have a huge role to play in the economic development of subsistence farmers and vice versa. Therefore, skills, capital, etc., are not only vertically transferable, but horizontally as well.

"Internationally, water resources can be successfully managed only if the natural, social, economic and political environments in which water occurs and is used are taken *fully* into consideration" (NWRS, 2002:9). According to the NWRS (2002), the Catchment Management Agency should be composed of and managed by local stakeholders, however, in the model a clear distinction is made between the responsibilities of stakeholders and those of 'managers'. An impression is created that managers are not stakeholders or that they are outsiders. It is important to point this out because an already documented case study on the development of CMAs in the Western Cape (DWAF conference, 10-12th Feb 2004) highlighted a strongly significant role played by Catchment Forums in CMA management. In that case study, CFs are portrayed as probably the most effective tools in driving a successful process of participatory water management. The CFs represent the local communities at the most grassroots level. Hence, it seems stakeholder participation is crucial from the beginning stages of implementing water management strategies.

"The successful (solicitation) of public participation within CMAs depends on how strong and functional CFs are. CFs are the champions of the whole CMA process" (EEU, 2003:37). Overall, the model in figure 2.2 and its explanations is not detailed enough about how economic incentives could be used to encourage local participation. The model emphasizes the importance of economic incentives during 'control' and 'regulation' phases, only after the Catchment Vision has been established (i.e. phase two). However, the sensitivity of accounting for all existing property rights, for instance, within communities, as has been argued, forms part of an important incentives regime and this should be accomplished at the beginning of the

implementation process. In Appendix 17, a revised version of the water management cycle model (fig. 2.2), which portrays an enhanced involvement of local stakeholders in specifying the catchment characteristics is discussed.

This thesis is about exploring economic roles of property rights, among other crucial variables, to enhance participation throughout the implementation process. About the economic role of property rights, the model (Palmer et al., 2003:44-66) is silent. Therefore, more conceptual work and case study analyses needs to be conducted to ameliorate the model's representation of a potentially successful implementation process. Revised models have to emphasise enhanced stakeholder participation at all stages of implementation. Local stakeholder participation is a recurring objective in the NWP (1997), NWA (1998) and the draft NWRS (2002), however guidelines towards achieving this goal are either vague or non-existent. Hence, in 2003 the WRC commissioned research on participation to the EEU, some of whose objectives are to address these issues.

2.5 ECONOMIC VALUATION OF THE ENVIRONMENT

To know the price levels of water-user licenses, levels of charges and fines to be placed on water resources, and to know whether these licenses, charges and fines would actually lead to altered and preferred behavior for the envisaged water resource management at CMA levels, economic valuation studies would be useful. Economic valuation studies can be used, firstly, to approximate the aggregated individual values of local water resources, and thereafter, to approximate levels of effective prices of charges, licenses and fines that can be imposed as incentives or disincentives aimed at protecting water resources against degradation and for efficient economic management.

There are a number of economic valuation methods that could be used to value environmental goods, each with its own strengths and weaknesses (Willis, 2002:635-645). However, the Contingent Valuation (CV) method is one of the most used and discussed in environmental economics literature (Willis, 2002; Hanemann, 1994; Hanley, 2000; Willington, 1998). Often, in environmental valuation studies, the CV

method is used together with other valuation methods[5] to cross check the validity of results (Baustista et al., 2000 and van Zyl et al., 2000:92-98).

Similar to the CV method is the Stated Choice (SC) method and the two form what is referred to as the Stated Preference methods. The CV method is a straight forward method of asking people for the value they are Willing To Pay (WTP) or Accept (WTA) in some hypothetical market where an environmental good would be protected or removed. Compared to WTA, WTP values are considered to be more reliable and realistic as these values do not suffer as much from effects like the 'endowment' effects (i.e. sentimental attachments to goods owned over a long time) or income and substitution effects, etc. (Morrison, 1997; Shogren and Shin, 1994; Hanemann, 1994 cited in Snowball, 1998:58-59). Morrison (1997 in Snowball, 1998:59) argues that sometimes people value goods they have owned for long time much higher than goods recently acquired (for sentimental reasons). On the other hand, where WTP values are regulated by income constraints, WTA values are not. Sometimes, for moral reasons (*warm glow*) WTA values can be infinite and impossible to work with (Snowball, 1998).

The Stated Choice method measures each individual part or attribute of an environmental good. For instance, in a national park, the value of lions can be measured separately from the value of rhinos. When this method is administered a choice experiment card is given to respondents who can have different choice combinations to which they can place different values they are willing to pay (Willis, 2002:642-643).

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[5] The following is a description of three further economic valuation methods by Willis (2002:635-645):
a) The *Mitigating and Averting Expenditure and Opportunity Cost Measures:* the method is often used in measuring the costs of people's averting behaviour e.g. the costs of avoiding pollution effects such costs in avoiding illness (e.g. medical costs). Using the method, the aggregated individual costs of installing air conditioners, medicine consumption, even migration, etc. are investigated, estimated and treated as the equivalent costs for pollution abatement policies and programmes.

b) The *Travel-Cost method:* using this method the economic values of recreational parks, for instance, are normally estimated. The average costs of travelling to a park are taken as equivalent to the price the visitors are willing to pay for the existence of the park or components thereof.

c) *Hedonic Pricing Method:* looks at the increase or drop in prices of assets like houses due to installations of environmental goods or bads. The average price differences between similar assets in different environmental conditions are treated as the price of the environmental good or bad, that buyers are willing to pay or forego.

However, because respondents do not always have the ecological information on the biological interdependencies among species in ecosystems, they do not always place an economic value on this ecological aspect of the environment. On the other hand, however, it can be argued that the provision of such information may be the responsibility of a thorough researcher. In any case, statistical evidence shows that there often always exist *part-whole biases* (discussed shortly) in the administration of environmental economic valuation methods.

The National Oceanic and Atmospheric Administration panel - a US government appointed body composed of prominent economists after the 1988 Exxon oil spillage - was responsible for regulations and assessment of environmental damages (NOAA, 1993 cited in Mundy and Mclean, 1998:294). The panel recommends the use of Contingent Valuation as more useful in measuring a number of environmental goods than is possible when using other methods. The Stated Choice experiment method is more specific about the environmental good it intends to value. It can also value combinations of different attributes of a good and this sophistication makes it harder to administer and its results more difficult to analyse econometrically (Willis, 2002:641-643).

Various problem areas and biases of the CV method have been highlighted by Hanley (2000:241-246) and Willis (2002:635-645):

a. *Part-whole bias/Embedding effects*: A good is valued higher in isolation than it is when forming a part of a bigger bundle, especially if the isolated parts are substitutes for each other. For instance, a tourist may be willing to pay a higher price to see a lion or a rhino on its own and be willing to pay less for that same lion if there was also a rhino to see next to it. Diamond and Hausman (1994:45-65) point out that this problem is against economic theory and probably the biggest criticism for using CV methods. “One possible ‘cure’ for the problem is to ask respondents to bid for the more inclusive good first, and then to apportion some of the total bid to the good that is being valued (i.e. attribute of focus)” (Hanley, 2000:242).

b. *Lexicographic preferences/Protests*: Some respondents in surveys bid infinite WTA values and zero WTP values to the same goods, which means that their choice bids are motivated by reasons other than utilitarian economic ethics in valuing environmental goods. Since such behaviour is not consistent with a model underlying Cost Benefit Analysis (CBA), such respondents should in effect be eliminated from surveys. The rule of thumb is that a respondent's WTP values should be within a 5% range of their overall income (Hanley, 2000:244).

c. *Non-use value*: Some respondents are willing to pay for environmental goods they will never use or see in their lives. Sometimes such bidding can be a product of the information given in the survey itself, as the survey can suddenly provide information about a good that respondents were not aware of before answering the questions asked. Since the lack of information or knowledge about such goods cannot be used to indicate that preferences for such goods do not exist, these values may therefore be used as an indication of "past choice opportunities to motivate information gathering" (Hanley, 2000:243). NOAA's (1993) solution to this problem is to use 50% of the total value estimated, as discussed in the following paragraph.

d. *Aggregating values*: because the values of non-use goods can be very high, considering the fact that anyone in the global population can bid for a good they have never seen, the NOAA suggests that "an ad hoc 50% in the absence of an experimental study undertaken along any given CV method" be used. However, this suggestion, Hanley (2000:243) argues, neglects the different probable calibrations in different contingent markets "across the non-use/use and public/private good continuums".

Overall, CV method is not perfect nor without problems in its administration and data analysis. Hence, the following are the recommendations by the NOAA panel in using CV methods (Hanley, 2000: 244):

1. A dichotomous choice format, as opposed to one value for which to bid, should be used (i.e. researchers should provide minimum and maximum values in WTP);
2. A minimum response rate of 70% from target sample should be achieved;

3. In-person interviews should be employed (not mail), and some role for telephone interviews in pilot studies are acceptable;
4. WTP, not WTA, measures should be sought;
5. After excluding protest bids, a test should be made of whether the WTP values are sensitive to the level of environmental damage (e.g a CBA test);
6. CV method results should be calibrated against experimental findings or results from other methods used concurrently, otherwise a 50% calibration should be applied to CV method values;
7. Respondents should be reminded of their budget constraints (otherwise use 5% of income rule). Further discussions and suggestions on the 5% income rule for developing countries and certain public policies are discussed in chapter five and seven;
8. Respondents should be given *adequate* information about the environmental change in question. Adequate information would have been given when provided values no longer change significantly.

In addition, Hanley (2000:246) and Willington (1998:21-30) recommend that when administering CV methods in developing countries extra precautions should be taken into account and these are:
1. Low income levels of respondents, demand that units other than money should used to value WTP (e.g. labour hours/time, livestock that respondents are willing to forgo);
2. Irregularity of income flows, means that the temporal nature of payments must be accounted for. For this problem, again other forms of payment other than money can be used (e.g. livestock or crops);
3. Contextual impacts or interview settings bias sources, meaning that enumerators should be aware of the effect other listeners have on the respondent's WTP bids made for reasons such as prestige or shame;
4. With regards to cultural views on environmental values, the western notion of CBA as a means of making decisions may fit poorly with cultural beliefs, which could lead to unreliable bids being provided.

Because of the problems mentioned, room for inaccuracies exist if CV methods are carried out without following the guidelines given by the National Oceanic and Atmospheric Administration (NOAA). On the other hand, some valuation methods

are more accurate and appropriate than others depending on the type of environmental good that is being valued, e.g. the travel costs method is better suited to valuing recreational areas (Hanley, 2000:241-246; Willis,2002:635-645).

It is not a surprise that some economists have been critical of the use of some of the methods, especially Contingent Valuation. Diamond and Hausman (1994:45-65) conclude that because of problems like the embedding effect, which is not consistent with economic theory, there is no reason these methods should be used to value environmental good. More importantly, they argue that these methods should not be used to inform government policy (Diamond and Hausman, 1994:46). However, as critical as some economists are of using CV methods, they do not provide or suggest alternative methods or improvements on current CV methods. In fact, many of the problems they cite in criticizing the CV methods are problems that have been subsequently discussed in literatures supporting the 'careful' use of CV methods (Willis, 2002 and Hanley, 2000).

In any case, the CV methods or WTP values elicited in this research are analysed comparatively across demographic variables like areas of enumeration, as discussed in chapter five and six. They are not used to identify some aggregated environmental value, from which to criticise or support the economic rationale of some public policy. The thesis looks at correlations (if they exist) between variables such as individual environmental values (obtained using CV methods) and variables like long term property rights, public participation, education, income, etc. The thesis aims to see whether other variables have an effect or not on how respondents value environmental resources. Hence, in the thesis, the careful use of CV methods for a comparative study is justifiable, with the method's limitations acknowledged. Besides, careful CV methods have been effectively used in the 1980-90s to support government policies both in the developed and developing countries. CV methods were also used in the 1989 Exxon Valdez oil spill court case in Alaska (Hanley, 2000:244).

2.6 AN EXAMPLE OF AN ECONOMIC VALUATION STUDY

An economic valuation study conducted in Madagascar, Ranomafana is particularly appropriate to be used as framework of reference in the KRV because of the similarities in socio-economic conditions of the two areas. Both areas are in poor, rural and developing country contexts and in both these areas government policy measures to protect the environment are being implemented.

Ferraro (2002:262) highlights the challenges that public policy and research are faced with when attempting to protect the environment as well as ensure local economic development. “Just as the failure to measure the benefits of biodiversity protection can lead to sub-optimal development policies, the failure to measure local costs of protection may lead to unworkable conservation strategies”.

For a more accurate measure of local costs borne by Ranomafano residents in implementing an environmental resource (National Park) protection policy, Ferraro (2002) used both semi-structured interviews and household questionnaires to collect qualitative and quantitative data respectively. The qualitative data provided a historical context to the quantitative information gathered through questionnaires. Opportunity costs borne by local residents were estimated over time, not just over a single year. The costs were also characterized both quantitatively and qualitatively (i.e. in local monetary terms and in international rates respectively). Ferraro (2002) concluded that the costs borne by local residents are much higher than the benefits to international communities when a protected area, with restricted access is established.

Like South Africa, Madagascar is a high priority area for biodiversity protection because of a high number of endemic species (biodiversity), a high rate of deforestation and habitat degradation currently taking place there. During the time of the study, Madagascar was undergoing its second phase of a fifteen year National Environmental Action Plan (NEAP). “Residents of Ranomafana were highly reliant on forests for their livelihoods, especially land, biomass for tavy, timber and other forest products” (Ferraro, 2002). Five kilometers around the park were rice-fields, agricultural plots and a total of 26000 people in 100 villages. About 150 people lived in each village.

Data on natural resource exploitation were collected over six months in 22 villages. 490 household questionnaires were completed and 300 interviews were conducted. The questionnaire's quantitative variables included demographic information, forest usage, agricultural activities and socio-economic indicators. The interview based qualitative data included information on local history, land tenure, forest allocation and agricultural techniques. Cross checks were also performed on individual attitudes against age, gender, power and economic categories. Household questionnaires were administered by health workers, as part of another study. Because of this, Ferraro (2002:272-273) concludes that likely biases on wrong information normally given when it is thought government is establishing a protection area were eliminated. The sample was divided into four zones along ecological, economic and cultural qualifiers.

In his research model design, Ferraro (2002) used a Cost Benefit Analysis method to measure the costs borne by local residents in establishing a protected area. He hypothesized that the change in full income equals the change in the level of expenditure on consumption. Therefore, less consumption equals reduced utility. It is the reduced utility for which developers of protected areas and the international community must compensate local residents. However, the distribution of compensation must be allocated equitably because factors like variation in resource use, gender, age, income, etc., differently affect the change in individual and household total income when protected areas are established. Similar trends are reported in South Africa, where poor women without land or other property rights are most dependent on natural resources therefore most negatively affected when their access to natural resources is limited (Andrew et al., 2004:1-28)

The obvious benefits to local communities are the increase in the level of tourism (however this is seasonal), increased watershed protection (e.g. flood control), and better micro climate control. However, tourism benefits, in immediate monetary terms, are only captured by a few residents who live close to main roads. The same trend is also observed in other developing country studies (Ferraro, 2002:271). On the negative side, tourism sometimes has an increasing effect on local prices. In that sense, tourism may become a cost and not a benefit to local residents.

Overall, there are other long term benefits from environmental protection, however, local residents may not see these benefits as immediate benefits affecting their own lives and hence may not support environmental protection policies. The neoclassical economic assumptions of self-interested human behaviour are valid for this case study, where compensation for immediate costs (i.e. economic incentive) is needed for the local support of environmental policies.

A similar approach, on the need for economic incentives in the form of employment creating projects for the KRV, is discussed in chapter six. The method of collecting and analyzing data and the arguments discussed in the Madagascar case study have, to some extent, informed the conceptual model of research and methods used in the Kat River Valley case study, e.g. the extensive use of household surveys.

The Ranomafana area is in many ways similar to the Kat River Valley, where a large number of unemployed rural people depended on the river's natural resources for their livelihood, including water for drinking and other purposes. There are also high levels of agricultural activities in both Ranomafana and KRV (as related in chapter five). However, the differences between the KRV and Ranomafana case studies are that in Ranomafana a policy on environmental protection or park creation was analysed and in the KRV the NWP (1997) policy for water resource protection and other objectives was analysed. Methodologically, in Ranomafana a Cost Benefit Analysis were used to measure compensation costs, whereas a household demographic survey and a Contingent Valuation methods were used in the KRV to document prevalent social attitudes and economic activities and their likely effects on the NWP (1997) implementation process.

2.7 CONCLUSION

This literature review began by discussing environmental awareness campaigns and developments in the international water arena. The international context has influenced and informed the South African trends in water resource conservation through equitable access. As water and other natural resources have become scarcer at a global scale, the need to treat this problem both at an international and national

level, it has been argued (Constanza, 1996:978-990), needs the collaborative work between ecological and economic models.

In response to water shortage challenges, the South African National Water Policy of 1997 proposes as its objectives, the sustainable use of water resources and the improved local stakeholder participation as well as economic empowerment in water resource management. Another reason to elicit a critical level of stakeholder participation is that water resources are public goods and such resources require political processes for their management (Dales, 1994). The characteristics of water resources as public goods have resulted in the design of strategic models such as those of Palmer, et al (2003:44-45). Such models are aimed at protecting water resources and enhancing public participation in a flexible and reviewable manner.

The thesis uses CV methods to measure the effects that property rights, across a number of selected demographic variables, have on the WTP values and the participation of stakeholders with regard to water resource protection and management. The use of CV methods, with their limitations (Willis, 2002:635-645 and Hanley, 2000:241-246), is justified in this research because environmental economic values are used only comparatively. The research methods and philosophical approaches used in the thesis are similar to those used in Ranomafana, Madagascar (Ferraro, 2002), largely because Ranomafana has geographical and socio-economic indicators that are similar to the Kat River Valley.

Game theoretic models, on whose assumptions the research question about the relationship between property rights, environmental economic values and participation is based, are discussed. These models are discussed with regards to their potential usefulness in the NWP (1997) implementation process.

CHAPTER 3 - THEORETICAL FRAMEWORK

3.1 INTRODUCTION

In this chapter definitions of property rights are discussed and different perspectives on common property rights are explored. Three influential game theoretic models (the tragedy of the commons, the prisoner's dilemma and collective action) are presented and how these affect government policies in the use of common resources is discussed. From the game theoretic models, an institutional model is derived and proposed as the framework for the thesis in the context of South Africa's National Water Resource Strategy (NWRS) (2002). Finally, a discussion is presented on how the game theoretic institutional model was applied in the household survey design, which explored the roles of property rights and environmental economic values on public participation.

3.2 PROPERTY RIGHTS REGIMES

Property rights are legal user rights owned by individuals or groups to use objects or property in some legally specified manner. Economically, "(a) primary function of property rights is that of guiding incentives to achieve a greater internalisation of externalities" (Demsetz, 1967:348). Property rights as user-rights are exclusive and legally prevent other people from using the reserved property (Dales, 1968:52-59 and 1994:174-182). However, "(i)t is when we come to various forms of public property rights that the concept of property rights becomes rather more tenuous - and yet, paradoxically, even more enlightening" (Dales, 1968:51). Publicly owned property rights are also referred to as common property rights by authors like Quiggin (1988). In any case, on some continuum beginning from 'no property rights' (open access) to well defined private property rights, regimes of rights exist that will be explained.

But, before these regimes are explained it should be explicitly stated that, in the discussion, commonly used property, with unrestricted access, is not presented as the same concept of common property rights. This view of common property rights is different to that of Dales (1994:174-187), where he defines common property rights as meaning open access to all. However, it is Ostrom's (1990:1-23) definition of

common property rights that is adopted, where common rights are viewed as restrictions to some users, outside the group membership. In fact, it is contradictory to speak of common property rights as 'unrestricted property', because to mention rights would automatically signal some kind of legal, moral or even customary restraint or restriction from using some property by those without such rights (Demsetz, 1967:347).

'Open access' means that for some good, no restriction of use exists for anyone or any group. Thus to this type of property (open access) the saying that "everyone's property is no one's property" (Dales, 1968:53) is applicable. However, the same phrase cannot apply to common property rights as defined by Ostrom (1990:1-23).

According to Ostrom (1990:1-23), common property rights or ownership refer to rights that are shared by a group of people or a community, and they exclude non community members. On the other hand, Dales' (1994:178) definition is that "(a) common property asset is one that can be used by everyone, for almost any purpose, at zero cost". Dales' (1994:178) definition of common property rights is one associated with 'the tragedy of the commons' thesis. Therefore, in institutional economics, Dales' (1994) neoclassical economic view of common property rights is questioned (Ostrom, 1990:1-23; Quiggin, 1988:1071-1085; Weschler, 1968 and Walker, 1990 in Ostrom, 1990:1-23). The following sections discuss reasons why the neoclassical view is questionable and at the same time propose an alternative definition of common property rights, which is the local and institutional management of Common Pool Resources (CPR).

Next in line along the rights definition continuum, Dales (1994:179) defines another form of property rights, which he refers to as 'restricted common property rights'. Dales' (1994) discussion makes a distinction between restricted common property rights and unrestricted property rights. However, as mentioned, the current discussion, which has adopted Ostrom's (1990) view, does not make such a distinction. Therefore, both unrestricted property rights and common property rights are here treated as the same thing. With respect to restricted property rights, Dales (1994:179) further explains that when common pool resources are restricted to identified potential users, they become 'status or fixed tenure ownership'. "Such ownership guarantees

excludability of use to the parties authorised to use property, but these rights are *not* transferable". This also means that such rights cannot be traded in open markets and there is no price system that is associated with them (Dales, 1994:179).

However, when restricted property rights are made transferable through a creation of 'pseudo-markets', they are referred to as 'transferable property rights', forming the third regime of property rights along the continuum. The transferability of user rights can be made possible when a government or community authority, through a political decision, decides to make tradable such restricted property rights (i.e. through the issuing of licences or permits in the use of public goods like water (Dales, 1994:180-185). In South Africa, the creation of a 'pseudo water resource market' is envisioned in the NWRS (2002), where licences to water use will be allocated at a price within Water Management Areas (WMAs). The fourth and last regime of rights, as defined by Dales (1994:184-185) are 'private property rights'. These exist for private goods, which are both excludable and divisible. These two concepts were defined in chapter two. For private goods, it is easy for private markets to emerge. In any case, the current discussion is concerned mainly with common property rights, where user-rights are restricted from non group or community members (Ostrom, 1990 and 1992). The common property rights regime is also discussed within institutional bargaining forums context in water resource management. Such a bargaining process also forms a part of collective or public action in resource management strategies.

3.3 COLLECTIVE ACTION IN THE MANAGEMENT OF COMMON PROPERTY

The three influential models on collective action in the management of common resources chosen for the discussion are: a) Hardin's (1968) 'tragedy of the commons', b) the prisoner's dilemma (game theory) (Dawes, 1973, 1975 cited in Ostrom, 1990:3) and c) the logic of collective action (Olson, 1965). What these models have in common is their acceptance and use of neoclassical economic assumptions of self interested and rational individuals (Fryer, 2003:1-15), whose opportunistic behaviour in the use of common pool resources leads to inefficient social welfare outcomes. Extreme inefficient outcomes can be the degradation of the common pool resources and their extinction (Ostrom, 1990:8 and Dales, 1968:50-59).

3.3.1 The tragedy of the commons

The tragedy of the commons thesis asks the reader to imagine a hypothetical grazing pasture open to all community herders. It should be assumed that zero property rights,to the use of the pasture (open access), exists, which is the same as Dales' (1994) definition of common property rights. "Each herder is motivated to add more and more animals (to the pasture) because he receives the direct benefit of his own animals (private benefit) and bears only a share of the costs resulting from overgrazing" (Ostrom, 1990:2). This is the root of a negative externality, where resource consumption, as illustrated in fig 3.1, occurs at **Ea** and where Marginal Social Costs (MSC) are higher than Marginal Private Costs (MPC) (Black et al., 1999:27).

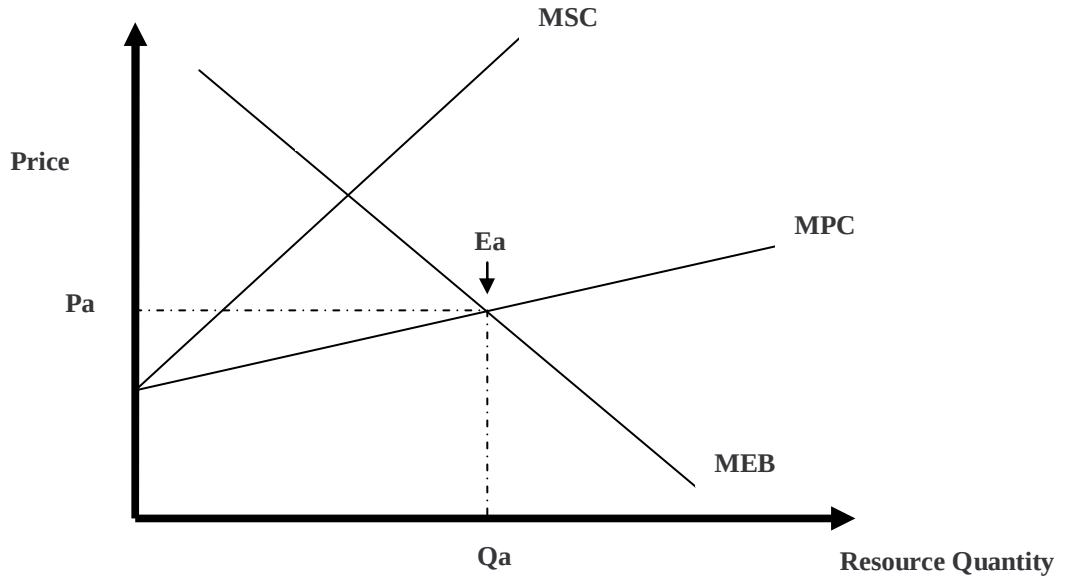


Fig 3.1 Negative Externality (MSC-MPC)
(Source: Black et al., 1999:27)

When the quantity of resources consumed is at Ea, over time the resource will be depleted because what individuals are paying for the resource use is less than what they are supposed to pay as a community. Therefore, "(t)herein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination toward which all men rush, each pursuing

his own best interest in a society that believes in the freedom of the commons" (Hardin, 1968: 1244). The same model was envisioned in Aristotle's (Politics book ii) and Hobbes's theory of 'the state of nature' (cited in Ostrom, 1990:2-3) where in pursuit of self interests individuals fight one another to survive. In some environmental economics literature (Cropper and Griffiths, 1994; Norman, 1984 and Thomson, 1977 cited in Ostrom, 1990:3) evidence of diminishing tropical forests for firewood and other uses with increasing global populations is cited as proof of the pervasive nature of 'the tragedy of the commons' (Ostrom, 1990:23).

3.3.2 The prisoner's dilemma

The prisoner's dilemma encapsulates benefits and costs for self-interested individual behaviour (Ostrom, 1990:1-23 and Kuhn, 2003). If the private individual gains from acting in a selfish manner outweigh the gains from acting cooperatively, individuals will act selfishly. In the prisoner's dilemma, the constraints to two herders or prisoners are that they cannot predict the actions of the other herder and they cannot leave the pasture (immobility). However, they both have information about the private and collective gains that could be made from either cooperating towards or defecting from a socially efficient use of the pasture (Kuhn, 2003).

To help explain the prisoner's dilemma, Ostrom (1990:3-5) asks the reader to assume that the grazing capacity of some pasture is L. Therefore each herder, with equal power distribution, must use L/2 capacity for the pasture to be maintained at an efficient and sustainable level (i.e. cooperation). Defection would happen when either one of the herders uses more than the agreed upon L/2 capacity. In the long run, this defection strategy will lead to overgrazing. On the other hand, if both herders cooperate and use their L/2 rations they would each make a ten point profit, but if they both defect they gain zero point profits. The defection strategy is a dominant strategy for the two herders because each self interested herder cannot predict the other's strategy but hopes the other would cooperate, and when only one of the herders cooperates the defector makes 11 point profits where the cooperator makes only 1 point profits. Therefore, in comparison, defection pays more than cooperation to individuals and this makes the defection strategy dominant for self-interested herders, as illustrated in table 3.1. Each herder hopes to make the highest gains from

free-riding the pastoral arrangement (i.e. gains without pay). In table 3.1, the four possible gains and/or losses from two possible actions from the herders are depicted (Ostrom, 1990). Another representation of this game as described by Kuhn (2003) was presented in chapter two.

Table 3.1 The prisoner's dilemma

PROFITS			
Herders' actions	Both Cooperate	One Defects / One Cooperate	Both Defect
Herder one	10	-1 or 11	0
Herder two	10	11 or -1	0

(Adapted from Ostrom, 1990:4)

From the table, it pays more to defect while the other player cooperates (11 point profits). The game's outcomes are insightful because it depicts neoclassical assumptions about rational selfish behaviour leading to *irrational* outcomes for the collective (Ostrom, 1990:5). However, this is the case, as discussed in chapter two, because of the nature of public goods, for which market failures are prevalent.

3.3.3 The logic of collective action

Olson (1965) in *the logic of collective action* thesis challenges Truman's (1958 in Ostrom 1990:5-6) *group theory* "that individuals with common interests would voluntarily act so as to try to further those interests". Olson's (1965) challenge shares the same pessimistic conclusions of the '*tragedy of the commons'* and '*the prisoner's dilemma'*, that self interested individuals' use of common property lead to inefficient social outcomes.

> "The idea that groups tend to act in support of their group interests is supposed to follow logically from this widely accepted premise of rational, self interested behaviour. In other words, if the members of some group have a common interest or object, and if they would all be better off if that objective were achieved, it has been thought to follow that the individuals in that group would, if they were rational and self interested, act to achieve that objective" (Olson, 1965:1).

However, for Olson (1965:2), the conclusion is not true unless the group in question is small, or some external authority coerces individuals to act in their collective interest. Olson's (1965) mention of a coercive force advocates government intervention as another effective measure in common pool resource management.

3.3.4 Reflection on the three models

The central theme in the three models is that the free rider problem always exists in the use of common pool resources. "Whenever one person cannot be excluded from the benefits that others provide, each person is motivated not to contribute to the joint effort, the collective benefit will not be produced" (Ostrom, 1990:6).

Importantly, for government policy formulation, the 'metaphoric' use of discussed models or theses, applying generically to all situations where common pool resources exist may lead to unintended and/or unwelcome consequences. If no empirical evidence or data are gathered on what institutional and socio-economic conditions prevail in different settings, application of policy using the models unquestioned may lead to inefficient social outcomes (Ostrom, 1990:10-23). It was earlier pointed out that the models assume as their premise that common property rights are equivalent to open access for all (Dales, 1994:174-187). However, this is not always true (Ostrom, 1990:1-23 and Quiggin, 1988). In the case of the prisoner's dilemma, the immobility constraint is also assumed without questioning, but this assumption is not always relevant or even realistic in some real life contexts.

In real life policy applications, the metaphorical application of the theories has led to extreme policies that either advocate central government control of common resource use, especially in developing countries (Heilbroner, 1974) or, at the other extreme, the imposition of private property rights and the creation of full pseudo-markets (Demsetz, 1967: 347-359). The fallibility of these extreme policy measures are discussed in the following section.

3.4 GENERIC POLICIES BASED ON THE GAME THEORETIC FRAMEWORK

In policies informed by the game theoretic models, governments often opt for centralised control of common pool resources at one extreme and complete privatisation at the other extreme (Ostrom, 1990:8-12). If government control is adopted as effective economic policy, it is assumed that the government has accurate information on the yield of resources, full monitoring capabilities, effective and reliable sanctioning with limited or zero administrative costs. If some of these assumptions do not hold true, such that defecting on the part of one player pays more than cooperating, the free-rider problem emerges and the government policy may fail (Ostrom, 1990:8-12).

In the prisoner's dilemma, Ostrom (1990:8-12) further asked the reader to imagine that the government imposes a 2 profit points penalty (i.e. 20% of cooperation profits) if defectors are caught. With the penalty of 2 profit points reduction, table 3.1 slightly changes to table 3.2.

Table 3.2 The prisoner's dilemma with a 2 point penalty

PROFITS			
Herders' actions	Both Cooperate	One Defects One Cooperates	Both Defect
Herder one	10	-1-2x or 11-2y	-2y
Herder two	10	11-2y or -1-2x	-2y

(Adapted from Ostrom, 1990:11)

Where:

y = is the probability of punishing defection (right move)

x = is the probability of punishing cooperation (wrong move)

And therefore

$y + x = 1$

The probability of punishing defectors is y (i.e. the right move by authority), and therefore the probability of failing to punish defectors is 1-y. On the other hand, the probability of punishing cooperation (i.e. a mistake by authority) is x, and therefore the probability of not punishing cooperation is 1-x. In table 3.2, if the government has

accurate information on the resource yield and for monitoring, y = 1 and x = 0. By substituting for the x and y values in table 3.2, the gains from cooperation are higher than the gains from defection (10 > 9). Therefore, the dominant strategy becomes cooperation. Hence, if the assumptions about the accuracy of the information possessed by the government on the resource yield and its capability to monitor players hold true, using central government control in common resources would be the least expensive and effective policy measure. However, this conclusion still does not account for administrative costs incurred by the government or any other external agency performing monitoring duties. In effect, the administrative costs are externalised to an external agency outside the community. Later in the chapter a discussion by Ostrom (1990:15-18) is presented on why and how administrative costs should be internalised. What should be emphasised at this point is that by varying the values of e (transaction costs), y, x and (P- penalty value), different outcomes on efficiency can be achieved, and these potential outcomes would require different policy measures. In short, advocating centralised control of common resources (Hardin, 1978:314 in Ostrom, 1990:8-12) is not always an appropriate policy measure for all contexts.

The other extreme policy measures of managing common resources by imposing private property rights and creating pseudo markets are also influenced by the tragedy of the commons and the prisoner's dilemma models and these are advocated by analysts like Demsetz (1967:347-359). These analysts advocate the imposition of private rights in the use of common resources as the only appropriate solution that should be applied in isolation (Ostrom, 1990:12-14). The same models are used to come up with varying policy solutions.

For a pasture, the introduction of private property rights is easier than it would be to fluids like water and air (Dales, 1968 and 1994). Between the two herders in the prisoner's dilemma, land can be divided into halves. However, the assumptions in the approach would be that the terrain and prevailing conditions, like the weather, are homogenous at any point in time (Ostrom, 1990:13). But in reality the probability of homogeneity in nature is very low. If, on the other hand, conditions change too dramatically over short periods of time both herders are impoverished (Ostrom,

1990:13-14), probably because their risk is no longer spread over a large area of land and they no longer enjoy economies of scale (Pindyck and Rubinfeld, 1998:159-162). Problems may still exist even if the herders decide to sell bumper crops to each other, because the creation of such a market would still require administration costs. Administrative costs would have to be directly borne and accounted for by the two herders. In reality, where there are more than two herders, with unequal information, the administrative and bargaining costs to set up such a market may be too high, compared to the perceived benefits from such an action (see figure 6.1). Hence, a disincentive to market creation may exist (i.e. market failure) (Fryer, 2003:162-180). This reiterates the fact that a blind advocacy for the imposition of private property rights in managing common resources for any context would be inappropriate.

Neither full central government nor privatisation solutions should be imposed as fitting solutions to all contexts. Policy formulators should avoid imposing generic policies, especially created from outside local contexts. Policy solutions for the management of common resources need to be dynamic and responsive to changing internal and external social and economic environments (Quiggin, 1988: 1071-87; Sethi and Somanathan, 1996:766-770). The following section discusses how such responsive policy solutions, locally designed, can be formulated through creating local socio-economic institutions or by efficiently using ones that already exist. The approach of using socio-economic institutions still accounts for game theoretic frameworks of defecting selfish individuals. But more importantly, the institutional approach also accounts for the internalisation of administrative and bargaining costs to local residents in setting up operational rules for resource management (Ostrom, 1990:15-18).

3.5 THE GAME THEORETIC INSTITUTIONAL APPROACH

The institutional arrangement as an alternative and more efficient approach can be explained by extending and modifying arguments already made using the prisoner's dilemma. However, the model also accounts for the creation of local institutions that have as foundations unanimously agreed upon operational rules to ensure equity, efficiency and sustainability of resources (Ostrom, 1992:10-23). The institutional model is based on the creation of responsive local governance. Ostrom (1990; 1992)

advocates the introduction of binding contracts between herders or players. Herders go through a negotiation phase before placing animals on the common pasture. It is assumed that herders know the capacity of the pasture better than any external agent. However, such an assumption is not always true and in a later discussion this point will be elaborated upon. Another assumption is that herders are better suited at monitoring each other than outside agents. It is to each herder's benefit to carefully monitor the other's actions. The latter assumption seems reasonable applied to self interested and competitive individuals. The negotiated binding contract is only enforceable once both herders have unanimously agreed on its conditions or operational rules, which are also reviewable. The costs (e) of negotiating and enforcing the contract are borne by the herders (i.e. the internalisation of administrative costs). The costs (e) must be low enough that gains from cooperation are greater than gains from defecting, which also depends on the punishment price (P) and the value of y (effective monitoring information) (Demsetz, 1967:348). Because the monitoring task is performed by the herders (locals) and because the herders are more likely to have better information than outside agents, the institutional model assumes that the value of y is closer to 1 ($y \sim 1$ and $x \sim 0$) than otherwise (Ostrom, 1990:15-18).

Part of enforcing the contract requires dispute resolution procedures with a neutral agent/body hired to perform arbitration functions. The costs of arbitration are captured by the value (e). Ostrom (1990:16) argues that a neutral arbitration process can be cheaper than any civil court proceedings. This may be the case where operational rules are easy to establish and are easily enforceable once all stakeholders have endorsed them, as opposed to cases where rules may be imposed by outsiders and could be resisted for political reasons. In any case, both herders only agree to have a contract enforceable if they can afford to pay for its enforcement (arbitration), therefore they choose the lowest (e) value as equilibrium (Ostrom, 1990:16-17). The lowest value of (e) is crucial and concurrently with (P) determines whether the binding contract would be sustainable. These values obviously differ from one social setting to the next. In settings where information is unevenly distributed and there are social inequalities and social divisions (non homogenous communities), administrative costs are likely to be high.

"In general, transaction costs can be large relative to gains because of 'natural' difficulties in trading or they can be large because of legal reasons" (Demsetz, 1967:348). In such settings, social cohesion is harder to achieve and negotiating a binding contract is an expensive undertaking. Bardhan (1993) discusses related issues about the price of democracy.

These local contracts are similar to arbitration approaches used in professional athletic leagues (IAAF, 2004), and in the South African labour market, e.g. the Commission for Conciliation Mediation and Arbitration (CCMA, 2004). In table 3.2, if profits from cooperation are (10 - e/2), where e captures transaction costs for negotiating operational rules and setting up a dispute resolution body, and the (10 - e/2) profits are greater than profits from defective behaviour, a sustainable local institution would have been established. In this institution, cooperation would be the dominant strategy and administrative costs would be internalised. The locally chosen (e) value is also dependent on the chosen penalty for defectors. With a sustainable local institution (table 3.2), the resource quantity consumed, compared to table 3.1, is lower and at a higher price (i.e. the price for democracy). Such a quantity and price correspond to point **Eb** in fig 3.2 and the price Pb.

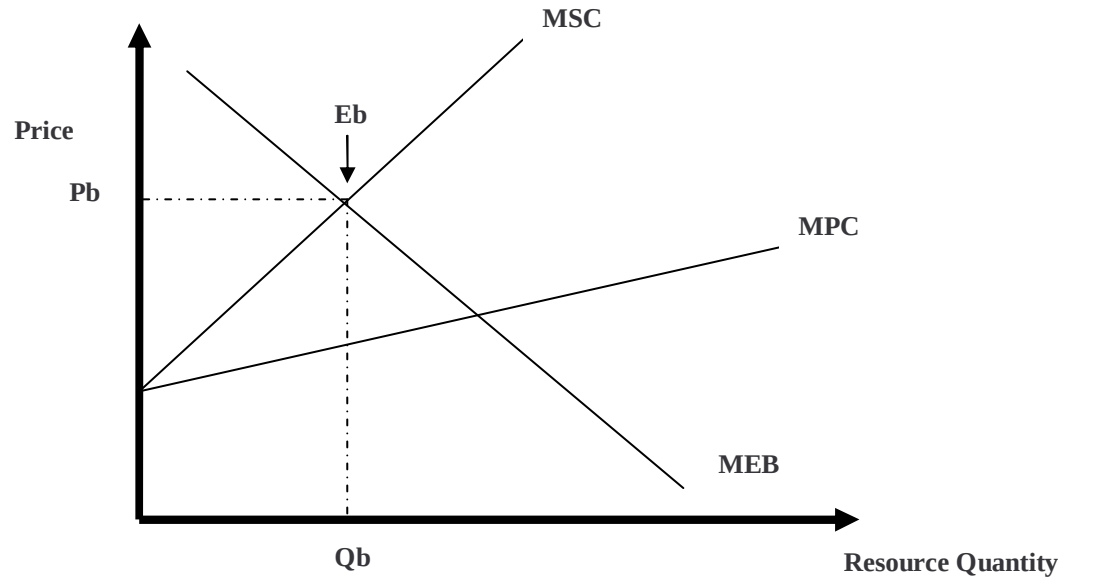


Fig 3.2 Determining the Sustainable Resource Consumption Point (**Eb**)
(Source Black et al., 1999:29)

3.6 REFLECTION ON THE GAME THEORETIC AND INSTITUTIONAL MODEL

A locally designed institutional arrangement (i.e. a binding contract) can only be agreed upon by stakeholders if its outcomes are *seen* to be fair and affordable to all involved. The model assumes that all stakeholders have better resource yield and monitoring information than outside agents. However, this is not always true and where total information (i.e. bargaining power) is distributed unevenly among stakeholders, unequal distribution of resources would be the achieved outcome (Fryer, 2003:133-153). In the long run, an institutional arrangement based on uneven information distribution may not be politically sustainable, which means the long run value of (e) may be higher than perceived (e) in the short run. In any case, inequitable social contracts are also more expensive because they require costly constant revisions. The NWP (1997), whose one objective is equity, also views inequitable contracts as socially unsustainable and not preferable. But in neoclassical economics inequitable contracts may still be *pareto* efficient, where *pareto* efficiency is not the same concept as social justice (Fryer, 2003:133-135).

In situations where inequalities exist, social scientists and philosophers may see the role of governments as to evenly distribute information (e.g. through education). Such a government actions would be to rearrange the initial bargaining positions for all stakeholders to achieve a social agreement deemed socially equitable (Fryer, 2003:133-135). However, governments' roles of 'leveling the playing fields' would be the only necessary role in scenarios where only informational problems exist.

Because society is continuously evolving it would be a mistake to view the government's role as an once off remedy. In an historically evolving society, while some members of the population are empowered through government interventions (e.g. education policies), other sections may at the same time be dis-empowered through other social processes or policies. Therefore, the government roles of empowering less empowered stakeholders should also be seen as continuous for sustainable equity.

The monitoring function is a responsibility of local stakeholders who benefit directly from monitoring defectors. The individual benefits from monitoring act as incentives

for self monitoring by stakeholders. Where monitoring is done by locals, administrative costs would rise, increasing the value of (e). Therefore, the rising (e) costs may lead to raising the penalty levels that communities choose for the maintenance of cooperative behaviour as the dominant strategy. In any case, when all administrative costs are internalised and cooperative behaviour is still the preferred strategy, a sustainable institutional arrangement for managing common resources would have been set up (Ostrom, 1990:18).

However, information on the yield of the resource is not always available or equally available to all stakeholders in all contexts, hence uneven monitoring and compliance may also be the non-preferred outcome. If uneven monitoring is an outcome, the arguments for corrective government roles (e.g. through education) during bargaining processes would apply. Otherwise if stakeholders do not share and take equal information to the bargaining platforms and cannot evenly or equitably perform the monitoring taks, the (e) value may rise unnecessarily. In some scenarios the (e) value may rise so high that unanimously accepted binding contracts are not possible to achieve. These pessimistic scenarios may serve as justification for central government's roles for common resource management.

The important point in the preceding discussion is that different case scenarios require different policy applications with different levels of government intervention, at different times in history. Public policy should not be metaphorically or generically developed. A single policy solution is not necessarily appropriate in and applicable to all contexts (Ostrom, 1990:23). Different social contexts lead to different socio-economic institutional arrangements with different operational rules as binding contracts, and as contexts change different policies are required.

3.7 APPLICATION OF THE GAME THEORETIC FRAMEWORK

A game theoretic model that encourages the full participation of all stakeholders as empowered or equal players in negotiating a binding contract is proposed as a framework against which public participation trends are analysed, theoretical arguments and recommendations are offered. According to the model, the number of stakeholder interactions (time spent together as prisoners or herders) positively affects

stakeholder cooperation (Sethi and Somanathan, 1996:766-787 and Quiggin, 1988:1071-1087). The time spent together by the prisoners is equivalent to the Mobility Constraint (MC) of prisoners who are locked in long term relationships. High MC encourages prisoners or herders to reach workable and fair contracts (Sethi and Somanathan, 1996:766-770).

To measure the effects of the MC variable, it is proposed that proxy variables like defined and perceived property rights (PR) are explored. Long-term local investments can be viewed as long term commitments to areas where investments are made. In this theoretical framework, defined and perceived property rights would increase cooperative behaviour. Such property rights may include rights to land (land tenure), water, irrigation equipment, historical attachments, even future expected land rights (e.g. restitutions). Quantifying these property rights may serve as an indirect measure of cooperative behaviour (Sethi and Somanathan, 1996:766-770).

On the other hand, Cooperative Behaviour (CB) can be viewed as positive stakeholder participation (PP), where (PP) represents both active participation and commitment to the process of establishing a socially binding contract (e.g. high willingness to pay values (WTP)). Once a binding contract has been established, (PP) on the part of stakeholders could mean respecting the social contract (i.e. non defective behaviour).

Therefore, applying the game theoretic model in exploring roles that property rights play on public participation would mean exploring the relationship between the PR and the PP variables. According to the model, a positive correlation is expected between the PR and PP or WTP variables, where PP or WTP (y-axis) is dependent on PR (x-axis). Therefore, if the objectives of the NWRS (2002) are to increase public participation in managing common resources, the Department of Water Affairs and Forestry (DWAF) has to explore ways of manipulating property rights to improve and increase the PR variable for enhanced PP or WTP values.

The statement of hypothesis is that, the individual's level of public participation or WTP is a function of his/her property rights:

PP or WTP = f (PR, A) and PP = a + b PR……(1)

where:

PP = positive public participation, WTP= Willingness to pay values

PR = well defined and/or perceived property rights

A = other influencing variables

a = constant (y intercept)

b = gradient of a linear fit

3.8 SUMMARY OUTLINE

In this chapter property rights regimes were explained and different perspectives on common property rights in these regimes were discussed. Three influential theoretical models (the tragedy of the commons, the prisoner's dilemma and collective action) were presented and how these affect government policies on the use of common resources were discussed. From the game theoretic models, a sustainable institutional model was discussed and proposed as an analytical framework for this thesis. Finally, a discussion and proposal of the hypothesis for the thesis was presented, exploring the likely positive effects that property rights have on public participation and/or willingness to pay values.

CHAPTER 4 - METHODS

4.1 INTRODUCTION

The research conceptual design (diagram 4.1), based on the theoretical assumptions in chapter two, was used as framework for collecting, analysing and interpreting data as well as for developing and discussing the recommendations for future research and policy implementation in chapters five, six and seven. In the design, government policies are seen as outside interventions aimed at manipulating socio-economic demographic data for preferred social behaviour. As far as the National Water Policy (NWP) of 1997 is concerned, public participation in establishing and managing water institutions is the preferred behaviour. However, such behaviour would require, among other things, that individuals have acquired some level of school education to be able to even read the policy written in a non mother tongue. Hence, government or other external policies should work in concert for a successful water policy implementation process.

In terms of the conceptual model of research, information pertaining to property rights, human and social capital, labour activities, demographics, etc. needed to be collected and analysed for its effects on participation trends. These effects were then used to develop policy recommendations aimed at improving participation levels.

In this chapter a research conceptual design adopted for the study is illustrated and a breakdown and descriptive explanation of the research methods used are presented. The methods are for data collection and analysis. Qualitative data collection methods, such as interviews, preceded and informed the methods used collecting quantitative data e.g. the household socio-economic survey. The insight gained from, literature, interviews with various stakeholders (e.g. WUA, CF members) in the KRV and researchers at Rhodes University (e.g. EEU, the Economics Department and IWR staff) informed the type and format of questions asked in the questionnaire. After data were analysed, a Kat River Valley (KRV) focus group was convened to relate and discuss data interpretations with residents and local government representatives.

4.2 THE CONCEPTUAL MODEL OF RESEARCH

Diagram 4.1 illustrates the conceptual model of research formulated for the Kat River Valley (KRV) study. In the diagram, the KRV is the **case study** and the National Water Policy (NWP, 1997) objectives are illustrated by the **participation** and **social contract** columns. The external interventions acting on the KRV (e.g. national government policies) are illustrated in the first column. Using the game theoretical assumptions, the major variables chosen for interrogation (e.g. property rights) are in the second column. The reviewable process of policy implementation strategies is captured by the diagram's cyclic nature.

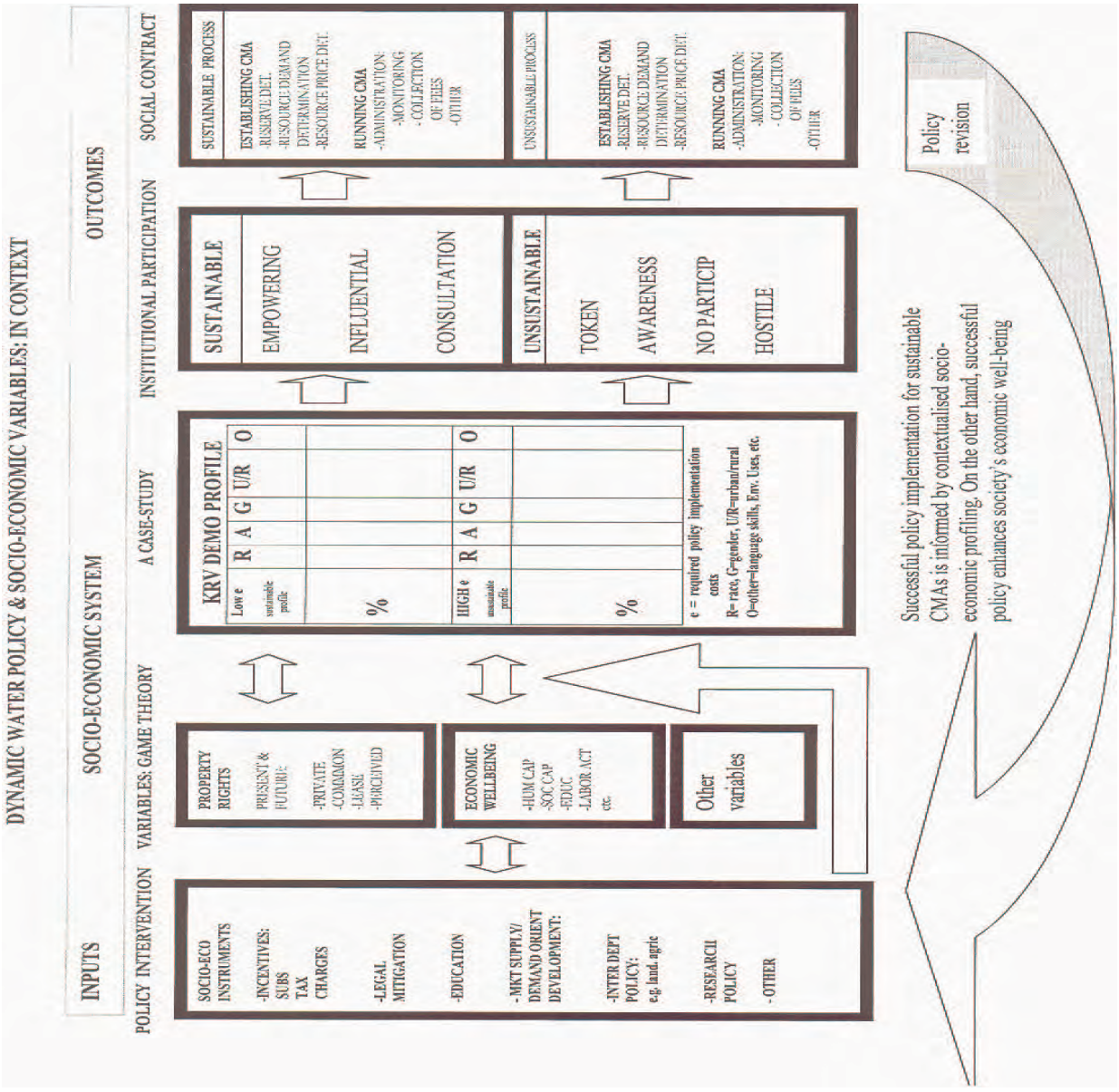


Diagram 4.1 The conceptual model of research

4.3 RESEARCH METHODS

Information pertaining to the National Water Act (NWA) No. 36 of 1998 and water policy implementation strategies was gathered from literature and seminars organised by the Department of Water Affairs and Forestry (DWAF) and the Water Research Commission (WRC). The information specific to the KRV was gathered through attending meetings of the KRV water bodies. Semi-structured interviews with government officials and representatives of local water institutions and researchers were conducted. Finally, a systematic-random household survey was conducted in three different KRV communities, namely with commercial farmers spread across the Mid to Lower KRV, villages in the Upper KRV and the Seymour township.

The household survey was divided into two phases: a pilot study the results of which were analysed for improving the survey questionnaire and thereafter the main survey was conducted. The collected data were described and complemented by the South African Census 2001 data (Stats S.A., 2004) and secondary data from literature. The data were interpreted using theoretical assumptions and the NWP (1997) as a framework.

4.4 THE DATA COLLECTION PROCESS

Collecting information on the NWP and its implementation strategies

Two seminars organised by the DWAF and WRC were attended before the household survey was conducted. The February 2004 seminar, organised by the WRC, focused on DWAF's policies for water resource management and implementation challenges from Water Management Areas. The second seminar, in April 2004, organised by DWAF, focussed on implementation strategies, challenges presented by current institutional arrangements, lack of public participation, and pricing strategies for use and consumption of water resources. In both seminars, the water policy and its implementation strategies were presented in relatively accessible formats. The challenges in the interpretation of the NWA (1998) were identified for improved broader public participation.

The interpretation of the NWP (1997) and the National Water Resource Strategy (2002) by academic researchers was sought through bi-weekly meetings with the staff of the Environmental Education Unit (EEU) and the Institute for Water Research (IWR) at Rhodes University.

Collecting KRV qualitative information

To collect broad information on numerous issues facing different communities in the KRV five meetings of water resource organisations were attended. Three Water User Association (WUA), one Catchment Forum (CF) and one Land Care Project (LCP) meetings were attended. Five face-to-face semi-structured interviews with executive members of the WUA, CF and the LCP were conducted. Three of the interviewees were commercial farmers and members of the WUA, of whom two were white and one was black from the ex-Ciskei development programme. The other interviewees were members of the CF and LCP. Two mail interviews were conducted with the provincial director at DWAF and a senior researcher at DLA provincial.

Collecting quantitative data

For a general preview of the socio-economic conditions in the KRV, data from the 2001 census and academic literature were synthesised and presented in chapter five, section 5.2 and 5.3. Quantitative data specific to the water resource use, property rights and individual environmental economic values were collected through the household survey. The questionnaire's (Appendix 13) objective was to obtain data to inform current relationships between the variables identified in the research assumption, which are:

a) Public Participation;
a) Individual Environmental Economic Values using WTP method, and
b) Property Rights.

In addition, the questionnaire also gathered demographic information and information on individuals' attitudes towards the NWP's (1997) objectives.

Sampling

For the main survey, systematic and stratified sampling techniques (Stoker, 1984:3-9) were used to collect information at household and individual levels. Rural villages and Seymour township were divided into five and three zones respectively on maps used for town-planning. From each of the zones, a proportionate number of houses (using the map) were systematically identified for interviews. Black and white Commercial farmers' households were selected for interviews. In aggregate the three samples: a) the commercial farmers; b) rural village residents and c) township residents, formed the universal sample.

As shown in Appendix 2, the sub-sample a) (commercial farmers) is distributed along the banks of the Kat River from the towns of Balfour to Fort Beaufort, b) (village respondents) is constituted by Fairburn, Hertzog, Tamboeksvlei, Ekuphumileni and Balfour villages, and c) is in Seymour township. The social and economic attributes used to differentiate the three sub-samples before the main survey was conducted were:

a) the type and levels of available public infrastructure (e.g. roads, sanitation facilities, etc),
b) the type and levels of labour activities (i.e. commercial versus subsistence farming),
c) rural versus semi-urban areas (i.e. villages versus township dwellers).

A detailed socio-economic presentation of these areas is presented in chapter five section 5.1 to 5.3.

Ten (out of thirty) commercial farmers (Nahamba, 2004) spread over a large geographical area, including the lower KRV, were selected. Rural villagers and Seymour residents were systematically sampled (using maps) to ensure representativeness. "Since elements of the population are drawn at equal 'distances' [in stratified and systematic sampling], this sampling method does not run the risk of not having a large part of the population represented in the sample" (Stoker, 1984:6). In total, 234 households formed part of the universal sample, with over a hundred each from the villages and Seymour respectively.

Phrasing of questions in the questionnaire

"[S]mall changes in question wording or order sometimes cause significant changes in survey responses" (Schuman and Presser, 1981 cited in Hanemann, 1994). Moreover, different interview settings affect the quality and/or quantity of responses differently (Anker, 1983). To limit wording-related problems, both narrow (closed) and broad (open ended) questioning strategies were used in the main survey following recommendations from Anker (1983) and Anker et al. (1987). Pre-coded answers as well as open spaces for long responses were provided in the questionnaire (Appendix 13).

Sources of questionnaire survey biases associated with interview settings include factors such as differences in gender, class, educational background, race, etc., between the enumerator and the respondent (Anker, 1983:709-722). To limit biases from these sources, the eight enumerators used in the survey came from different geographical, social and educational backgrounds. Four of them were Kat River Valley residents; these were selected because they had a better cultural understanding of the area as well as extensive environmental education experience, having worked for several years in environmental projects (e.g. Land Care Project). The other four were final year and honours students from the Department of Economics at Rhodes University. Three of the student enumerators were females.

4.5 DATA ANALYSIS

Economic methods

The theoretical hypothesis used as framework for the research question was discussed in chapter three. According to game theoretic models, cooperative behaviour between players is enhanced if: a) they are locked in long-term relationships and b) fewer asymmetric information problems exist, etc. The problem of asymmetric information also relates to the number of players in the game or relationship. With fewer players behavioural information is transparent and problems associated with free riding are limited.

From the theoretical discussions, it was expected, for instance, that positive correlations would exist between the PR (Property Rights) and PP (Public Participation) and/or WTP (Willingness To Pay) variables, where PP and WTP were treated as exploratory variables. In chapter five, table 5.2, the variables generated from the survey questionnaire are grouped as either exploratory or as explanatory using the game theoretical hypothesis.

Some of the variable correlations explored in chapter five were between average incomes, education levels, age, environmental resource use, etc. over gender, race, employment status, etc. as independent variables. In many cases, the dependent versus independent classification of variables was not constant, for instance, in some cases average incomes were treated as dependent variable against age, but as an independent variable against participation.

In mathematical terms, some of the explored linear relationships could be represented in the following manner:

$PP = f(PR, A)$ and $PP = a + b\,PR;\ 0 < b < 1$…….(1)

In words: public participation is a function of property rights and other variables

where:

PP = positive public participation

PR = well defined and/or perceived property rights

A = other influencing variables

a = constant (y intercept)

b = gradient of a linear fit

In econometric terms: the relationship including an error term:

$PP = a + bPR + u$……..……(2)

where:

u = error term

For analyses, correlation coefficients, multi-variate or cross tabulations and simple linear regression models between selected variables were explored using the Stata (statistical computer) programme. The explanations of some the cross-tabulations, correlations coefficient tables, simple linear regression outputs are discussed in chapter five and Appendices 9 to 13 and 16 to17.

Creating variables

Continuous variables were created from data for analyses using Stata. Three variables for public participation were created for a) participation in general community platforms, b) environmental platforms, and c) the sum of the two were used in creating a variable for overall public participation. Using information gathered in section four of Appendix 13, ranking scores from 0 to 4 (5 in some cases) were allotted to individuals for their a) attitudes towards participation in general, b) knowledge of public events of meetings, c) culture of public meeting attendance, d) membership in public organisations and e) occupation of responsible positions in community organisations. The scores were summed for each participation variable. For an example the lowest and highest possible score assigned for participation in general community platforms (GPP) ranged between 0 and 23.

In creating the property rights variable, different types of property rights were ranked differently using game theoretic assumptions on cooperative behaviour and long term investments, and the NWP (1997) objectives. Even though this ranking system was based on reasonable specifications, it cannot be argued that it is a perfect or even accurate system. Nevertheless, it was useful for purposes of comparative analysis, as discussed in chapters five and six.

In table 4.1, permanent ownership of land, water (old water rights) and businesses, for instance, were ranked higher than livestock ownership. In a thesis, concerned with long-term water management issues, water and land rights were perceived to be a better representative of long term investments by individual owners and more useful for Integrated Water Resource Management (IWRM) than other property rights. Besides the hierarchical nature of the ranking system used, the actual values allotted for each right were admittedly still arbitrary.

Table 4.1 Ranking scores for creating the Property Rights variable

Permanent Rights	Allotted Scores
a. Land, Business, House or Business Structure , Water, Irrigation Equipment	4
b. Big livestock	3
c. Pollution	2
d. Other	1
Leased Rights	
a. Land, Business, House or Business Structure , Water, Irrigation Equipment	3
b. The rest	1

The property rights variable, as can be seen in appendix 13, was further divided into: a) currently owned rights and b) rights that individuals expected to acquire in future. In chapter five, the two groups of rights are analysed and discussed separately.

For other variables such as environmental education a less complicated ranking system than the one used for the property rights variables was used. Responses to section 5.1 of the questionnaire (Appendix 13) were allotted scores in the same manner described for public participation. The lowest and highest possible scores for environmental education were 0 and 22.

After the variables listed in table 5.2 were generated, relationships between them were explored using statistical tools like cross tables and simple linear regressions, as listed in section 4.5. In chapter six, relationships found between variables were discussed, firstly, theory, and secondly, for recommendations towards IWRM implementation challenges in the KRV and similar areas.

4.6 SUMMARY OUTLINE

In chapter four, a breakdown and descriptive explanation of research methods used were presented. The methods used for data collection were described first, followed by a description of methods used in data analyses. Having laid out the methods used in generating the data, the following chapter five presents and interprets this data within the theory framework discussed in the last chapter and the implications for the NWP (1997).

CHAPTER FIVE – THE KAT RIVER VALLEY CASE STUDY

5.1 INTRODUCTION

All the collected data are analysed, presented and interpreted for the National Water Policy (1997) implementation process in this chapter. In section 5.2 and 5.3 a history of forced migration racial conflicts over natural resources in the Kat River Valley (KRV) is presented together with a description of three prototypical communities, with different socio-economic attributes created by that history. In the socio-economic data, commercial farmers are presented as better resourced in terms of public infrastructure (roads, sanitation, etc.) and business opportunities, whereas the Upper Kat River villages have a limited public infrastructure and job industry. The limited resources are highlighted as contributing factors to low standards of living in these areas. Lastly, Seymour's (a semi urban township) and Balfour's (a densely populated village) presentation of social and economic attributes appears to be better than in the villages, however, not as good as those of commercial farmers.

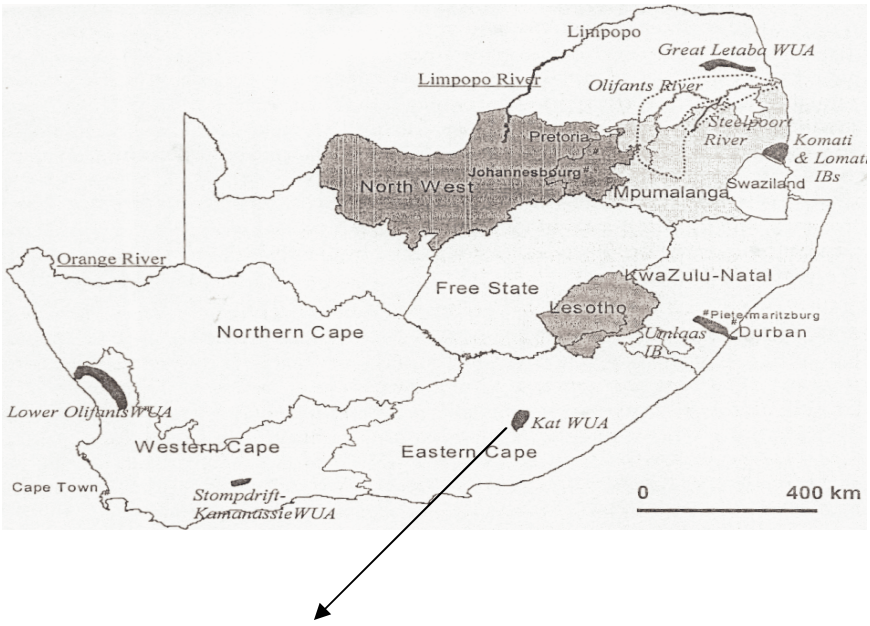
From the 2004 KRV survey data presented in section 5.4 to 5.7, information on Public Participation trends, Individuals' Willingness to Pay (WTP) Values and Property Rights, as exploratory variables, is analysed against demographic variables such as gender, age, area of enumeration, etc. Trends across demographic indicators are highlighted, compared and summarised for the exploratory variables. From interviews and meetings, issues of conflict affecting the different communities and viewed as pertinent to Integrated Water Resource Management the National Water Policy (NWP) of 1997 objectives are discussed.

5.2 THE BACKGROUND OF THE STUDY AREA

In map 1, the Kat River Valley (KRV) is located in the map of South Africa. Along the Kat River there are an estimated 36 villages and semi-urban settlements between the towns of Fort Beaufort, which is the biggest urban centre in the region, and Seymour, as depicted in Appendix 2, (Motteux, 2002). Many of the rural communities living along the Kat River have a direct economic relationship with the river, in that they use its water for household and irrigation purposes. The semi-urban residents

(i.e. Seymour) have their water piped and purified from the Kat River Dam (also known as Seymour Dam). However, both rural and urban residents harvest many other riverine resources like fish, building material, etc. directly from the Kat River and its riverbanks. There are three economically identifiable community types presently living in the KRV, namely; commercial farmers, whose reported average individual incomes are substantially higher than those of two other communities; the households of Seymour, which is one of small semi-urban townships; and the rural villages in the Upper KRV.

Map[6] 5.1 South Africa and the selected water catchment areas with the Kat River Valley in the Eastern Cape Province



The Kat River Valley
(Source: Faysse, 2004:60)

The KRV was chosen as a study site because:

a) it is part of a Water Management Area (WMA) as demarcated in the National Water Act No. 36 of 1998, and therefore the description and analysis of its socio-economic indicators and its response to the challenges of water management, it is hoped, will contribute towards an understanding of

[6] To fit the map on the page the scale may have been altered

decentralized water management issues and an effective water policy implementation process;

b) researchers from several academic fields (i.e. Geography, Anthropology, Water Quality Research, etc.) at universities such as Rhodes, Fort Hare etc., have conducted studies in the area, the results of which are documented and readily available for analytical comparisons (e.g. Nel, 1998 and Rowntree, 2003 cited in Motteux, 2002.),
c) compared to other Water Management Areas (WMAs), it was relatively less expensive to visit and conduct surveys in the KRV, because of its accessibility from Rhodes University, Grahamstown;
d) two water institutions (i.e. the statutory KRV WUA and the non-statutory sub-CF) as public platforms for water management already exist in this area, and
e) a history of racial conflicts over land resources and current socio-economic inequalities across communities present themselves as a good research material for game theoretic analysis.

The KRV is situated in the eastern part of the Fish to Tsitsikama WMA, which is area number 15 as illustrated in Appendix 1. It occupies 1.8% (1600 km^2) of the whole WMA. The Kat River is the main tributary to the Great Fish River. The primary commercial activity in the mid-lower part of the valley is citrus farming, and some of the citrus is exported to European markets by Riverside S.A. and Katco farmers. Rangeland stock farming, small-scale and subsistence farming are practiced in the lower and upper parts of the KRV. As seen in Appendix 2, Fairbairn, Hertzorg, Stonehenge, etc., form part of the Upper KRV rural village settlements, whose residents obtain and use water supplies (non-purified) directly from the Kat River (Everitt, 1999; Magni, 1999; Rowntree, 2003 cited in EEU, 2003:65 and Motteux, 2002:43-51).

In the 1800s the KRV experienced a history of forced migration, land dispossession and racial conflicts when the British white settlers arrived for occupation with their former coloured slaves. On arrival, the British army granted the former slaves farming land for having collaborated in their military operations against the native Xhosa resistance. The land given to former slaves formed a barricade between the white settlers and their Xhosa enemies. However, in the many wars that ensued, some

coloured people were accused of rebellion and were chased out of the land they had been offered, thus losing all rights to occupy or use the land.

In 1913, the Land Act was enacted introducing racially segregated land settlements, but this did not affect the Stockenstroom region until it was transferred to the Ciskei homeland government in the 1970s. The land transfer forced white and coloured farmers to sell their land, in many cases at lower than prevalent market prices, to the South African government to be handed over to the new Ciskei homeland. On the other hand, Xhosa people evicted from the white demarcated land were resettled in Ciskei by the South African Development Trust (G.R.C. 1988; Logie, 1997 in Motteux, 2002:51).

In white South Africa, the Boedel Erven Act of 1875 transferred rights to around 1800 km^2 of land to white farmers who could prove that they had occupied land between the years of 1836 and 1865 (Nel, 1998 in Motteux, 2002:50). The main effect of the Act was to change the farming practices in the valley to intensive farming as observed in 2004 on large citrus farms in the mid to lower KRV.

After the establishment of Ciskei in 1971, Xhosa farm labourers remained on some of the previously white owned farms without supervision, because the Ciskei government did not have a clear land development policy (Nel, 1998 in Motteux, 2002:50-51). However, the Ciskei Agricultural Corporation (ULIMCOR), a government parastatal, later took over some of those farms in an effort to assist the agricultural development of interested black farmers (Motteux, 2002:52).

“By 1984, ULIMCOR (was in charge of) most of the (black) citrus farms in the area. The land was divided into plots of 16.8 to 36 hectares and farmed with the vision of training ‘black’ farmers to eventually take over (their) management. Black farmers were funded with loans from the Development Bank of Southern Africa (DBSA), which enabled them to lease the land for a period of five years (de Wet et al., 1996). The expressed intent was that, after the five-year period, the farmers would be able to purchase the land outright. However, this failed to materialize – no property rights were transferred. This legacy remains today as emergent (black) farmers and former

farm workers remain on the land, but have no secure property rights and no long-term guaranteed access to use it or to the means of production" (Motteux, 2002:54).

Some of the farms that were bought by ULIMCOR still lay neglected and idle in 2004. Some have been leased to white farmers who had previously worked on them. "Currently, much of this land has no defined tenure and thus villagers are able to use it opportunistically. Some villagers in Tamboekiesvlei, Hertzog and Fairbairn gained permission from the Department of Agriculture in the late 1990s, *under the new South African government,* to farm the land (Nel et al., 1997a). A small minority of Xhosa farmers who have obtained land tenure since the early 1900s also populate the area. This group is based around Fairbairn" (Motteux, 2002:54).

In 2004, it was easy to identify the different communities in the KRV through their socio-economic attributes as can be seen in photographs contained in Appendix 3-5. Using game theory assumptions, it is argued, that some of the observed economic attributes can inform the motivations, economic interests and attitudes of communities and individuals in terms of the IWRM implementation process. The following sections describe and analyse these socio-economic indicators, which are discussed in chapter six in terms of theoretical assumptions and IWRM implementation process. Section 5.3 presents data from researchers like Motteux (2002) and (Nel and Davies, 1999 in Motteux, 2002). Section 5.4 to 5.7 presents and analyses quantitative data from the 2004 KRV survey and qualitative data from interviews conducted and meetings attended for the research.

5.3 THE SOCIO-ECONOMIC KRV DATA

Two commercial farming groups specializing in citrus production, packing and marketing operate in the KRV. These are the Riverside S.A. enterprises and the Kat River Cooperative (Katco). The majority of members in these groups are white with some black farmers from the former Ciskei. The population of Seymour and the Upper KRV villages is mostly black with a coloured minority. Some socio-economic indicators from these communities are summarised in table 5.1.

Table 5.1 The KRV socio-economic indicators

Commercial farmers:	**Seymour**	**Upper KRV villages**
a) Around 30 commercial farmers are in the KRV (Nahamba and Roberts, 2004) b) A population of approximately 200 people for Katco and riverside (including labourers) c) Citrus farming with limited livestock d) Piped water is obtained from the Kat River, other streams and boreholes, e) Riverside has ISO 14000 accreditation, Katco was in the process of acquiring accreditation f) A good infrastructure i.t.o. roads, electricity, telephones, sewerage, etc. g) An interest in setting up a conservancy h) Riverside farmers have a primary school	a) A population of around 5000 people and between 400 to 500 households (Fort Beaufort Local Government, 2004) b) Purified water from Kat River Dam obtained from communal taps c) Limited infrastructure i.t.o. roads, telephones, electricity, etc., and a bucket system is used for sewerage in some parts of the area d) little or no farming e) little service industry in the form of general stores, f) a number of NGOs housed (e.g. World Vision, German Bilateral Aid Agency, etc.) g) education institutions catering for pre-schooling to high schooling years	Balfour: a) Has a reported population of 3500 b) Similar public services as found in Seymour c) Traditional and informal housing structures d) Unpurified water obtained from boreholes and Balfour stream e) NGOs located in the area are: Working for Water and Philani Other Villages: a) Population of 2500 b) Some access to farming land and irrigation equip-ment under the Hertzog Agricultural Cooperative c) Unpurified water for household and irrigation use obtained from the Kat River d) Electricity installed e) No sewage system f) A micro-economic project called MBB engineering exists g) A community hall

(Source: Motteux, 2002:66-67)

The overview of the communities makes it clear that the KRV, as a whole, is a non-homogenous area, with a great potential for different, even conflicting, interests around water use and management. Such differences, as argued by Faysse (2004:52-70), normally lead to unequal representation of interests in water management bodies. A description and analysis of the data from the KRV 2004 survey in section 5.4 illustrates the socio-economic inequalities across gender and age groups, areas of enumeration, etc.

5.4 DATA FROM THE 2004 KRV SURVEY

Twenty-four variables formed part of the data description and analysis. The variables were selected based on the game theory assumptions of cooperative behaviour as discussed in chapter three and the primary NWP (1997) objectives of equity, resource protection and economic development, discussed in chapter two. The variables that could indicate cooperative or non-cooperative behaviour of stakeholders were grouped together as suitable for exploration while those that could explain the possible sources of such behaviour were grouped as explanatory as illustrated in table 5.2.

Table 5.2 Selected variables for description and analysis

VARIABLES FOR STATISTICAL EXPLORATION	EXPLANATORY VARIABLES
1. Public Participation (PP): a. General public participation in different platforms b. Participation specifically in environmental platforms	1. Area of residence 2. Income (at individual and household levels) 3. Education levels 4. Environmental awareness and education 5. Gender 6. Employment status 7. Employment sector 8. Age of respondents 9. Environmental uses
2. Environmental economic values measured in terms of WTP (willingness to pay methods) a. WTP for water licences b. WTP for the resource protection/reserve c. WTP for the establishment of and the administration of the CMA	**10. Property rights:** a. Current (private, common and perceived) b. Future (private, common and perceived) 11. Source of water resource (for household and other uses)
3. Property rights: a. Current (private, common and perceived) b. Future (private, common and perceived)	12. Migration: a. History and b. Future plans 13. Race **14. Knowledge of:** a. the NWP b. the CF activities c. the WUA **15. Attitudes towards:** a. Private property rights b. Common property rights c. Open access to property

5.4.1 General overview of KRV 2004 survey

For the majority of exploratory and explanatory variables[7], positive correlations of varying strengths were expected, e.g. the individual WTP values for water licences were expected to be positively correlated to individual incomes, which was true to varying degrees across areas of enumeration and average income groups.

5.4.1.1 Gender and average income[8] distribution

Survey information on 583 respondents from 235 households was gathered through questionnaires from the three different communities as discussed in section 5.3. As can be seen in table 5.3, 59% of the respondents were female, and 41% male.

Table 5.3 Area and Gender distribution of respondents, 2004

AREA	GENDER		
	Male	Female	Total
Commercial farmers	7	3	1%
Seymour	126	199	56%
Villages	107	137	43%
Total	41%	59%	100%

In Seymour and in rural villages the number of reported female respondents was much higher than males. Because the survey gathered information on all adults

[7] Statistically, selected variables can be primarily grouped as either continuous (e.g. age, income levels, etc.) or categorical (e.g. gender, race groups, attitudes towards CF activities, etc.), and secondarily, categorical variables can be further grouped into ordered (e.g. attitudes) or binary (e.g. race group or gender) variables. The groups mean that there are different statistical ways in which each group of variables can be analysed. For instance, the means or averages of continuous variables such as income levels, age, etc., can be computed for meaningful use, however, the averages of variables such as gender, race, etc., even though they can be computed, they can hardly be interpreted in any meaningful way. Therefore, for binary variables such as race, mode values, instead of means, are more meaningful and could be useful in determining the largest race group in the sample.

On the other hand, whether the means or averages of ordered categorical variables such as attitudes have any meaningful use is open to debate in social sciences and their use also depends on how they have been created (University of Cape town, 2004). In single or multi linear regression analyses only continuous variables are used as dependent variables, whereas Maximum Likelihood Estimation Techniques (MLET) (e.g. ordered Logit) are used for analysing categorical variables. These techniques are available for programming in the STATA software and have been selectively used in this chapter. With respect to ordered categorical variables, bi- and multi-variate analyses have been used. Appendix 9 describes the reading of the ANOVA table and the linear regression output table.

[8] All presented income values in the thesis are in whatever unit that has been quoted **per month**, unless where explicitly stated otherwise.

belonging to the same household, even if not present at the time of the interview, it seems an even higher proportion of females than males actually reside in the Upper KRV. This, however, was not evident in the smaller sub-sample of commercial farmers.

Table 5.4 is a summary of cross-tabulated average incomes by gender, with percentages for average income differences by gender groups given for the three areas of enumeration.

Table 5.4 Unemployment and income[9] by surveyed area, 2004

Unemployment (see footnote on definition)				
Area / *Gender*	*Universe*	*Seymour*	*Villages*	*Com Farm*
Females	64%	66%	63%	0%
Males	36%	34%	37%	0%
Income per month				
Females	R576	R613	R453	R4750
Males	R776	R610	R740	R5300
Income differences	25%	0.6%	39%	10%

The percentage of females who reported to be unemployed was higher at 64% while unemployed males were almost half that percentage (36%). In Seymour, 66% of females were reported to be unemployed, compared to 34% males unemployed. In the villages the percentage of unemployed females was marginally lower at 63%, compared to Seymour's 66%, but marginally higher for males at 37%, compared to 34% in Seymour. Overall, in both Seymour and the villages, more females reported

[9] Because many commercial farmers during informal interviews and meetings reported minimum gross business revenues of around R400 000 per year, it would seem that the individual incomes that some of them reported during household questionnaire surveys may have been strategically understated, the same way that their WTP values for water licences were deliberately understated (section 5.6). Reported individual incomes for commercial farmers ranged between R3 500 and R11 000 per month. However, these incomes were still much higher than incomes reported in Seymour and in the villages and useful for comparative analyses between the areas of enumeration.

With regards to unemployment, it is likely that in some areas these were overstated. Depending on many factors, e.g. whether respondents believed that enumerators were government employment agencies, they may have declared themselves unemployed in cases where they might have been underemployed. Anker and Anker (1989) discuss similar problems of measuring employment rates in developing country contexts.

For the study, a close to broad definition of unemployment was used. No cross-checking methods were used to determine informal employment, under employment or even active searches for employment.

being unemployed. In the Commercial farming sub-sample, no unemployment was reported.

Even though a relatively higher unemployment rate for males was reported in the villages, compared to Seymour, the villages' male average income at R740 was higher than Seymour's male average income at R610. However, the average income for females in the villages, at R453, was lower than all other groups. Interestingly, the average income for females and males in Seymour was relatively the same.

The average income differences were largest in rural villages, at 39%. This was a surprising finding because the level of female unemployment in Seymour was higher than in the villages. The male unemployment rate was higher in the villages than in Seymour, but still, gender income gaps were larger in the villages. In the Commercial farming sub-sample, the average income gender differences were 10%.

5.4.1.2 The average income distribution over age and gender groups

The average age in the universal sample was 44 years old and the oldest respondent was 101 years old. Overall, the age variable was slightly correlated to average income (0.2), mostly because the oldest group of respondents reported receiving government pension grants, while high levels of unemployment were reported for the youngest respondents. However, when breaking down the sample into five age-group categories, correlation coefficients ranged from positive to weak negative between average income and age variables as illustrated in table 5.5.

Table 5.5 Correlation between age-groups and average income, 2004

Age-group	Under 30 years	30 to 39 years	40 to 49 years	50 to 59 years	60 years and above
Correlation	0.33	0.02	0.08	0.02	-0.12

Although income-age correlations were weak, it was expected that average income would initially increase with rising age and then decrease beyond the age of retirement from active labour. In South Africa, the usual retirement age for females is 60 and 65 years old for males. A scatter graph in Appendix 7, illustrates a changing

and complex relationship between average income and age[10] for the universal sample, mainly because of high unemployment rates.

Because average income varied for each age group, it was analysed separately for the different groups. As can be seen in table 5.6, the age groups with the highest number of respondents were 'the over sixty year' and 'the less than 30 year' olds, at 145 and 126 respectively. The age group with the highest average monthly incomes was the 'over 30 to 40 year olds' at R956. The 'under 30 year olds' reported the lowest average income at R135.

Table 5.6 Average income and age groups by area of enumeration, 2004

Age-group	Com farmers	Seymour	Villages	Total		Average income/month
Under 30	1	77	48	126	23%	R135
30-39	2	59	59	120	22%	R956
40-49	3	44	29	76	14%	R897
50-59	1	43	41	85	15%	R765
= & > 60	0	88	57	145	26%	R820

As already mentioned, even though the expected normal age-income correlations were not found, by age group the average incomes were not surprising, considering that 63% of respondents under the age of 30 years old reported being unemployed. This was the second highest unemployment rate as illustrated in table 5.6. The highest unemployment rate was 75% for respondents over the age of 60, however, because 86% of these respondents reported receiving pension grants, their income were not the lowest of all groups. In fact, the average income for the whole sample seems to approximate pension grant incomes.

Important to note is how having described the average income variable for each age group, the correlation coefficients found in table 5.5 and the scatter graph in appendix 7 were easier to explain. Initially, individual incomes increased slightly with age

[10] From a scatter plot of average income versus age in appendix 7 there were many zero income responses (255). No negative income responses were reported either, mainly because there was no question that asked whether respondents had debts. All respondents were over 18 and below 110 years old ticks. The highest income was reported at over R12000, at just over 50 years old.

(positive correlations), but after a certain age they levelled off, giving rise to weak and negative correlation coefficients per sub-samples for different gender and age groups.

In the following sections, the presented demographic data and correlations are used to explore the nature of public participation, WTP values as well as property rights variables per demographic groups using the hypothesis derived from game theory[11]. From the hypothesis it is expected that public participation is a function of property rights, with a positive gradient.

5.5 PUBLIC PARTICIPATION (PP)

Questions aimed at generating categorical variables for public participation (see Appendix 13) were divided into a) general public participation (GPP), b) environmental public participation (EPP), and c) the sum of GPP and EPP formed the overall participation variable (OVERPP), as explained in section 4.1 and 4.2. The respondents' answers were allocated scores ranging from 1 to 5, where 5 was allotted to an answer that indicated the individual's highest involvement in public platforms, for instance holding an executive committee position in some community organisation.

5.5.1 Overall public participation (OVERPP)

The scores for the OVERPP variable per respondent ranged from 0 to 46, unless there were missing responses, in which case no score was allocated. From 583 respondents, 513 responses were offered (206 males and 307 females). To control for outliers, medians, instead of means, were used as values for participation levels. The OVERPP median score for the villages and Seymour were the same at 38 units and for commercial farmers was higher at 44 units. A further sample breakdown, by other demographic variables, for commercial farmers could not be performed because of a limited number of observations (7) in that sub-sample.

[11] $PP = f(PR, A)$ and $PP = a + b\,PR;\ 0 < b < 1$…….(1)

In table 5.7, the correlation coefficient between reported income and overall-participation was 0.12. For males, it was stronger (0.26) than for females (-0.04).

Table 5.7 Overall-participation per income and age correlation coefficients, 2004

OVERPP cor by	Universal	Male	Female
Income	0.12	0.26	-0.04
Age	0.06	0.16	-0.01

The correlation coefficient between age and overall-participation for the universal sample, was weak at 0.06, but again marginally higher for males (0.16) than for females (0.01). In sum, overall-participation in the universal sample was weakly correlated to either individual incomes or age, however, marginally stronger correlation coefficients were observed for the male group.

For the sample breakdown, illustrated in table 5.8, the males' correlation coefficients between overall-participation, individual income and age were largely higher than for females. For a number of age groups, correlation coefficients found were weak, except for males between the ages of 30 to 39 years old. The males' individual incomes and age variables were relatively more positively correlated to participation, compared to females.

Table 5.8 By age-group: overall-participation, income and age correlation values, 2004

Age-group	Gender	Income / OVERPP correlation	Age / OVERPP Correlation
Under 30	Male	0.09	-0.06
	Female	0.08	-0.05
30-39	Male	**0.42**	**0.24**
	Female	-0.22	-0.09
40-49	Male	0.28	0.04
	Female	0.03	0.19
50-59	Male	0.13	0.10
	Female	-0.11	0.00
60 and over	Male	-0.10	-0.16
	Female	0.04	*-0.15*

5.5.2 Overall participation in rural villages

In table 5.9, correlations between overall-participation, income and age variables in the villages are presented. The strongest positive correlation coefficient between participation and individual income was 0.47 for males between the ages of 40 to 49 years old. This was higher than for females in the same age category (0.25), which means that incomes for males were more correlated to their community participation.

Table 5.9 By age-group: overall-participation, income and age correlation coefficients in **rural villages**, 2004

Age-group	Gender	Income / OVERPP correlation	Age / OVERPP Correlation
Under 30	Male	-0.06	0.22
	Female	**0.32**	-0.03
30-39	Male	0.12	**0.50**
	Female	-0.05	-0.10
40-49	Male	**0.47**	-0.03
	Female	**0.25**	**0.37**
50-59	Male	-0.08	0.04
	Female	0.11	0.03
60 and over	Male	**-0.26**	**-0.25**
	Female	0.13	-0.26

It is interesting to note one of the few instances where females had higher income-participation correlation coefficients compared to males, was for the age group 'below 30 years old'; in fact, males in this age group had a weak negative coefficient. On the other hand, both males' and females' individual incomes were negatively or weakly correlated to participation for respondents over the age of 60 years old.

In table 5.9, the male cohort with the highest correlation coefficient for individual income and participation also had the highest participation score of 42 and the second highest average income of R1173. For this group, increasing public participation by a score of one increased average income by R223 - in a linear regression with an R-squared value[12] of 0.22.

[12] Appendix 10 explains the reading of a regression output table.

The female group with the highest correlation coefficient (i.e. under 30 year olds) had the lowest female average income and the second lowest participation score. For this group, rising overall-participation only explained 10% of rising average incomes - in a linear regression with an R-squared value of 0.10 and t-value of 1.52. Further data exploration revealed that females under the age of 30 years old, living in rural villages had a higher average income (R137) than their male counterparts (R10). Because 79% of these females reported to be unemployed while 25% reported to be receiving government child grants, it seems that grants were their main source of income. No males reported to be receiving children grants, which were valued at R160 per month in 2004.

The highest correlation coefficient for age and participation was 0.5 for males between the ages of 30 to 39 years old. Even though this group did not report the highest participation score, however, it seemed that within this group, raising the age variable had the highest positive effect on participation. The same could be said for females between the ages of 40 to 49 years old, but these females, on the other hand, also reported the highest participation score (39) compared to other female age groups.

In summary, from the data it seems that males were more active in public platforms than females in all explored cohorts. In the villages, the two most active age groups were males and females between the ages of 40 to 49 years. The individual incomes for males in this age group also had the strongest positive correlation to participation levels; females had the second highest coefficient.

On the other hand, participation levels amongst males between the ages of 30 to 39 years old increased most rapidly with the rising age variable. Lastly, the youngest and the oldest groups were the least active in public platforms, often with weak or negative correlation coefficients between participation, individual income and age variables.

5.5.2.1 Overall participation in Seymour

In Seymour, stronger positive as well as negative correlation coefficients were observed for both males and females, compared to the villages as can be seen in table 5.10.

Table 5.10 By age group: overall-participation, income and age correlation coefficients **in Seymour**, 2004

Age-group	Gender	Income / OVERPP correlation	Age / OVERPP Correlation
Under 30	Male	0.06	**-0.31**
	Female	-0.19	-0.09
30-39	Male	**0.72***	**-0.30**
	Female	-0.25	-0.19
40-49	Male	-0.15	**0.34**
	Female	**-0.47**	-0.02
50-59	Male	**-0.53**	0.19
	Female	-0.21	-0.04
60 and over	Male	0.03	-0.16
	Female	0.01	-0.09

(-0.38 when outliers were excluded)*

In some cases, however, the strong variations were as a result of identifiable outliers in the sample. On average, males had slightly stronger correlation coefficients between participation and individual income, except for 'the 50 to 59 year' olds, where the correlation coefficient was strongly negative. Compared to rural villages, overall participation for most age groups in Seymour was weakly or negatively correlated to both individual income and age variables. However, like in the villages, 'the middle aged males' were the most active respondents in public platforms, but this participation was not related to rising average or individual incomes.

Not all participation findings were surprising when considering what researchers like Motteux (2002), and Nel and Binns (2000:367-377), have written about rural development projects taking place in the upper KRV villages. The projects include the Hertzog Agricultural Cooperative and the Land Care Project, some of whose objectives were to protect environmental resources while also improving the

economic conditions of rural residents by offering short-term employment opportunities to participants.

However, it seems that the main beneficiaries of the projects have been middle-aged males and, to a lesser extent, middle-aged females. Correlation coefficients between environmental work and participation for these cohorts were also the highest at 0.2. It also seems that the cohorts most excluded from such environmental employment projects were the over 60 year and under 30 year olds. The reasons for the exclusion of over 60 year olds may be related to the fact that this group already received incomes, in the form of pensions, in which case their exclusion may have been voluntary. On the other hand, environmental projects like the Land Care Project often require physical strength from participants. This may have rendered them less attractive to older residents.

The reasons why the youngest age group (under 30 year olds) was excluded from participation, even though they had the lowest average incomes were not explainable from the data. However, during a focus-group organised to discuss data trends, the present members of the community agreed that young people did not participate in the projects and felt that this was because many of them were financially supported by their older and more responsible family members. On the other hand, females were not given the same opportunities to participate by dominant males who had become gatekeepers in community run projects.

5.5.3 Environmental public participation (EPP)[13], education and environmental education

[13] The variable for environmental-participation was generated in such a way that it formed part of the overall-participation variable, as described in section 5.5.1. Compared to overall-participation, participation in environmental platforms was, however, expected to correlate more strongly with education in environmental issues, education in general as well as environmental work in environmental bodies such as the CF, the Land Care project, the WUA, etc.). To avoid the negative effects of outliers, the median instead of mean values were used throughout section 5.5.3 when discussing EPP levels. In the same way that points or values were allocated for participation variables as described in chapter four, points were given to individual respondents for the frequency and length of workshops or courses they had attended or completed in environmental courses or education by 2004.

As already mentioned in section 5.4.1, commercial farmers reported the highest average income of R5 142 per month, and as can be seen in table 5.11, they also reported the highest average education (14), environmental participation (EPP) (22) and environmental education (6) levels.

Table 5.11 Average education, environmental education and Environmental Public Participation (EPP) levels[14] by area of enumeration, 2004

Commercial farmers			Seymour			Rural villages		
Education	Enviro-Education	EPP	Education	Enviro-Education	EPP	Education	Enviro-Education	EPP
14	6	22	8	2	17	7	3	19

The villagers, especially females, reported the lowest average years of school education, but they also reported marginally higher environmental education and EPP scores than Seymour residents. Because more environmental education workshops had been conducted in the villages between 1996 and 2004 (Motteux, 2002) and (Ntsebenza, 2004) than had been in Seymour, it was not surprising that villagers reported marginally higher levels of environmental education and participation than Seymour.

In table 5.12, it can be seen that education levels decreased with increasing age in Seymour and in the villages for both males and females. However, there were no obvious trends in environmental education levels across genders in both areas. On the other hand, the oldest age groups, compared to other age groups in both areas, reported the lowest environmental education levels.

[14] In table 5.11, education refers to the number of years in a formal school or college, where 16 represents the individual's possession of a university degree. The variable's range was 0-16 for the survey. Environmental education refers to a variable created to capture an individual's informal to formal environmental educational experience (i.e. ranging from zero experience (1) to a year's formal education in environmental issues (7) (appendix 14). The EPP variable was created in the same way described in 5.5.1, with a range between 1 and 27.

Table 5.12 By area, gender and age groups: average education, environmental education levels and participation, 2004

	Age group	Education		Environmental Education		Environmental participation	
Gender / Area		Male	Female	Male	Female	Male	Female
Seymour	Under 30	10.4	10.3	**2.5**	**2.4**	18	16
	30 to 39	9.5	11.4	2.2	2.3	16.5	17
	40 to 49	8.2	6.7	**2.6**	2.3	15	17.5
	50 to 59	4.0	5.4	1.8	2.1	17	16
	Over 60	5.2	5.3	2.1	**1.7**	18	18
Villages	Under 30	8.6	10	2.9	3.0	17	19
	30 to 39	10	8.5	**3.7**	3.2	18	19
	40 to 49	7.8	7.2	2.6	**3.4**	**21**	**21**
	50 to 59	5.5	6.9	2.5	2.5	19	17.5
	Over 60	4.5	4.3	2.7	**1.8**	19	17.5

There were no significant differences in environmental participation scores across the gender variable in Seymour. In the villages, males reported marginally higher environmental participation levels in all but one age cohort and, for both genders, the highest environmental participation levels were reported for 'the 40 to 49 year olds' group.

Through correlation coefficients, table 5.13 explores whether education and environmental education, led to increased levels of participation in environmental platforms, by gender and age group in the two areas.

Table 5.13 Correlations between EPP, education and environmental education by age Groups, 2004

	Age group	Correlation between EPP and education		Correlation between EPP and environmental education	
Gender / Area		Male	Female	Male	Female
Seymour	Under 30	-0.12	0.35	-0.07	-0.24
	30 to 39	**0.35**	**0.38**	**0.32**	**-0.44**
	40 to 49	0.27	0.18	0.28	0.16
	50 to 59	-0.42	-0.06	0.06	**0.39**
	Over 60	0.19	-0.05	-0.12	0.16
Villages	Under 30	-0.17	0.22	0.13	0.25
	30 to 39	**0.47**	0.29	**0.63**	0.13
	40 to 49	0.19	**0.44**	0.29	0.31
	50 to 59	-0.01	-0.35	0.31	0.08
	Over 60	0.00	0.40	0.25	0.39

In Seymour, for the under 30 and over 50 year old males, increasing education levels did not lead to higher participation. On the other hand, females under the age of 40 years old had higher correlation coefficients between education and participation. Environmental education did not lead to higher participation for both the youngest and oldest male and female cohorts in Seymour, while the 30 to 39 year old males reported the highest (comparatively) correlation (0.32), with the 50 to 59 year old females coming a distant second.

In the villages, except for the youngest age group, males had relatively higher correlation coefficients than females for both education and environmental education variables, with the 30 to 39 year old males attaining the highest correlation coefficient (0.63) between the environmental education and participation.

In general, the most obvious trends from the tabulated data are that, a) in villages, on average, the middle age groups reported higher median EPP scores over years of education than other age groups, as illustrated for the male groups in fig 5.1. The youngest age group reported the lowest median EPP scores over education levels. In Seymour, the oldest age group reported higher median EPP scores over education levels, b) compared to other age groups, education and environmental education, led

to marginally higher participation levels only for the middle age groups in both Seymour and villages, but there were no significant gender correlation differences, as there were between average and individual income and EPP levels.

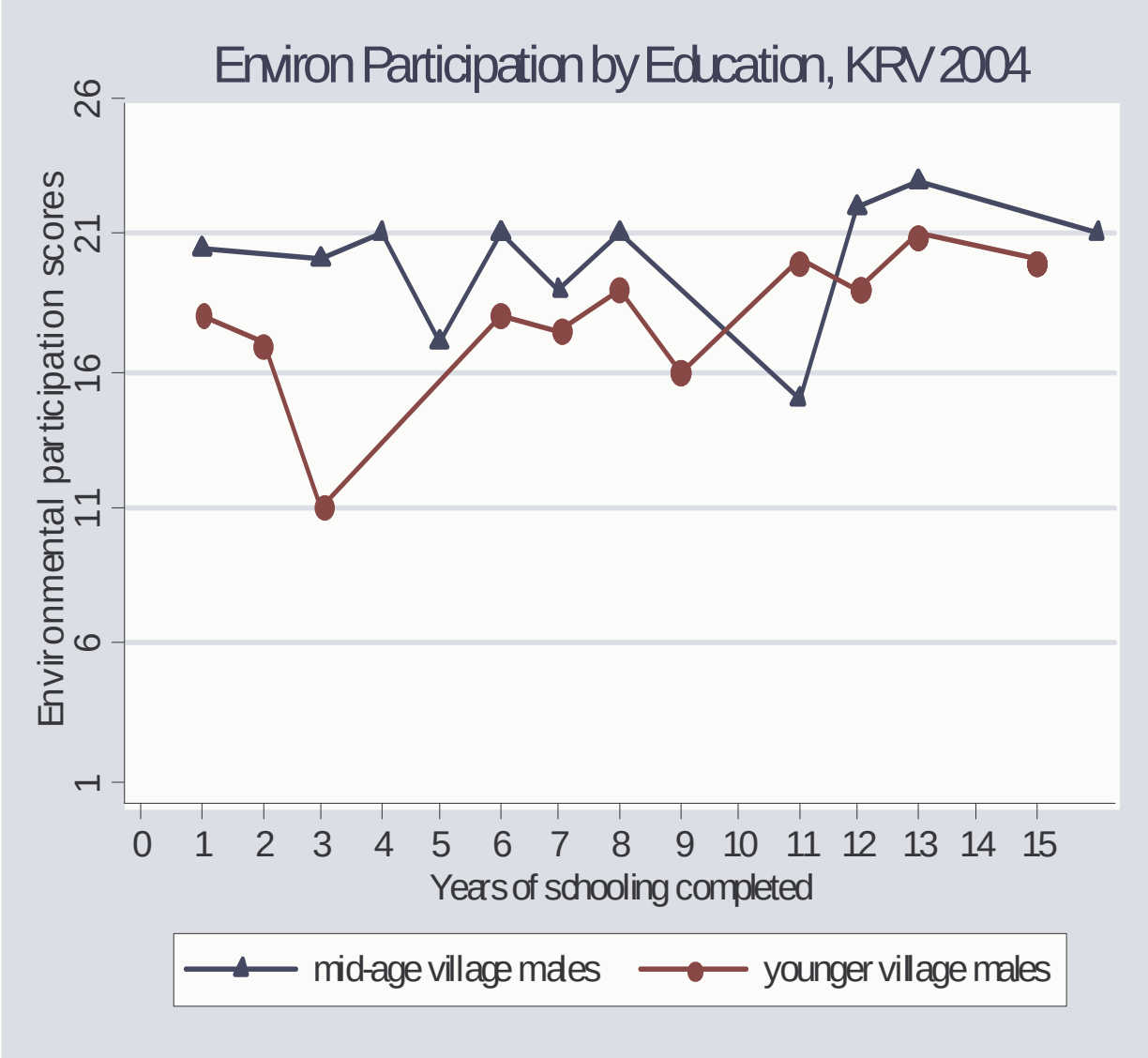


Fig 5.1 Environmental participation over education levels for village male age groups

5.6 ENVIRONMENTAL ECONOMIC VALUES[15]

Individual environmental economic values (in South African rands) using the Willingness To Pay (WTP) method were sought for three aspects of environmental resources (i.e. water licences, water resource protection and the establishment of a Catchment Management Agency (CMA) (Appendix 13, section 5). For each of the three environmental aspects, enumerators were instructed to offer bid values only when it was obvious that the respondents were struggling to provide their own economic values. In these cases, the enumerators would offer bids in all the different currency units listed on the questionnaire and they could increase or decrease the bids until the respondents accepted them as their own economic values. Therefore, both open and closed bidding approaches were used as required in each interview setting.

[15] Environmental economic values placed by individuals on water licences, water resource protection and the establishment of CMAs were determined using the Willingness to Pay Method (section 5.2 and 5.3 of the survey questionnaire). Following guidelines for developing country contexts as discussed in chapter two, four currencies were used to measure the values and they were: a) money, b) labour time c) crops or livestock and d) combinations.

However, contrary to guidelines discussed in chapter two for WTP methods, of accepting economic values as valid only if they are within 5% of respondents' income, WTP values in labour time units from unemployed respondents with zero incomes were also analysed, but later excluded for a conventional analysis. The economic values of unemployed respondents were analysed by considering DWAF's policy plans of recruiting local stakeholders to perform, with payment, the different tasks of establishing and administering CMAs and of resource determinations. A R500 monthly income (close to the sample's average income) was used as a basic wage for converting labour time into money currency. The basic income was used because unemployed labour can be seen as potential future labour force for DWAF's water policy implementation process. It can be argued that upon using this abundant labour force, DWAF will in fact save on its budget labour costs as most of the local labour force would be cheaper than rates paid to consultants, who were employed in the preparatory phases of IWRM implementation in 2004. In essence, using R500 as the basic wage would most likely be an underestimation of the reported economic values, especially when considering the much higher salary scales proposed by DWAF (2002) for future labour. The lowest proposed salary rate by DWAF was R30 000 p/a or R2500 p/m (e.g. for clerical work). If on the other hand the lawful basic wage of around R800 was used, instead of the average R500, the difference in observed trends would have been insignificant, because only a very low proportion of respondents in any case used labour time as a unit currency (table 5.14).

As on the other hand, many of the local stakeholders would most likely still need some kind of training before being recruited, it should be noted that some human capital investment costs would be incurred by DWAF in the process of decentralising or delegating tasks to local stakeholders. Hence, with such future human capital investment costs in mind, the underestimation of environmental economic values, in using R500 instead of R30 000, as the lowest proposed wage might be justifiable. But what is crucial here is that the main purpose of the valuation exercise was only to use the individual and community's average environmental economic values as indicator variables comparatively across the demographic groups. In that case, the changes in environmental economic values and not the actual values were useful. In any case, as mentioned already in last paragraph, only 13 unemployed respondents with no income indicated their WTP values in labour time unit currency, this was 3.7% of total responses. As can be seen in table 5.14 the effect of values in labour time and livestock/crop units on aggregated WTP values was insignificant for both Seymour and the villages. For a theoretical discussion, however, these values were included in describing the reported data.

However, during the analysis of the data, extreme outliers and/or protest bids were discarded using average incomes as a framework for making the decision.

Besides money currency, labour time, crops and livestock were used as currencies in measuring individual WTP values. The conversion of labour time, crops and livestock units into the money currency was achieved by using average market prices for these resources in 2004. In sections 5.6.1 to 5.6.4, individual average WTP values for the three aspects of environmental water resource management were analysed by area of enumeration.

5.6.1 The willingness to pay[16] for water licences by area of enumeration

In table 5.14, individual average values for water licences by area of enumeration are illustrated. In money terms, Seymour respondents reported the highest average values, but in terms of labour time, the highest values were reported by the villagers, followed by Seymour. Only in the villages were livestock and crops offered as currencies for WTP values.

Table 5.14 WTP values (**in South African rands**) for water licences by various currencies, 2004

Area	Average water licence WTP Values by currency (converted **to rands**)			
	Money only	Labour only	Livestock/crop	Aggregate
Farmers	0.03 (6)	-	-	0.03 (7)
Seymour	**37** (170)	80 (17)	-	**40** (205)
Villages	18 (132)	**134** (10)	**25** (13)	22 (178)
Universal	28	**89**	25	32

( ) = number of respondents, and the use of labour time units did not necessarily mean that respondents had zero income as only (13) of (27) respondents who used labour time units also reported zero incomes. A 'mixed currency' category was excluded from the final presentation of all WTP tables, because it did not add value and therefore the aggregated totals are slightly higher than the sum of the listed currencies.

It was not surprising when many respondents in the villages and Seymour used labour time units when indicating their WTP values, this was partly due to the highest

[16] **The units for WTP values for licences were given or converted to rands per cubic metre of water and the units for WTP values for the resource protection and CMA establishment are rands per month.**

reported unemployment levels in these two areas (as illustrated in table 5.4). Therefore, leisure time was most abundant in the two areas. On the other hand, even though some commercial farmers reported keeping livestock, they did not use these as currencies for WTP values. Unlike the two other areas, commercial farmers reported zero unemployment rates and had the highest levels of average incomes, which means that they had better access to money and preferred to expend it when valuing environmental water resources. Overall, average WTP values measured *in labour time currency*, were the highest of all other average values in other currencies (table 5.14).

It should be pointed out that some commercial farmers strategically offered the water price as currently charged by DWAF as their WTP values for water licences (i.e. R357.46 per hectare per annum of scheduled area[17]) even though many of them conceded during interviews that this price was low and insignificant when compared to marginal profits gained from citrus production. Commercial farmers feared that because of the KRV survey and interviews conducted for this research, water licence prices may be affected.

5.6.2 The willingness to pay for resource protection (the ecological reserve) by area of enumeration

In table 5.14, the commercial farmers' WTP values for resource protection were much higher than for water licences, but as already mentioned, this was partly because in valuing licences some farmers used DWAF's low current prices.

Table 5.15 WTP values (in South African rands) for resource protection by various currencies, 2004

Area	Average resource protection WTP Values by unit currency **(converted to rands)**			
	Money only	Labour only	Livestock/crop	Aggregate
Farmers	**254**	-	-	**269**
Seymour	32	114	-	40
Villages	14	**166**	**25**	20
Universal	25	**127**	25	33
The notes in table 5.14 apply to this and all other WTP value tables				

[17] 9000m^3 was equivalent to one hectare per annum in the agricultural sector in 2004 (Nieuwoudt et al., 2004:166).

In money terms, Seymour residents and the villagers were willing to pay less for resource protection, but again in labour time currency, they were willing to pay significantly more. However, because relatively fewer respondents in both the villages and Seymour used labour time or crop unit currencies (table 5.14) when valuing the three aspects of water resource management, in the end the weighted effect of WTP values in unit currencies other than money was insignificant. The weighted individual values were R32, R33 and R28 for water licences, resource protection and CMA establishment respectively (in tables 5.14 to 5.16).

5.6.3 The willingness to pay for the establishment of a CMA

The majority of commercial farmers, in table 5.16, did not provide any WTP values for the establishment of the CMA, hence their average values could not be computed. This also contributed to the lowest average values, in money terms, for CMA establishment at R19.

Table 5.16 WTP values (in south African rands) for CMA establishment by various currencies, 2004

Area	Average resource protection WTP Values by Currency (converted to rands)			
	Money only	Labour only	Livestock/crop	Aggregate
Farmers	-	-	-	-
Seymour	26	114	-	34
Villages	12	123	24	17
Universal	19	**116**	24	28

In summary, commercial farmers, on average and in money currency terms, were willing to pay the highest values for the protection of resources, on the one hand, the villagers and Seymour residents were willing to pay the highest values for water licences. But because commercial farmers' WTP values for licences were approximated to low current water prices, the licence values should be treated with caution when analysed or compared to other values. In any case, for all areas enumerated, the average WTP values for water licences were still the highest, *in money terms* (R28), while the WTP values for establishing a CMA were the lowest (R19).

5.6.4 Correlations between WTP values and individual incomes

In terms of money currency, commercial farmers' correlation coefficient between individual incomes and WTP values were strongly correlated (0.7), followed by Seymour (0.45). In the villages, when the unemployed were excluded from the sample, the correlation coefficient was stronger at 0.40, which meant that rising average and individual incomes led to higher reported WTP values, when respondents with lower and no money incomes were excluded, as can be seen in table 5.17. In the villages, the WTP values were the least associated with reported incomes, even when the unemployed were excluded from analysis.

Table 5.17 Correlation between WTP values in money terms and incomes, 2004

Area	Com farmers	Seymour	Villages
Coefficient	0.7	0.45	0.12*

(*Note: the coefficient was 0.40 when the unemployed were excluded)

Van Schalkwyk (1996) and Conradie (2002) in Niewoudt et al. (2004:165) argued that in several studies in poor communities "poor people are willing to pay for water and that this willingness-to-pay indicates the opportunity for efficient allocation through price". However, they found that domestic water demand in low-income communities is a big function of income among many other factors, such as season, perceived scarcity, etc. These factors may also determine the price elasticity of water demand, for instance when water is perceived to be scarce a relatively higher value is placed on the assurance for minimum required water quantities, on the other hand, lower economic values are placed on extra volumes of water above minimum required quantities (Nieuwoudt et al., 2004:167). Because the household survey on which this research is based was a once off survey (i.e. cross sectional), price elasticity changes due to changing factors such as seasonal weather, for instance, could not be explored.

5.6.5 Environmental water resource uses and WTP economic values

Fifteen water and riverine resource uses were listed in section 5.1 of the survey questionnaire (Appendix 13) for respondents to indicate whether they consumed or used them. Fig 5.2 illustrates the fractions of the uses by area of enumeration. Water

abstraction was the highest reported use by commercial farmers and in-stream washing (laundry) the highest use in Seymour and in the villages[18]. In table 5.15, the villagers also reported a higher variety of riverine uses, followed by Seymour and commercial farmers. It is important to note that fig 5.2 only depicts, in reported proportions, the different types of uses, and not the quantities thereof.

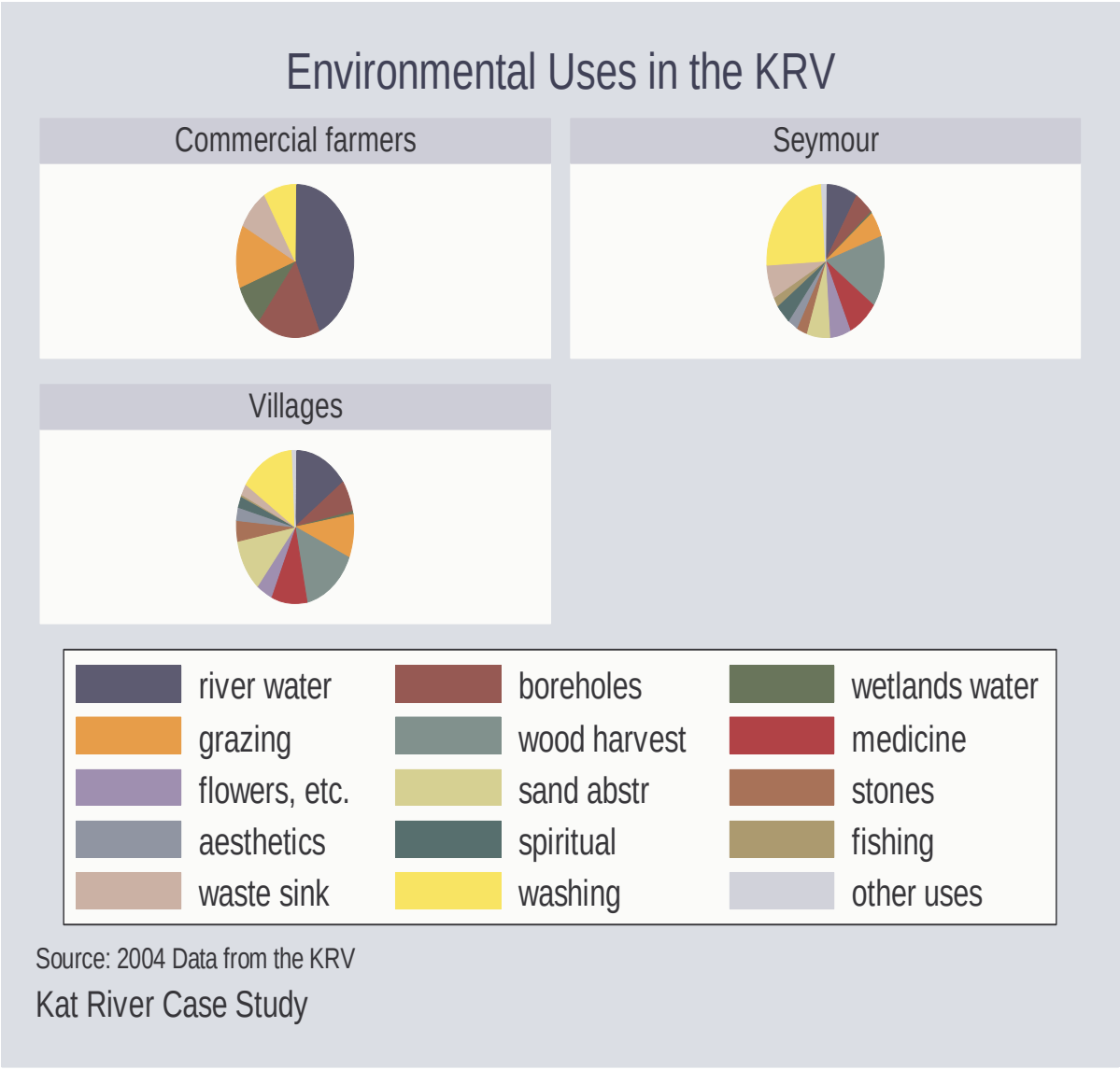


Fig 5.2 Environmental uses per area of enumeration

[18] Soviti (2002:46-66) looked at the water quality effects of washing in the Upper Kat River villages and found insignificant impacts on the studied biota.

For all three areas of enumeration combined (Appendix 14), the top six environmental uses per respondent were: a) washing/laundry (19%), b) water abstraction (15%), c) wood harvesting (12%), d) sand harvesting (9%), e) medicine harvesting (9%) and f) livestock grazing (8%). The order of use was only slightly different for each area as can be seen in fig 5.2.

Table 5.18 lists the average number of riverine uses per area of enumeration and the correlation coefficients between that number and average WTP values for all environmental resource aspects. The value represents the variety of environmental uses reported by respondents in each area, for instance the villagers' and Seymour's reported uses of riverine resources is higher, which means more varied, than for commercial farmers, whose primary use of the Kat River is water abstraction for irrigation. The high variety is depicted in fig 5.2.

Table 5.18 Average environmental uses and WTP value correlations by area of enumeration, 2004

Area	Com farmers	Seymour	Villages
Average number of environmental uses	3.3	3.5	5.7
Corr. Coefficient	0.42	0.08	0.12

It should be noted, however, that the average value (variety) of uses does not offer any insightful information on either the volumes or quantities of goods harvested or the economic benefits or profits gained, in any unit currency, per respondent. For instance, an environmental resource use, like water abstraction, would provide higher economic benefits, in monetary terms, to irrigating commercial farmers than it would to household users in villages. This is because commercial farmers abstract higher volumes of water as a production input that also leads to higher profit gains than the villagers. This differentiation in quantity and economic benefit per resource use per respondent is not captured in the data, partly because the volumes of resources and their efficient use by respondents were not targeted in the questionnaire.

On average, the villagers used a higher variety of resources than Seymour respondents and commercial farmers, however, their economic valuation of water resources, using

all currencies, was the least correlated to that variety of use[19]. On the other hand, even though commercial farmers used the lowest combination of environmental resources, their economic valuation values were the most correlated to the variety of use. In this sense, the commercial farmers' economic values for resource diversity seemed better expressed in their WTP values than for the two other areas, but their economic gains from use are also significantly higher.

In summary, water licences, in money terms only, were valued higher than the other aspects of water resource management, even though commercial farmers' WTP values for water licences were based on low current water prices. It should be noted, however, that because the average WTP values were weighted per number of respondents, the effect of the commercial farmers' values on the average values was limited as they were the smallest sub-sample. Upon converting other currencies into money, resource protection was valued marginally higher (R33) than water licences (R32). This was partly because villagers and Seymour residents valued resource protection higher than water licences in labour time unit currency. Respondents in these two areas were willing to work longer hours to protect environmental resources, than they were willing to pay money for the resources.

As to why the same respondents preferred to only work longer hours for resource protection but pay higher monetary values for water licences remains unexplained from available data. One possible economic explanation could be that, in truth, villagers and Seymour residents valued water licences relatively higher than other environmental resources, because they used their less abundant resource (money) to express WTP values for water licences than they did for other water management

[19] However, another important observation to point out, which was not factored in the above analyses, was that relative 'to average incomes per area of enumeration', the WTP values were different from those reported in absolute money terms. For instance, because commercial farmers' average income was R5025, R612 for Seymour, and R597 for the villagers, the WTP values for resource protection for commercial farmers were only 5.4 % of their average income, while it was 6.5% for Seymour and 3.4% for the villagers. Therefore, relative to average incomes, Seymour residents were willing to pay the highest average values for the protection of environmental water resources. This was not obvious from reported values in table 5.15, where it seemed that commercial farmers, in absolute money terms, were willing to pay much more for resource protection than the other areas. If the analysis was done using WTP values as a percentage of average incomes, Seymour would have appeared to value resource protection higher than the other two areas. However, this was not done, because in the NWRS (2002), differential pricing has been ruled out as an option within WMAs and therefore only absolute values in money terms are useful for the water policy strategies.

aspects. This explanation was accepted by many of the present community members in a focus group meeting organised to discuss data interpretations.

5.7 PARTICIPATION, WTP VALUES AND PROPERTY RIGHTS (PR)[20]

5.7.1 Participation and WTP values

Participation and WTP values were weakly correlated in Seymour (0.12) and villages (0.10). Participation, for a number of age groups in Seymour (table 5.9) and in villages (5.10), was also either weakly or negatively correlated to incomes. On the other hand, WTP values and incomes, especially for employed respondents were strongly correlated (table 5.17). It seems, therefore, that as far as participation is concerned, incomes and WTP values in the two areas, especially for employed respondents, could be treated as substitute variables.

Dependent on their employment status and income levels, many respondents were either willing to pay monetary values for resource uses or were willing to participate in their public management. Unemployed respondents, with limited money incomes and relatively unlimited time resources were either already active or willing to be active in public platforms, whereas employed respondents with limited time resources and higher incomes were willing to pay money for the use of resources.

5.7.2 Property rights by area of enumeration and age groups

Besides cultural factors, how respondents felt about the different types or regimes of property rights was also a reflection on the type of property rights they held in

[20] In section 3.2 (current property rights) and section 3.3 (future property rights) of the questionnaire (appendix 13) property categories were listed to which respondents had to indicate whether they held rights and what kind. Thereafter each category was ranked in terms of: a) its perceived significance towards water resource management and b) as proxy for long term local investment indicators (e.g. water rights and land rights were ranked higher than building structures and livestock ownership rights respectively). On the other hand, permanent rights were ranked higher than lease rights and where no rights existed, a zero ranking was allocated. The actual points or numbers indicating each ranking were discussed in chapter four. The numbers are arbitrary and **do not** reflect the true relative value of each right, however, they serve a convenient purpose in differentiating each right's perceived significance of water resource management based on game theoretic assumptions on individual's long term investments or commitment to the KRV, as discussed in chapter three.

majority. For instance, no commercial farmers felt that common ownership of environmental resources was 'the best way to look after environmental resources', while 55% and 64% of Seymour and village respondents respectively, felt that this was the best management system for such resources (section 3.1 of Appendix 13). As indicated in table 5.19, the highest number of private property rights, by far, was held by commercial farmers (16), who also disapproved of common resource ownership.

Table 5.19 Average reported property rights (current and future) categories by area of enumeration (appendix 13 section 3.2 and 3.3), 2004

Area of enumeration	Current Private	Current Common	Current Perceived	Sum of Current	Future Private	Future Common	Future Perceived	Sum of Future
Farmers	16	6	5	27	6	3	0	9
Seymour	5	2	3	10	6	4	4	14
Villages	6	5	7	18	11	9	8	28

From table 5.19, with regards to common and perceived property rights, the villagers reported relatively higher values than commercial farmers, but Seymour respondents held the lowest number of property rights for all categories. The villagers were highly optimistic with the highest number of expected future rights reported in all categories, followed by Seymour. However, commercial farmers were the least optimistic, expecting to acquire the lowest number of rights in most categories. On the other hand, even though the majority of the villagers expressed the most positive attitudes towards *common* resource ownership, in future they expected to acquire the highest number of *private* property rights.

In table 5.20, the younger age groups in Seymour held fewer property rights than middle to older age groups, but younger respondents expected to hold more rights in the future than did older respondents. This was also reflected in slightly positive correlation coefficients between age and property rights (for current rights) and slightly negative coefficients (for future rights) for Seymour in table 5.22.

Table 5.20 Average property rights by age group in Seymour, 2004

Age group	Current Private	Current Common	Current Perceived	Sum of Current	Future Private	Future Common	Future Perceived	Sum of Future
> 30	3.2	1.7	2.8	7.7	7.7	4.6	4.9	17.2
30-39	4.8	1.8	2.2	8.8	4.5	2.3	2.2	9
40-49	6.7	3.5	3.1	13.3	5.4	3.8	3.6	12.8
50-59	6.6	2.8	3.2	12.6	6.8	3.1	3.8	13.7
= > 60	6.6	2.5	3.3	12.4	5.9	3.6	3.7	13.2

There were no correlation trends between current property rights and age as can be observed in table 5.21 and 5.22.

Table 5.21 Property rights by age group in villages, 2004

Age group	Current Private	Current Common	Current Perceived	Sum of Current	Future Private	Future Common	Future Perceived	Sum of Future
> 30	5.9	5.4	8.3	20	11.4	11.4	11	34
30-39	6.5	4.6	6.2	18	11.5	10	8.6	30
40-49	5.3	4.3	6.1	15	9.7	8.0	7.3	25
50-59	4.9	3.3	7.0	15	8.2	6.8	7.1	22
= > 60	6.8	4.2	5.5	17	10.1	8.2	6.3	25

However, the oldest age group held the highest number of private property rights, followed by the '30 to 39 year old' group. As was the case in Seymour, the villages' younger age groups expected to hold more property rights than did older respondents (table 5.20 and 5.22).

Table 5.22 Correlations between age and reported property rights (current and future) categories by area of enumeration (from appendix 13 section 3.2 and 3.3), 2004

Area of enumeration	Current	Future	Total
Farmers	0.48	-0.01	0.45
Seymour	0.14	-0.05	-0.05
Villages	-0.08	-0.15	-0.15

In the same manner that incomes were correlated to the age variable across areas of enumeration (i.e. 0.90; 0.22; 0.13, for commercial farmers, Seymour and the villages respectively), so current property rights correlated with age. At the same time

correlations between *current* property rights and individual incomes were relatively stronger and positive only for commercial farmers (0.45). To a larger extent, increasing current property rights for farmers meant increasing individual incomes, but this was not the case for both Seymour and the villages, where a lower number of current property rights were held and lower individual incomes were prevalent.

5.7.3 Property rights and WTP values

In table 5.23, positive correlations were found between current property rights and WTP values for commercial farmers and Seymour, with a linear regression model explaining 64% of the distribution. As discussed in section 5.71 and 5.72, for commercial farmers and *employed* respondents in Seymour and the villages, a high number of current property rights indicated higher individual incomes, and in section 5.6.4 it was found that higher incomes also led to high WTP values.

Table 5.23 Correlation between WTP values and Property rights (current and future), 2004

Area of enumeration	Current rights	Future rights
Commercial farmers	0.80	-0.72
Seymour	0.10	-0.10
Villages	-0.14*	-0.10

(0.10 excluding the unemployed)*

It was therefore not surprising that for the respondents with higher incomes, positive correlations were also found between current property rights and WTP values. Commercial farmers reported to hold a higher number of current property rights, but probably because many government policies in 2004 had equity as one of their objectives (e.g. NWP (1997)), they expected to acquire a comparatively lower number of new property rights in the future. Therefore, even though they were willing to pay higher values for resource use, management and protection, these values were negatively related to property rights they expected to hold in the future.

5.7.4 Property rights and environmental participation

As was the case with WTP values and participation in section 5.71, current property rights had strong negative to weak positive correlations to participation for commercial farmers and the two other areas as indicated in table 5.24.

Table 5.24 Correlation between property rights (current and future) and participation in environmental platforms, 2004

Area	Current	Future
Commercial farmers	-0.99	-0.24
Seymour	0.17	0.07
Villages	0.06	-0.09

It was argued in section 5.7.1 that respondents with higher individual incomes prefer to pay for resources than participate in their public management. Because incomes and current property rights, especially for commercial farmers, are positively correlated, participation was also found to be relatively low for respondents currently holding a high number of property rights. Stronger negative correlations between current property rights and participation (-0.2 and –0.4) were also found for employed respondents with an average incomes greater than R1000 in Seymour and villages respectively.

In section 5.5.2 it was discussed that for males and females between the ages of 40 to 49 years old, especially in villages, participation in public platforms led to rising incomes. It was also discussed that some of this participation was in employment creating environmental projects (e.g. the Land Care project). It would seem that incomes received from such projects were not very high and on average, not higher than R1000 per month. This conclusion is drawn because somewhere above this income level, participation drops in both Seymour and the villages.

In table 5.25, a simplified version of selected variable scores and correlations are summarised. The discussions of the highlighted findings or values were the most emphasised in the preceding sections.

Table 5.25 A simplified summary of indicators of the main findings, 2004

	General participation	Environmental economic values	Property rights: Current / Future
Simple indication of **levels**			
By location			
Commercial farms	most active but not cor. to income	**highest** in money terms	**highest** / lowest
The villages	more active	**lowest** in money but highest in labour time	low / **highest**
Seymour	least active	higher than villages in money terms	lowest / high
By gender			
Males	more active	higher than females	higher than females
Females	less active	lower by 40%	lower by < 1%
Simple indication by **correlation** coefficient levels			
By income			
Below R1000	**higher cor**.	lower cor.	no cor
Above R1000	lower cor.	**higher cor.**	**pos. cor**. / no cor.
By age			
Younger: below 30 years	**highest cor**. but least active	not sig.	not sig.
Middle aged: below 60 years	*ave.* cor. but most active	not sig.	not sig.
Older: 60 years and above	*low* cor. and least active	not sig.	not sig.
By school **education**	*not* sig. pos	**strong pos. for farmers**	not sig.
By environmental education	*slightly* significant in the villages	**strong pos. for farmers**	not sig.
By knowledge of NWP (1997)	not sig. pos.	**strong neg. for farmers**	not sig.
By number of **env. resource use**	no cor	no cor	no cor. / **sig. cor.**

5.8 ISSUES OF CONFLICT AROUND WATER RESOURCE USE AMONG KRV STAKEHOLDERS

5.8.1 Mid to Lower KRV commercial farmers

Scheduling water rights

In 2004, commercial farmers were divided mainly between those with scheduled water use rights and those without. The scheduled water user rights cost R357.46 per hectare per annum. These rights were introduced in the 1960s and entailed that scheduled areas, mainly upstream farms, be restricted from further developing their land for citrus or other irrigation production after the rights were allocated. However, there was some guarantee, dependent on water availability in the KRV dam, that the scheduled areas would receive water as required by land owners. Unscheduled areas on the other hand did not have any guaranteed water supplies from the KRV dam. Farmers on these areas could only buy water on request under rules dictated by owners of scheduled areas (Mildenhall, 2004). For instance in 2004, no water could be sold to unscheduled areas if the dam was not above the 60% of its full capacity (KRV WUA, 2004).

With the implementation of the National Water Policy (NWP) of 1997, scheduled user rights would be replaced by non-riparian water licences, which means that water use rights will no longer be associated with land rights, as discussed in chapter two. The NWP (1997) implementation process entails a restructuring, reallocation and an equitable redistribution of water licences, especially to black and poor water users. However, all areas that previously held scheduled water rights would still receive priority for water licence allocation over previously unscheduled areas.

On the one hand, because a water yield study had not been completed and permit allocations not determined by mid 2004, there was disagreement as to how many water licences the unscheduled water users would be entitled to under the NWP (1997). Owners of scheduled areas feared that owners of unscheduled areas would apply for a comparatively larger number of water licences because they had not been restricted, as scheduled areas were, to develop more land for production since the

introduction of scheduled water rights in the 1960s (KRV WUA, 2004). On the other hand, owners of unscheduled areas felt that the water reserve determination study currently being undertaken, would reveal that enough water resources were available for all water licence demands (Mildenhall, 2004), which if true, would give them an advantage in citrus production.

In any case, before the yield study and permit allocations to users were determined, it seemed, disagreements would continue. These would be fully resolvable only through proper licence bargaining processes under the guide of the NWP (1997). As a short-term solution, at a KRV Water User Association meeting held on the 26th January 2004, a resolution was adopted, pending DWAF's approval, that owners of non-scheduled land should investigate the possibility of temporarily using and paying for water rights allocated to the Upper Kat farmers. Many Upper Kat River Valley farmers were no longer farming or paying for their scheduling rights. This temporary arrangement would stand until water permits, in accordance with the NWP (1997), were allocated.

Plans for Developing the Upper Kat River Valley

The Riverside S.A. and Katco groups were reported to have intentions of developing citrus farming on about 700 hectares of scheduled land in the Upper KRV villages for black economic empowerment purposes, which, in the process, would meet the groups' increased production demands from European markets (Roberts, 2004). At the time of the interviews, the groups were awaiting replies on loan applications from the Development Bank of Southern Africa (DBSA) to begin executing their development plans.

The development plans, if successful, would possibly go part of the way in alleviating the concerns of owners of scheduled land areas, who would have access to more land for development. On the other hand, because the targeted 700 hectares already have scheduled water rights, the groups would have a higher priority in terms of new water licence allocation.

The Black Commercial Farmers

The lack of clearly defined land property rights or land title deeds affected the majority of the black commercial farmers of the former Ciskei. Most of the farmers were worried that the new South African government had not transferred land rights as promised in the arrangements made with the former Ciskei government and ULIMCOR. The lack of land rights had made it difficult for black commercial farmers to apply for land development loans from institutions like the Development Bank of Southern Africa (DBSA). They felt this was inefficient and discriminatory behaviour on the part of the government (Nahamba, 2004).

According to the Department of Land Affairs (DLA), black commercial farmers do have some assurance on the continued use of the farms they currently occupy. Their land use falls under common law lease arrangements between farmers and the state. The only time DLA can withdraw the farmers' lease rights would be if it was found that farmers were not utilizing the land for citrus production, but even then farmers would be able to challenge the state's decision in court and have their lease rights reinstated (Loets, 2004).

In June 2004, the DLA was in the process of preparing to hand over permanent title deeds to the black commercial farmers, which it was estimated would be accomplished within 18 months. It was because of lengthy negotiations between many role players (i.e. financial institutions, the state and farmers) and the resurveying process of the farms that delays had been experienced in handing over permanent title deeds (Loets, 2004).

The rural villages

During interviews and community meetings, village residents expressed negative feelings towards working relations between the provincial DWAF and the KRV CF. As was reported to be the case in Umtata catchment, villagers wanted DWAF to begin hiring local residents as consultants in IWRM projects (KRV CF, 2004). High unemployment rates were some of the reasons why villagers wanted more formal

working relations established and employment projects initiated soon (Ntsebenza, 2004).

On the other hand, the unofficial reason why provincial DWAF had not formalised its relations with the KRV CF, was because, unlike in Umtata, the CF in the KRV was formed through research initiatives from Rhodes University, hence for DWAF the CF remained the university's responsibility (Murovhi, 2004). Some Rhodes university researchers thought that the university's adopted role of initiating research projects in the KRV left officials at provincial DWAF feeling undermined. This had translated into DWAF's nonchalant attitude towards the activities of many KRV water bodies formed without their full support or consultation (EEU, 2003: 92-93). It seemed the KRV CF members were the ones bearing most of the costs created by negative working relations between provincial DWAF and Rhodes University researchers.

Seymour township

Seymour residents were relatively less represented in KRV environmental and water institutions, as these bodies were mainly concerned about issues about overgrazing and/or water abstraction from the Kat River. Seymour's residents kept little livestock and their main water supplier was the local municipality. However, they were still concerned that water from the Kat River Dam had flooded an old local cemetery for black people (see Appendix 6). They felt that DWAF had a responsibility to remove the graves, as it did the graves of white people when the dam was built (Jezile, 2004). How DWAF is seen to be responding to this concern may affect the type of future relations that unfold between itself and Seymour residents as well as the IWRM implementation bargaining process.

5.9 SUMMARY DISCUSSION

In section 5.2 and 5.3 a background history of racial conflicts and forced migration over land resources in the KRV was presented together with a description of three prototypical communities, with different socio-economic attributes created by that history. Commercial farmers were presented as better resourced in terms of public infrastructure (roads, sanitation, etc.) and business opportunities, whereas the Upper

Kat villages were described as having the most limited public infrastructure and job industry. The lack of resources were identified as contributing factors to low economic standards in these areas. Lastly, the public infrastructure and socio-economic conditions in Seymour and Balfour appeared to be slightly better than the villages', but still not as good as those of commercial farmers.

From the 2004 KRV survey data described in section 5.4 to 5.7, information on Public Participation levels, Individual (WTP) Values and Property Rights as exploratory variables was analysed against demographic variables such as gender, age and area of enumeration. On average, commercial farmers' reported average incomes, education and public participation levels were highest compared to other demographic groups. However, this group's public participation levels were not correlated to their incomes. In the villages, on the other hand, middle-aged males and females, between the ages of 40 to 52 years old, reported the highest participation levels in environmental platforms with relatively high positive correlation coefficients between income and participation levels compared to other age groups. The overall participation levels, for most age groups in Seymour, were weakly or negatively correlated to both income and age variables.

On average, the WTP values for environmental resources were positively correlated to incomes, especially in the commercial farmers' cohort. In the villages and Seymour, the WTP values of employed respondents, whose monthly incomes were above R1000, were positively correlated to individual incomes. However, the participation levels of these respondents were not correlated to incomes. From these correlations, it was argued that the participation levels of these individuals behaved as substitute variables for their WTP values in water institutions.

Commercial farmers reported the highest levels of current property rights, and these were positively correlated to incomes and WTP values, but were negatively correlated to their participation levels. The villagers and Seymour residents expected to acquire a high number of property rights in the future, even though at the time of the survey they held a fewer number of property rights. It was argued that the different future expectations between commercial farmers and villagers in acquiring future property rights were less a factor of present economic wealth (e.g. high incomes) but more

dependent on how each group perceived the future impacts of many of the present government's redistributive economic policies.

Lastly, from interviews and meetings, water allocation conflicts and disagreements on how the NWP (1997) would reallocate water rights between owners of scheduled and non-scheduled areas were discussed. Each group felt that it deserved to receive first priority in water licence allocations. Black commercial farmers, on the other hand, reported that the government's failure to resolve the issue of land property rights transfer to former Ciskei commercial farmers, by mid 2004, had negatively affected their commercial competitiveness.

In the villages, the urgent need for employment opportunities and the reported perceptions that provincial DWAF was slow or even not interested in creating formal working relations with Rhodes University established water institutions had left feelings of disenchantment among KRV CF members. On the other hand, Seymour residents were less concerned about water resource shortages compared to residents in other areas; however, they were apprehensive about the pollution effects from water flooded graves, partially submerged under the Kat River Dam water.

In chapter six, pronounced relationships between exploratory, explanatory and demographic variables as well as the identified stakeholder conflicts are used in discussing the game theoretical hypothesis for IWRM implementation process. Potential challenges based on identified correlation trends, KRV water conflicts and the objectives of the NWP (1997) are discussed for policy recommendations. Some of the suggested economic solutions are based on implementation lessons from other case studies in similar socio-economic environments.

CHAPTER 6 – DISCUSSION AND POLICY RECOMMENDATIONS

6.1 INTRODUCTION

To draw the theoretical discussions, the described data for policy recommendations, in this chapter the game theoretical approach is used for breaking down and discussing costs for the establishment and management of local water institutions within Water Management Areas (WMAs). It is argued that the majority of the costs for establishing institutions will have to come from external agencies such as the national Department of Water Affairs and Forestry (DWAF) and the Department of Land Affairs (DLA). Only after institutions have been established will the revenues for their administration be internally raised.

A number of job creating public-works projects in the water sector are identified as vehicles for stakeholder empowerment, which will lead to equitable representation and participation in water platforms such as Catchment Management Agencies (CMAs). It is argued that to fund these water projects for establishing local institutions, economic instruments such as cross subsidies, user charges, permits and quota systems, etc., as well as agencies to execute the projects have to be identified for an efficient redistribution and reallocation of resources.

Lastly, issues pertaining to a) cultural definitions of water resource use, as opposed to economic definitions, b) unclear delineation of responsibilities in the decentralisation of water resource management and c) the lack of interdepartmental coordination in public policies are discussed as constituting some of the obstacles in the implementation of Integrated Water Resource Management (IWRM). These issues have been identified in other developing countries, such as Sri Lanka, Argentina, Vietnam, Mexico, etc., and are discussed for their relevance to South Africa's National Water Policy (NWP) of 1997.

6.2 THE GAME THEORETIC DISCUSSION

For the effective management of common resources, the main arguments put forward from game theory discussed in chapter three are concerned with a) the definitions of

rights to resource use, b) transaction costs associated with asymmetric information and c) the binding nature of local and long term investments.

As mentioned in chapter three, Dales (1968:53) saw common property rights as ‘open access’, if resources are not controlled by central government. If they are centrally controlled, he defined them as ‘restricted common property rights’ (Dales, 1994:179). On the other hand, Quiggin (1988:1071-1085) saw some common property as resources whose uses are collectively controlled through cultural or traditional rules that evolve over time. These rules, however, are not written down in conventional legal formats. The differences in these definitions of property rights, it was argued, determines how each predicts the resources’ use as either sustainable or unsustainable. Dales (1968) subscribed to the ‘tragedy of the commons’ thesis, where commonly owned resources are invariably over utilised to extinction, whereas, Quiggin (1988) argued that in cases where cultural norms are respected by the majority of citizens, common resources are managed in a sustainable manner, without intervention from central government. Somewhere in between the two extreme viewpoints, Ostrom (1990:1-23) advocates a legal institutionalisation of locally founded rules in managing resources. Instead of hoping that citizens may respect traditional norms, she proposes that binding and renewable social contracts are established.

Integrated Water Resource Management principles are based on social contracts that respect the protection and rehabilitation of natural common resources by using decentralised and economic management approaches. However, such contracts require that information on the use, consumption and economic value of resources be readily available to such an extent that costs associated with the establishment and maintained observation of legally binding contracts are lower than the actual or perceived marginal benefits gained from non cooperative behaviour (i.e. free riding).

In discussing the Kat River Valley (KRV) case study, the approach that explores transaction costs associated with establishing and managing water institutions like Catchment Management Agencies (CMAs) is adopted. Once institutions are established, the costs of managing them is discussed against individual benefits from non cooperative behaviour. A large portion of transaction costs in establishing and managing institutions relates to information costs. In negotiating binding social

contracts, for instance, the costs of facilitating information flows for smoother bargaining processes will have to be borne mostly by DWAF, whose responsibility it is to initiate and implement the NWP (1997). Thereafter, information costs associated with monitoring the behaviour of parties in the use and consumption of resources will be borne mostly by CMA bodies (NWP, 1997). Other transaction costs relate to capacity building, in terms of local skills and infrastructure. The limitation of this approach, however, is that no full account is taken of uncertainties that might exist with regards to a) economic values of natural resources on which most public preferences are based and b) the unknown public preferences of future generations that will be affected (Dosi, 1984:221-235 and Arrow, 1962:609-625). After all, the NWP (1997) was initiated from central government and in the KRV 75% of respondents were unfamiliar with it. Therefore, whether the public does really prefer its implementation is not clear.

Nevertheless, from the perspective of either DWAF or the KRV, in cases where there are high transaction costs and low benefits from establishing and managing institutions, there are no incentives for action. Therefore, ways of minimising costs and/or of maximising benefits need to be sought for the NWP (1997) implementation process. In diagram 4.1 (chapter four), a responsive public policy model, based on game theoretic assumptions, is proposed as one of many other tools for informing public policy about the public's needs and/or preferences. According to the model, when public needs are taken into account, initiated policies become more relevant and stand a better chance of being successfully implemented.

The game theoretic assumption put forward in chapter three is that cooperative behaviour (e.g. non-free riding behaviour) among citizens partly depends on the citizens' binding and long-term local investments (i.e. immobility). This means that in maximising levels of binding local investments, the benefits from behaving cooperatively would also be maximised. Such local investments, actual or perceived, can alter individuals' behaviours from non-cooperative to cooperative. In reducing transaction costs, on the other hand, especially those stemming from asymmetric information, clearly drawn social contracts, sensitive to local circumstances need to be adopted by a critical number of stakeholders. What this means is that individuals

need to be informed about the contracts' objectives and they need to see these as individual benefits enhancing, beyond individual gains from free riding.

From table 6.1 (discussed in chapter three in more detail) it is argued that to achieve cooperative behaviour, with a 10 unit benefit to all players, a social contract whose costs to establish equals (e) can be sustained as long as (e) does not reduce benefits from cooperation to 9 units, which are benefits from defective behaviour (e.g. free riding). The assumption in the model is that y = 1 (i.e.100%), where y represents the accuracy of information available for effective administration and monitoring of citizens' behaviour in their use of common resources. The penalty imposed on individuals for defective behaviour is therefore dependent on both (y) and the economic value of the resource. In the same model as was illustrated in chapter three, the penalty is set at *two units* such that the total benefits from cooperating are greater than benefits from defecting.

Table 6.1 The prisoner's dilemma with a 2 point penalty for non cooperative behaviour specific to the KRV

PROFIT SCENARIOS (as was illustrated in chapter three)			
Herders' actions	Both Cooperate	One Defects One Cooperates	Both Defect
Herder one	10	-1-2x or 11-2y	-2y
Herder two	10	11-2y or -1-2x	-2y

(Adapted from Ostrom, 1990:11)

Where:

y = is the probability of punishing defection (right move)

x = is the probability of punishing cooperation (wrong move)

and therefore

y + x = 1

Where the abstract players represent all the bargaining KRV stakeholders/parties

A reduction in the accuracy of information (y), at a central level, entails an increase in the value of (e), the costs for establishing a legally binding contract. This necessitates the delegation of the common resources' management to local agencies, where better information for monitoring purposes may be available. However, because effective monitoring also depends on the availability of skills or expertise, monitoring is not

always better at local levels. Therefore, how far the decentralisation process can go would partly dependent on the local capacity to administer resources.

It is apparent that for the central or local management of common resources to be sustainable, marginal benefits from cooperation must be greater or at worst equal to marginal costs. This means that, from the KRV empirical data, an increase of individual benefits (from cooperation) with increasing individual local investments was expected. A willingness to protect resources (e.g. participation and or WTP values) should rise with higher investments. The conclusion, however, depends on whether respondents also view participation and/or WTP values as cooperative behaviour in resource management. There may exist different cultural beliefs about participation or payment *in monetary terms* for natural resource, for instance the cultural restrictions on women's public participation.

As earlier mentioned, 75% of respondents in the KRV were not familiar with the NWP (1997), however, many of them were active in public platforms and viewed participation as cooperative behaviour. 88% of respondents felt that participation was 'a very good thing to do', and 77% reported to be attending public meetings, 'at least some of the times'. Therefore, using public participation as a proxy indicator for cooperative behaviour seemed appropriate.

A surprising finding was that 'currently held property rights' were not positively correlated to participation, but to incomes, although high incomes were correlated to WTP values. Because respondents with high incomes also possessed a high level of property rights, they expressed their cooperative behaviour mainly through expressing high WTP values. As discussed in chapter five, poorer respondents expressed their cooperative behaviour through participation, and wealthier respondents through their WTP.

Even though these findings are interesting and seem to validate the game theoretic assumptions made about factors affecting cooperative behaviour, ways to use them for successful water policy implementation process need to be devised. The implementation process needs to maximise benefits to the public, while limiting costs to agencies like DWAF and thereafter CMAs, in establishing and managing

institutions. Already a high willingness to either participate or pay for resource use, protection and management exists in the KRV, however, the capacity (e.g. infrastructure and skills) to achieve these objectives is limited for most population groups. The high WTP values and to participate need to be converted into currency for implementation, which is infrastructure, money, labour and skills.

The village and Seymour's abundant labour and the commercial farmers' capital and technical skills need to be channelled into water related public work or projects. In raising capital from direct and indirect environmental uses, taxes, user charges, etc., should be designed and executed in a redistributive manner (Ferraro, 2002). To transfer skills from commercial farmers, researchers, DWAF, etc., to the villages and Seymour's unskilled labour, training institutions and water works projects with remuneration incentives should be established. However, the transfer of skills and capital from one section to the other can happen, efficiently, when supported by a good public infrastructure, whose responsibility and mandate to set up is the government's.

The successful establishment of representative CMAs must follow the technical and administrative training of local stakeholders through established job-creating institutions in the water sector. The challenge of identifying the appropriate economic policy instruments to maximise the capacity of institutions (so as to minimise the (e) value) should assume a systematic and more linear approaches, with built-in self-checking mechanisms, as illustrated in table 6.2. Besides, the effectiveness of the economic tools used, the mechanisms should also ensure that the groups targeted for equitable participation are involved and empowered with skills and capital. As the initiator of the water policy, the majority of the initial costs in building water related infrastructure and work projects would be *borne by DWAF*. In any case, the data analysis in chapter five indicated that respondents were willing to pay the lowest values for establishing or managing water institutions. The following sections discuss the possible economic projects and instruments to effectively manipulate the (e) and (y) values using data from the KRV.

6.2.1 Economic measures for quantifying and minimising the costs (e) to establishing participatory institutions in the KRV

Public works projects and cross-subsidies for improved infrastructure and participation

Available public infrastructure normally determines the level of economic activity in given locations. It is therefore not surprising that in the villages and Seymour township, where poor public infrastructure was reported, the highest levels of unemployment and the lowest average incomes were also reported. Concerning public participation levels by area of enumeration, commercial farmers could better access the venues of participation, not only because they had better information about public water events but also because they had better transport facilities to reach the venues. The villages and Seymour residents lacked both public and private transport facilities in general. Hence, DWAF could consider providing transport facilities for the water participation of all stakeholders, at least as a short-term solution. In the long run, the national Department of Transport could facilitate an improvement of public transport facilities, like roads, and railways, etc., for the whole KRV. The reintroduction of the rail system for passengers as well as agricultural goods should complement the expected agricultural development projects. Public transportation projects should also ensure that minimum wage jobs are created for locals.

From the KRV data, it seems that even wages below a R1000 per month impact positively on public participation. Therefore, considering government's limited resources, spreading the number of jobs to as many stakeholders as possible will ensure a broader stakeholder participation. However, these jobs should be designed in a manner that *enhances* targeted participation in the water sector, because as earlier noted, increased incomes from a non-water sector may only lead to an expression of high WTP values. Having assumed that individuals often behave in ways that maximise their individual utilities, creating any employment in the water sector would successfully convert this behaviour into required levels of participation. Therefore, at the same time that environmental education campaigns are championed, especially by environmentalists, as *the* tool to alter individual beliefs, water related employment

projects would guarantee that individuals' economic interests are met and hence their behaviour is altered to meet enhanced participation levels in water bodies.

Faysse (2004:52-82) identified the lack of agricultural infrastructure as another source of lower stakeholder participation at Water User Association (WUA) levels in case studies from WMAs around South Africa. He argued that even though there is a legal assurance of access to water resources for the poor, the physical access to resources, which also ensures a direct involvement in their administration is difficult for subsistence farmers. Largely, subsistence farmers are not in desperate need for water licences, but need the actual water resources, which can only be abstracted using irrigation equipment. They also "need to be part of (water resource) day to day management" (Faysse, 2004:62). In rural communities, such infrastructure is unavailable and its maintenance is impossible without funding.

To meet some of these needs, Faysse (2004:66-68) proposes that wealthier commercial farmers cross-subsidise subsistence farmers. However, rational commercial farmers, as selfish individuals, would not make this decision unless it entailed economic gains larger or equal to costs. Therefore, direct or indirect economic incentives have to be designed and used to entice commercial farmers' cooperation into cross-subsidising subsistence farmers.

Institutional arrangements similar to those formulated for Black Economic Empowerment (BEE) in the private sector (e.g. tax rebates, etc.) can be used at WUA levels. However, in order to avoid identified corruption or failures in such arrangements, their administration would need to be delegated to accountable WUAs. Government departments should only issue tax rebates or subsidies to commercial farmers who are members of the same WUAs to which subsistence farmers belong.

Ultimately, however, the general public has to be willing to pay the higher taxes to raise funds for such cross-subsidisation. Contingent Valuation Methods (CVM) (e.g. stated preferences) may be used to determine the sources and levels of appropriate taxes.

The use of water related public projects to increase participation levels in semi-urban areas, like Seymour, should prove to be a greater challenge than in the villages, because water demand and use in urban areas were less directly associated to river water resources. However, like the villagers, urban residents were also worried about water pollution. Urban residents may, in fact, be worse polluters (fig 5.2) than the villagers, especially because in the majority of cases they do not abstract water resources directly from rivers. In Seymour, residents were worried about water pollution because of water flooded graves. On the other hand, they reported as many riverine uses (fig 5.2) as the villagers. Therefore, project works aimed at curbing water pollution as well as creating economic markets for riverine uses specific to Seymour residents should be designed specifically for their needs.

In summary, increasing representative participation by manipulating local and individual economic interests through carefully thought out project works and agricultural cross-subsidy schemes should prove effective in minimising costs associated with establishing water institutions (e).

Property rights, incomes, WTP values and participation

Because property rights were better correlated to incomes, and less so to participation, DLA and DWAF should coordinate on formulating future policies aimed at land rights redistribution. Similar to water projects, the redistribution of land property rights, if not carefully thought out, may not necessarily lead to desired levels of participation in water platforms, but like high incomes may only influence expressed WTP values.

Because a large number of respondents in the villages and in Seymour expected to hold more property rights in the future, the redistribution of rights to the poor must have, associated with them, clear conditions supporting IWRM implementation. One such condition, for instance, may entail a limit on the tradability of rights in open markets, especially across the poor and wealthier groups. Unfortunately some of the conditions may entail that social costs are incurred, but as with many other equity policies, such costs may be acceptable as long as they do not exceed long run social benefits, such as political stability.

In any case, DWAF's water policy implementation strategies already prohibit water licence trading within Water Management Areas (WMAs) (DWAF, 2001). Nevertheless, DWAF does not have to restrict licence trade within income groups. If, for an example, differently coloured licence permits were issued to specified income groups and an effective method of identifying these groups was established, then the trade of same-coloured licence permits would be permissible. The restrictions to the trade of rights should apply to land rights and other equitable rights, until equity objectives are no longer socially and/or politically desired.

Concerning commercial farmers, a short-term solution proposed at a KRV WUA meeting in January 2004 to resolve the conflict between owners of water scheduled and non-scheduled areas was that non-scheduled owners be allocated water resources from the unused and unpaid for rights from the Upper KRV villages. For economic efficiency and good social relations, DWAF should consider implementing the solution only in the short-run, while the ecological Reserve determination is underway. Economically, the solution would mean that relatively higher revenues are generated from water use in the KRV, and the WUA would be better financed. Socio-politically, it would mean that the current water disputes and the mistrusts observed between commercial farmers would be reduced. For any bargaining process, high levels of trust, besides transparent information between parties would ensure that high costs, especially in terms of time units, are avoided (Fryer, 2003:197-201). This would also lead to lower (e) values in establishing CMAs.

Concerning black commercial farmers, DLA has to ensure that a) the process of handing over property rights does not drag on any longer than necessary, b) the payment methods for the debt owed to the former Ciskei development schemes are resolved and c) the means of acquiring new loans for land development projects are arranged. If these issues were attended to soon, black commercial farmers' perceptions that the government was being discriminatory towards them would not persist and their outlook and contribution towards the NWP (1997) implementation process would be enhanced. However, this would require coordinated policy work between both DWAF and DLA.

For the villagers, who also reported high expectations of receiving property rights transfers in the future, the citrus development schemes such as one proposed by the Riverside S.A. and Katco groups should be supported by DWAF and DLA. Not only are villagers familiar with citrus farming, as some of them are former citrus farm labourers, in 2004 many citrus farms stood unutilised in the upper KRV. Seven hundred and sixty hectares of citrus farmed land with scheduling rights were not cared or paid for in the villages (KRV WUA, 2004).

The reintroduction of citrus farming, by commercial groups, into the villages would be easier and not only lead to economic development and job creation, but also to higher stakeholder participation in water institutions. This would also be a form of cross subsidisation that benefits both parties, without a need for the government to use economic incentive offers to commercial farmers. Nevertheless, the extent to which citrus farming is developed would be determined by water availabilities as found in the Reserve determination study currently underway.

The initiation and support of economic projects and the legal transfer of land and water rights to the poor parts of the KRV will improve infrastructure, develop skills and entice the population into supporting the IWRM implementation process. If the execution of the projects is successful, the implementation costs to DWAF would be greatly reduced.

6.2.2 Economic measures to maximising the monitoring and administrative information flows, the (y) value

Education, language and participation

Without the transfer of knowledge about the National Water Policy (1997) and its implementation strategies to the people eligible for election into CMA management, the monitoring of defective behaviour in WMAs will be impossible. As already mentioned, more than three quarters of the respondents reported that they were unfamiliar with the NWP (1997). Sixty three percent and eighty percent of respondents had no knowledge about the Catchment Forum (CF) and Water User Association (WUA) activities respectively (Appendix 15). Therefore, it would not be

wise for DWAF to continue establishing water institutions without, first, investing in widespread educational campaigns about the water policy. During these campaigns DWAF would also have to gauge the public's reaction to the policy. The weighing of stakeholder attitudes towards the policy would determine the required efforts in the implementation process and from that the estimated costs. To ensure that stakeholders are educated about the policy, initiated development projects could also be used as vehicles for educational campaigns. Many of the KRV environmental projects (e.g. the Land Care Project) carried out in 2004 were not NWP (1997) specific. This is evident from the large number of respondents who expressed positive attitudes towards the protection of environmental resources (63%) but at the same time were not familiar with the policy itself.

On the other hand, the KRV has already experienced a culture of using economic incentives for participation in environmental projects (e.g. job creation in Land Care Projects), therefore expanding this culture, however, with added water specific and measurable participation outcomes, should not be too difficult.

Even though over 74% of respondents reported that they followed proceedings during environmental meetings 'very well', because most CF meetings were conducted in the local Xhosa language, most could not read or understand the policy documents written in formal English language (e.g. NWP (1997), NWRS (2002), etc.). 69% of respondents could not 'write, read and speak' the formal English language (Appendix 16). This means that many stakeholders could not access the information contained within DWAF documents. The kind of policy information known to most respondents had been received from secondary sources such as workshops conducted by researchers and field workers like Motteux (2002) and Ntsebenza (2004).

In table 5.12, the average years of school education reported for Seymour and the villages respondents, older than 40 years, was less than grade 6, whereas for the age group younger than 30 years old it was above grade 10. Considering the fact that in both areas it was older respondents who reported to be more active in public platforms, the financial options for DWAF for enabling respondents the primary access to the NWP (1997) would be to either translate its documents into local languages or to recruit younger respondents, with higher education levels. If younger

people were targeted, an option entailing that long-term investments would be made, the socio-cultural costs of alienating the already active older respondents would also need to be considered. In any case, the water policy's equity objective, which demands that more women be represented has already invited similar socio-cultural pressures.

In 2004, there was only 15% of female representation in the KRV CF, only two women, one of whom was the black, were represented in the KRV WUA. In all of the WUA meetings attended, the black female representative reported that she did not understand any of the proceedings, because of language barriers, the lack of technical farming skills and of the political grasp of issues discussed during the meetings. Her presence, it seemed, was purely token in nature.

Therefore, concerning policy information required for managing water resources, which also entails the monitoring of stakeholder behaviour in the use and consumption of resources, DWAF could not ignore the challenges of embarking on widespread educational campaigns. How these campaigns are undertaken in cost effective and efficient ways would depend on financial constraints, the quality of educational projects as well as their execution.

In the short run, it would make economic sense to recruit already active local members to intensive education programmes, initially facilitated by DWAF personnel or consultants. In the long run, the policy training responsibilities may be delegated to local graduates as a form of employment creation. The WUA can also be entrusted with training local stakeholders, using carefully worked out incentives. Using skilled locals would ensure that both technical and socio-cultural information is transferred in the most culturally sensitive manner. Once the training functions are delegated to locals on the one hand, DWAF should devise methods for ensuring that the quality of the communicated information is sufficient and accurate in terms of the NWP (1997).

Table 6.2 illustrates the type of projects and the phases in which they could be initiated for the NWP (1997) implementation process. There are two identified phases for establishing and managing of water institutions that require economic, educational and technical projects as drivers. In phase one, many of the projects

would require DWAF's support or other big investors' involvement, at least in the initial stages. However, once initiated, the projects could be managed by other agencies, with economic instruments for their funding identified. In phase two, the use of projects would depend on the responsibilities and effective functioning of the CMAs.

Table 6.2 Water related projects for policy implementation and management

PHASE ONE: IMPLEMENTATION COSTS (mainly externally funded)							
Broad classification of projects	Specific projects types	Project Initiators	Project Executors	Targeted Recipients	Main Funding Agent	Main Economic Instruments	Individual project outcomes:
Core Projects							
Agricultural Infrastructure	1.Irrigation 2.Packing 3.Chemical 4. Marketing	DLA DWAF Local inst Commercial farmers Local gvt	DLA DWAF Local inst Local indiv Local gvt	Subsistence farmers Rural and Urban res Esp. Youth and females	DLA DWAF Int. donors Commercial farmers Local Inst Other bus	Taxes User charges Subsidies	Profitable and sustainable local agric. bus
Broad Water Policy Awareness	NWP Strategies	DWAF Consultancy Local grads	DWAF Consultancy Local grads	All	DWAF DLA Consultancy	Taxes	Broad critical level of awareness
Technical and Scientific	1.Environmental 2.Water reserve determination (Palmer et al. 2003:43-44)	Consultancy Local inst	Consultancy Local inst	All	DWAF DLA Int. donors Educ. inst	Taxes User charges	Water permit negotiations and allocations
Policy Related Projects	1.Water rights 2.Land rights restitution	DLA DWAF Consultancy	DLA DWAF	Individual and Collective Land claimants	DWAF DLA	Taxes	Clearly defined land and water rights
Training (Tech/Policy)	NWP 1. Agric tech 2. Agric business 3. Business & financial & institutional management 4. Monitoring 5. Other water bus Environment	DWAF Commercial farmers Consultancy Local inst	DWAF Commercial farmers Consultancy Local inst	Local inst & gvt Community & individual entrepreneurs Stakeholder Representative	DWAF Int. donors Commercial farmers Local Inst Other bus	Taxes Subsidies User charges	CMA Management skills -financial -human -admin. Use & consumption monitoring
Other							
Supporting Projects							
Broad Public Infrastructure	1. Transportation 2.Communication 3. Public arenas for meeting	DWAF Consultancy Other depts. Local gvt	DWAF Consultancy Other depts. Local gvt	All	Consultancy Other depts. Local gvt	Taxes User charges	Critical level of -public infrastructure -participation -management
⇩							
PHASE ONE OUTCOME: LEGAL ESTABLISHMENT OF SUSTAINABLE CMA							
⇩							
PHASE TWO: CMA MANAGEMENT COSTS (mainly internally funded)							
Physical monitoring of resource abstraction	Monitoring of chemicals used and effluents	Continued technical training	Management of permit markets	CMA administrative and human resource costs	Funding of other water bodies in the WMA	Continued NWP awareness campaign	Continued business initiation and training
The CMA as the responsible body delegates the functions to local institutions, such as WUA, consultants, municipalities, business and individuals. The revenues to carry out the administrative functions are raised through user charges and user permits, where appropriate (e.g. for multi source point pollution through taxes), and to a limited extent from external agencies.							

The initial investment costs (sunk costs) into WMAs from external agencies would decrease over time as CMAs become independent and are able to generate and manage their own revenues. In phase two of table 6.2, most of the management costs would be borne internally by local institutions and individuals.

Fig 6.1 illustrates the relationship between decreasing sunk costs borne mostly by DWAF and increasing management costs borne internally. The figure also illustrates how with the establishment of institutions benefits from free-riding would decrease and those from cooperative behaviour would increase over time.

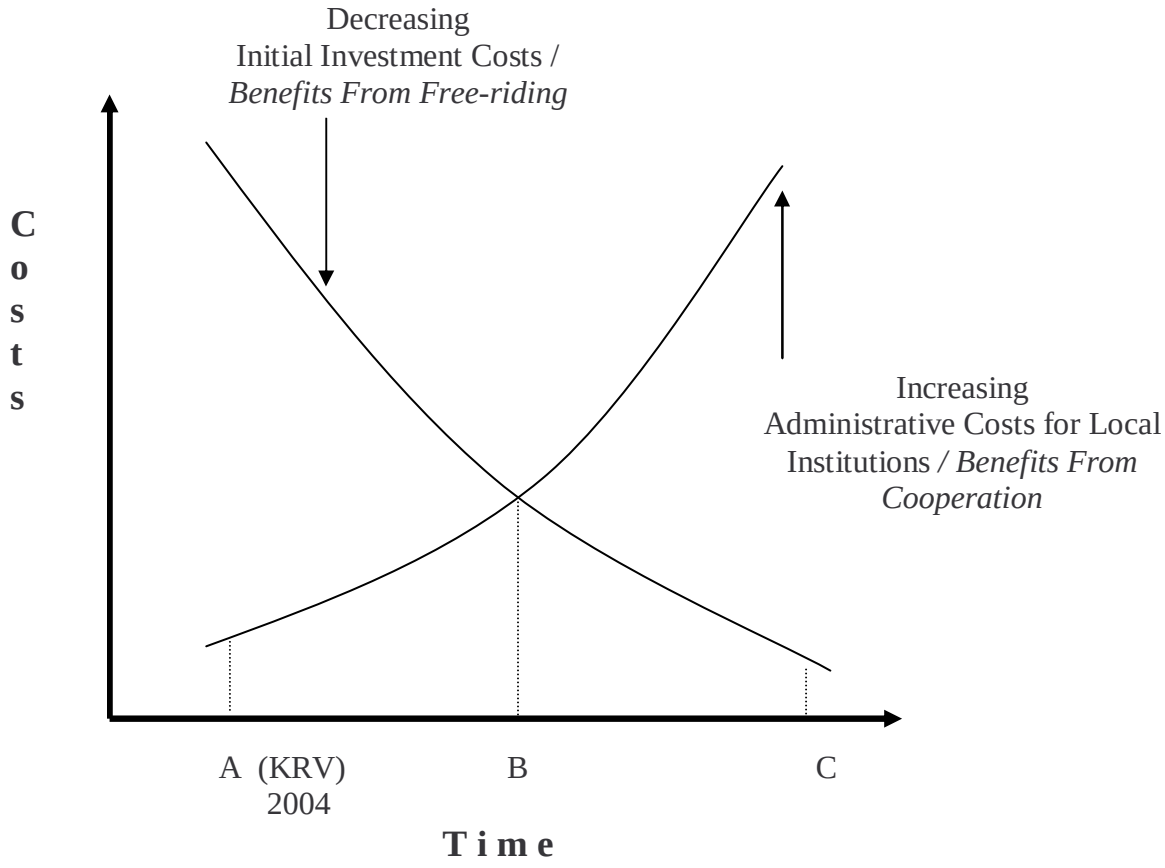


Fig 6.1 Implementation costs of establishing CMAs versus costs of their administration

Point A of fig 6.1 depicts the beginning of phase one and B the legal establishment of a CMA. Point C depicts phase two of table 6.2, where the CMA is fully functional and no longer dependent on external support. In 2004, the water policy implementation process in the KRV could be located near point A. Where only a sub

CF and a WUA had been established as water bodies, however, both with limited financial resources from Rhodes University and the WRC. Near point A, no CMA establishment process is underway.

Estimating the Initial Costs for Initiated Projects

In estimating the costs needed for citrus agricultural infrastructure, for instance, the undeveloped land suitable for agriculture has to be identified. In the upper KRV at least 762 hectares of suitable land had been identified by Riverside S.A. and Katco groups. The present day costs to active commercial farmers can be used to estimate the initial minimum and maximum costs for a project aimed at developing and running 762 hectares of citrus production. These costs would vary depending on the type and quality of citrus production that subsistence farmers would be willing to produce as well as the packaging and marketing costs to be incurred. Riverside S.A., for instance, incurred higher production and marketing costs compared to black commercial farmers, because they supplied European markets with higher demands for quality and variety of citrus products. On the other hand, many of the black commercial farmers sold their products in local markets (e.g. former Transkei villages), where demands for high quality and variety were lower. This also meant that their production, packaging and marketing costs were relatively lower. During production, black commercial farmers used less technically, chemically and labour intensive infrastructure.

In estimating the technical training costs for agricultural production and water management in local water institutions, a minimum and maximum number of stakeholders could be identified using a) the amount of available land for potential agriculture, b) the NWP (1997) targeted representation and c) the total population in the KRV villages and Seymour. Depending on the size and number of the water institutions established, proportional representation could be worked out from total populations of demographic groups (i.e. race, gender and income). The size and number of water institutions, on the other hand, would depend on the size of the WMAs, their population density and the number of envisaged agricultural activities, etc. For larger WMAs with high density populations and highly varied agricultural activities, bigger water institutions would have to be established or alternatively the

WMAs would have to be further demarcated into smaller areas. This would entail that many but smaller water institutions are created for effective management and monitoring activities. The choice between larger and/or many smaller institutions would depend on public preferences, DWAF's planning, which could be informed by management lessons from successful cases.

To work out the tuition costs, choices would have to be made on the length and content of courses offered. These could be guided by tuition fees paid at Agricultural colleges in the Eastern Cape (e.g. Fort Cox Agricultural College). For NWP (1997) specific tuition, not necessarily offered in public colleges, field experts such as university researchers, DWAF personnel, successful commercial farmers, etc., could be hired as teaching consultants. Table 6.3 illustrates an example estimation of technical and policy training course, running over a year, for 60 targeted stakeholders, proportionally identified and/or elected for water management functions as well as those interested in agricultural businesses.

Table 6.3 Estimating a year's technical training costs in the KRV for 60 stakeholders in 2004

FUNCTION	COSTS IN S.A. RANDS
Tuition fees	R4 000 x 60 = R160 000
Subsistence income	R1000 x 60 x 12 (months) = R720 000
DWAF's or hired bus costs	R100 000
Consulting costs per year	R100 000
Teaching material	R 50 000
Other	
Total	R 1 130 000

The chosen subsistence income of R1000 per month is slightly above South Africa's minimum wage. The above estimate is a reasonable estimation of training costs if the KRV agricultural college is used as the training centre with tuition fees of around R4000 per year. Different costs can be estimated for different WMAs or Catchments for different policy implementation projects listed in table 6.2.

6.3 IWRM POLICY CHALLENGES FROM OTHER CASE COUNTRIES

The economic versus cultural views of water resources

The biggest challenge for many developing countries, like Vietnam, Sri Lanka, etc., in implementing IWRM policies has been to organise and coordinate a large number of small and non-homogenous groups of subsistence farmers into income units (Shah et al., 2001). In catchments where there are many small subsistence farmers, the cultural values and uses of water resources do not follow the conventional rules of economic markets. Therefore, in such areas, the introduction of economic tools, such as water quotas, permits, etc., to manage water resources is a greater challenge (Shah et al., 2001).

The farming community of South Africa and in the KRV comprises of many small subsistence farmers from former black homelands, and fewer large, mostly white, commercial farmers, whose use and understanding of water resources are economically different. In chapter five, the village and Seymour respondents reported riverine uses such as spiritual and cultural uses, whereas the commercial farmers' reported uses were mostly economic in nature (e.g. irrigation and recreation). Because the NWP (1997) stipulates that free access to limited and non profit household water resource uses and consumption be free to subsistence farmers, these cultural and economic differences in the understanding of water resource should have a limited effect on their economic management. However, this would be true for as long as the subsistence farmers' use of water resources remains below the stipulated free limits. On the other hand, water resources, even in limited amounts, are not only abstracted, they are also used as sinks for pollutants. Therefore, free or priced access to water resources may mean nothing if that water is polluted and unusable. From the pollution perspective, the economic understanding of water resource use, together with economic tools for curbing pollution is crucial to all users, whether they have free access to water or not. Moreover, innovative economic tools, not linked to direct water abstraction, have to be devised to limit the KRV Dam's pollution by upstream semi-urban Seymour residents.

About the protection of riverine biodiversity, the NWP (1997) and the National Water Resource Strategy (NWRS, 2002) documents are silent about how economic tools would be used in preventing over harvesting resources like medicinal plants, sand, etc. Moreover, the water policy does not yet have preventative guidelines on the potentially detrimental use of washing detergents on living organisms in river waters. In fact, besides water resource abstraction, recreational uses and single point source pollution, the policy does not discuss many of the reported environmental uses listed in fig 5.2 in chapter five.

The delineation of responsibilities in decentralisation policies

Because IWRM aims to decentralise the environmental and economic management of water resources to local CMAs, it is important to discuss the reasons why, especially in many developing country cases, decentralisation policies have been ineffectively implemented. Such policy implementation have often led to outcomes worse than original social and economic conditions (Shah et al., 2001).

Ribot (2002:2-3) defines decentralization as entailing the strengthening of local as well as *central* government agencies in ways that support the natural unification, democratization, greater economic efficiency and equity in the use of common resources and local service delivery. Ribot (2002) argues that decentralization is a logical evolutionary process because locally based institutions, if they have both political and financial power, can better discern local needs and aspirations and they can be quick to respond to local demands. However, for proper decentralization to be achieved, local institutions must be downwardly accountable (i.e. to their constituencies and not to the central government), otherwise, these institutions would continue serving national governments' interests (Ribot, 2002). In cases where institutions remain accountable to central governments, the attempt at decentralisation results in mere de-concentration (i.e. the delegation of responsibilities from central to local institutions). Partly, what this means is that it is essential that the legal and constitutional frameworks that define local institutional powers of jurisdiction allow for accountability to local constituencies.

Ribot (2002:7) lists and discusses reasons why many developing country governments feel pressured to implement policies of decentralisation, even though they lack the required a) political will, b) economic resources, c) technical skills, etc. to do so. If countries with limited resources respond to pressures to follow decentralisation policies, their established local institutions end up accountable to central governments. Some of the sources of pressures, as discussed by Ribot (2002:7) are:

a) pressures from economic crises (Therkildsen, 2001:1; Olowu 2001:53);
b) a means for central governments to shed fiscal burdens (Nsibambi, 1998:2);
c) a failure of central administration (Wunch and Olowu 1995);
d) an emulation of reforms in other developing countries (Therkildsen 2001:1);
e) a result of populist political success (Heller 1996; Olowu 2001:53) and
f) a result of donor pressures and conditions as part of structural adjustment and other programmes imposed from the outside (World Bank 2000; Mutizwa-Mangiza 2000:24; Therkildsen 2001:1).

With regards to IWRM in South Africa, it can be argued that a clearly defined provincial strategy to legally establish and empower local institutions as independent statutory water bodies does not yet exist. In the KRV and other WMAs in the province, provincial DWAF, seven years after the NWP (1997) was formulated, had not completed the formulation of its Internal Strategic Perspective documents (ISP) to guide the CFs and CMAs' establishment processes (KEKE, 2004).

Moreover, in the NWRS (2002) the legal, financial, etc., roles for local municipalities in CMAs had not been clearly defined. In 2004, the Nkonkobe district municipality, in which the KRV is located, had not even obtained a copy of the NWP (1997). The first time the municipality officials in environmental portfolios had learnt about the NWP (1997) objectives was during the workshop organised as a community debrief for this research. It seems, municipal roles are better defined in DWAF's policy for Water Service Delivery (DWAF, 2001), as the Nkonkobe municipal officials were more familiar with that policy.

In 2004, the economic strategies for charging multi-point source pollution were still under review (DWAF, 2004). Nationally, the implementation process has been slow

and burdensome (DWAF, 2004). Awareness campaigns and grassroots training programmes, in the KRV, had not been *officially* rolled out. Previously disadvantaged stakeholders in many WMAs were not yet well represented in water bodies like WUAs (Fayese, 2004). Of the proposed nineteen WMAs, in only one had a CMA been established.

Whether the lack of clarity on implementation timeframes, especially in the Eastern Cape province, and the lack of clearly defined responsibilities for local institutions such as municipalities were because of the lack of political, financial, legal, etc., resources as mentioned by Ribot (2002:7) in decentralisation processes is not clear. However, some of the data seem to indicate that this is likely. Moreover, a discussion about the likelihood of the lack of political will from DWAF officials should be undertaken. This discussion should explore the officials' attitudes or fears about the inevitable redistribution of power from central government to locally established institutions. In the policy strategy objectives, some of the current responsibilities of DWAF's officials would be partially or completely lost to local stakeholders (NWRS, 2002), and this may entail possible job loses at national and provincial DWAF levels. Whether this is a factor as to why DWAF has been slow in implementing the NWP (1997) needs thorough investigation.

Concerning the possible lack of financial resources as a reason for the slow implementation process, it is important to discover whether DWAF's ability to raise funds could ensure that the implementation costs for all 19 WMAs (using the guidelines in table 6.2 and in accordance with game theory) are covered. A national budget has to be drawn up to ascertain whether South Africa can afford to implement full IWRM policies at present or in the future. Only after it is known whether or not the country's citizenry is willing to pay for the implementation process can it be concluded that a proper decentralisation of water management is achievable.

Interdepartmental coordinated policy frameworks

A water policy implementation challenge faced by Argentina relates to the delineation of policy responsibilities between central and provincial government departments. The constitution of Argentina gives control of water resources to provincial

jurisdictions, of which there are 23 in total. This constitutional arrangement prevents the central government from adopting a consistent water resource policy at a national level. Hence, unlike in South Africa, in Argentina it is hard for the national government to dictate what functions can be performed at provincial or local levels (World Bank, 2000). Moreover, "Other agencies at national level dealing with water resources include: (under the Mil V) the secretariat of public works, the secretariat of transportation which oversees the under-secretariat of water and port transportation; the ministry of economy, the ministry of social development and environment, the ministry of defence and finally the ministry of foreign relations" (World Bank, 2000). However, this arrangement, without a water policy coordinating body, has led to an "overlapping of functions and jurisdiction and at times confusion between technical and political (functions)" (World Bank, 2000).

South Africa does not have similarly deep constitutional confusions of overlapping responsibilities between different government departments, but still the lack of coordinated work between departments exists. For instance, with regards to agricultural land and water use, provincial DLA and DWAF do not have working committees on areas of common policy interests, even though the agricultural sector is the biggest water user (Loets, 2004). With this lack of collaborative policy, there are chances that departmental policy efforts would be duplicated and/or mismatched, resulting in unnecessary social costs borne by taxpayers.

In the KRV, DLA still needs to resolve the outstanding issues of communal and private commercial farmland rights, as inherited from the former Ciskei. With land rights eventually decided, the initiation of economic and water based agricultural projects would be better poised for success. Hence, coordinated water and land policies between DLA and DWAF, in terms of when and for whom water projects are carried out is crucial.

6.4 CONCLUSION

The game theoretic approach was used in discussing the establishment and administrative costs for local water institutions within WMAs. It was argued that most of the costs for establishing institutions would be borne by external agencies such as DWAF and DLA and, thereafter, independent, self-sufficient institutions and individuals would internally raise the revenues for administering CMAs. One of the many social benefits from establishing water institutions will be the decline of free-riding as the preferred strategy in stakeholder behaviour within WMAs (fig 6.1). A successful IWRM implementation process would lead to effective administration and monitoring of water resource use and consumption for the resources' sustainable availability.

Job creating public works projects in the water sector could be used as vehicles for stakeholder empowerment, leading to equitable representation and participation in established water bodies such as CMAs. To fund the water projects for the establishment of institutions and their administration, economic instruments such as cross subsidies, permits, quotas, taxes, and charges, have to be carefully identified to maximise an efficient redistribution and reallocation of resources. Another advantage of using projects as vehicles for the implementation process is the relative ease of quantifying the costs borne externally and internally, as illustrated in table 6.2.

Public choices, informed by local demographic data and the NWP (1997) objectives, have to be made in deciding the nature and size of the chosen water projects as well as the type and number of stakeholders who participate and benefit from them. For instance, younger stakeholders may be chosen over older ones because this choice is economically sensible in terms of long run investments and because these respondents reported higher education levels and better English language skills, compared to older respondents. However, older respondents reported higher public participation levels in water institutions and thereby expressed a higher willingness to be involved in public organizations. Hence, targeting older respondents makes economic sense in the short run.

Issues such as a) cultural definitions of water resource use, as opposed to economic definitions, b) unclear delineation of responsibilities during decentralisation processes and c) the lack of interdepartmental coordination in public policy were identified and discussed as constituting some of the obstacles facing developing countries involved in IWRM implementation processes. These issues were identified in countries, like Sri Lanka and Argentina, and because South Africa is also a developing country with similar economic and social conditions, the discussion of these obstacles was relevant for informing and guiding the NWP (1997) implementation process so that the identified policy mistakes reported in these countries are not repeated.

CHAPTER SEVEN – IMPLICATIONS FOR FUTURE RESEARCH AND POLICY IMPLEMENTATION

7.1 INTRODUCTION

In this chapter a short review of previous chapters is offered. Secondly, the research approach and theoretical framework followed in collecting and analysing data are summarised. Thirdly, implications of proposed policy recommendations are discussed with regards to the three areas of enumeration. Fourthly, the limitations of the research are highlighted with potential areas for future work identified.

From the review of literature, presented in chapter two, it was established that international developments in IWRM policies have influenced South Africa's formulation of its National Water Policy (1997). The contested nature of definitions of common resources, it was argued, has led to historically different approaches in the management of such resources, some advocating full market management, some government intervention, and some a strategic combination of the two approaches as in the case of Ostrom's (1990) institutional management of common pool resources.

In terms of full-market oriented approaches, it was argued that the development of full private property rights is seen as a natural progression towards an efficient management of public goods (Demsetz, 1967:348 and Hardin, 1968). However, because of the fluid and diffusive nature of public goods like water and air, the full development of private rights to their use and consumption has been cumbersome. The management of fluid public goods, therefore, requires that political and collective decision making processes be established (Dales, 1994). In such political processes, public participation is crucial as it allows policy makers an opportunity to recognise and factor in prevailing public preferences in their policy formulations (Black et al., 1999 and CIS, 2001). Hence, economic valuation methods such as Contingent Valuation helps to quantify, in monetary terms, the economic values of such preferences which also enabling a more effective public spending (Willis, 2002; Hanemann, 1994; Hanley, 2000; Willington, 1998).

Drawing on the discussion of game theoretic models, in chapter three, a hypothesis was put forward on how research could determine public participation trends by

looking at how it is related to other economic variables such as property rights. Such research would bring a better understanding of prevailing public preferences and thus lead to a politically sustainable policy implementation.

The data collection methods were described in chapter four and its analyses were presented in chapter five. The main findings, revealed that, on average, environmental economic values and current property rights were positively related to individual incomes and highest for the healthier respondents, whereas public participation for the poorer respondents was driven by the opportunities for temporary employment or lack thereof. Finally, in chapter six, policy strategies for improving public participation by strategically identifying water related and job-creating projects as incentives especially for the policy targeted groups were offered.

7.2 THE USEFULNESS OF THE THEORETICAL APPROACH

The research approach followed, as illustrated in diagram 4.1 (chapter four), required that quantitative and qualitative information be collected and analysed for participation trends motivated by economic interests, especially long term local investments. The approach was based on neoclassical economic and game theoretic assumptions. From the data, it was apparent that in most areas of enumeration there were connections between reported conflicts and individual interests in water use and/or consumption rights. For instance, reported conflicts among commercial farmers were about rights to water access and land for development. Black commercial farmers worried about economic costs incurred because the Department of Land Affairs (DLA) had been slow in resolving issues about title-deeds to land. Finally, some of the villagers' environmental participation was based on incomes received from environmental projects such the Land Care Project.

Therefore, economic interests were the basis for recommending that, to effectively implement the water policy in the Kat River Valley (KRV), long-term employment creating economic projects *in the water sector* should be initiated as vehicles for the implementation process. In phase one of implementation (illustrated in table 6.2), the costs of establishing water institutions would be borne externally (mainly by the Department of Water Affaires and Forestry - DWAF), and in phase two, the

administrative costs of established institutions would be borne by local stakeholders. Different economic instruments, such as subsidies, permits, quotas, etc., should be identified for each project to cover the total implementation costs in the two phases.

Because the phase one implementation costs would be borne by central government, it is important that DWAF and/or hired consultants estimate the minimum required budgets for each water related project contributing to the establishment of a Catchment Management Agency (CMA). Table 6.3 illustrated how a year's budget for a KRV training project could be estimated. Similar estimation exercises for projects listed in table 6.2 can be undertaken and used to estimate the total costs for all projects. With total implementation costs estimated, it would be easier to see whether DWAF's policy implementation budget is sufficient or not to cover all required costs. If estimated costs were found to be higher than budgeted costs, economic valuation studies could be performed to gauge the public's willingness to pay for the required extra costs. The public could, for instance, pay more for DWAF's implementation budget through higher taxes.

The policy recommendations for using economic projects discussed in chapter six are based on theoretical frameworks that acknowledge both the difficulties associated with the economic management of public goods and market externalities. The recommendations recognise both the merits of using open market approaches that appeal to individual economic interests, as well as the need for central government agencies to introduce those interests in the form public works projects.

At a political level, the research approach recognised the need for public choices to be factored into the formulation of public policies. For instance, the KRV survey identified trends in public behaviour and socio-economic needs (e.g. participation and high unemployment levels), from which policy recommendations were suggested. The research was an effort to synchronise public policy with public choices for a politically sustainable implementation process.

7.3 THE IMPLICATIONS OF POLICY RECOMMENDATIONS TO AREAS OF ENUMERATION

With regards to commercial farmers and above average income earners in the villages and in Seymour, it was found that even though public participation was an expression of cooperative behaviour in resource management, these respondents preferred to pay rather than participate in the management of such goods. Because they had access to higher levels of money incomes relative to leisure time and because their work and sources of income were not related to participation in environmental water bodies, relative to other respondents, they preferred to forgo money incomes rather than spend their time in public meetings.

The implications of this argument is that the projects proposed in table 6.2 should not be directed at commercial farmers as the primary economic beneficiaries, partly because the employment wages, as incentives, offered in such projects are less likely to attract them, but more importantly because the NWP (1997) equity objectives are not targeting this group of respondents. However, because the recommended projects need some level of cooperation from commercial farmers, for instance in the transfer of farming skills to the villagers, there should be other incentives devised to attract commercial farmers' cooperation. In chapter six, tax rebates for farmers were proposed for schemes aimed at cross subsidising agricultural infrastructure for subsistence village farmers (Faysse, 2004:52-82). Therefore, even though commercial farmers may not be the primary targets of the recommended projects, their essential cooperation should be sought.

Besides black commercial farmers, both the villagers and Seymour residents expressed a very high expectation of receiving property rights, especially to land, in the future (section 5.7.2). On the one hand, even though weak correlations were found between environmental participation and these future expectations (table 5.24), how these expectations are realised, through DLA's land reform policies, should ensure that an enhanced stakeholder participation in water management is achieved. What this means is that part of the land reform policy implementation process should be coordinated between DLA and DWAF. Agricultural land, for instance, should be redistributed with specific conditions that entail sustainable water use and

management. After all, before any of the projects listed in table 6.2, are initiated in the KRV it should be ensured that they will support water management and NWP (1997) objectives.

7.4 RESEARCH LIMITATIONS AND FURUTE IMPLICATIONS

The KRV was the geographical context for the research survey, discussions and policy recommendations suggested. To further validate or negate the findings and policy recommendations in other WMAs, further research using similar approaches and theoretical framework would need to be conducted. For DWAF and DLA, this means that further funding for research projects should be budgeted as proposed in phase one of table 6.2.

Furthermore, concerning the discussion on decentralisation problems in developing countries (section 6.3.2), political investigations need to be undertaken to verify if DWAF officials would be willing to forgo the financial and bureaucratic power associated with centralised water management. If it is found that DWAF personnel need to be compensated for additional costs borne by individuals in the process of implementing the water policy, measures to fairly compensate such individuals need to be instituted to avoid internal resistance to the implementation process.

As far as Contingent Valuation Method (CVM) guidelines for developing countries are concerned, further research needs to be carried out to establish whether for public policies, whose primary objectives are to create employment, different guidelines in accepting Willingness to Pay (WTP) values should be considered. A proposal for a review of guidelines was discussed in section 5.6, where WTP values, especially in labour time unit currency, from unemployed respondents were evaluated for reasonableness and then accepted for analysis. The rationale for accepting the values, it was argued, stood to benefit the policy implementation process.

7.5 TABULATED SUMMARY OF RECOMMENDATIONS

In table 7.1, a simple summary of water related challenges and conflicts, as identified in the KRV and at a national level, is presented alongside policy recommendations

aimed at enhancing sustainable water policy participation as discussed in chapters six and seven.

Table 7.1 The summary of challenges, conflicts and recommendations for the National Water Policy (1997) implementation process in the KRV

Location	Challenges	Recommended Actions and/or Agent
Commercial farmers including former Ciskei farmers **without** secure land tenure	Land tenure for ex-Ciskei farmers	DLA land policy, in June 2004 18 months were given, by provincial DLA, as time to complete title deed process
	Land and business developments	Financial loan schemes for commercial farmers, especially ex-Ciskei without secure tenure
	Business development, partnerships and BEE	Support for locally initiated development projects, especially Riverside S.A. and Katco
	Ecological and social reserve determination and licence allocations	Support for current local research, must include social reserve determination
	Equitable local licence trading	Income level determined trading system, ideas and research required
Rural villages and Seymour township	Unemployment	Initiation of water related public works projects (see table 6.2)
	Technical training	Incentives for commercial farmers, researchers to transfer technical skills
	Policy training	Environmental educational campaigns and formal policy courses
	DWAF support to KRV villages	DWAF policy and researchers' initiatives for better relations between DWAF and locals
	Infrastructure: a. Public b. Irrigation	Public works projects, transport (e.g. goods and passenger rail), and cross subsidies for irrigation infrastructure (Faysee, 2004)
	Equitable licence trading	Income level determined trading system (as above)
	Land tenure	DLA policy (as for commercial farmers)
	Representation: youth and females	Specified conditions in project involvement, with long term human investment considerations
	Monitoring of water use	Formal training and technical support with incentives for locals
National and provincial government departments	Interdepartmental policy	Coordinated policy work especially between DLA and DWAF
	Cultural versus economic views	Creation of economic interests (e.g. establishment of economic water projects for employment in water sector)
	Decentralisation	Clear delineation of responsibilities to local institutions (esp. municipalities)
	Funding / Budget	Investigation of local costs for establishing CMAs using the project appraoch
	Future research	a. Social reserve investigations (Appendix 17) b. CVM calibration and investigations for public choices and taxes
Location	**Conflicts**	**Recommended Actions and/or Agent**
Commercial farmers including former Ciskei farmers **without** secure land tenure	Water scheduling	Support of locally initiated temporary solutions by DWAF and DLA before licence allocation
	Water pollution	Access to temporary water rights by non scheduled groups as locally initiated
	Water payments	Development of land, water and production markets for subsistence farmers (integration of local government)
Rural villages and Seymour township	Flooded graves	Support of local cultural projects aimed at removing the graves
National and provincial government departments	Legal constraints to coordinated work between departments	Possible revision of constitutional aspects towards lower implementation costs
	DWAF officials' political will to transform	Investigation of appropriate incentives for officials

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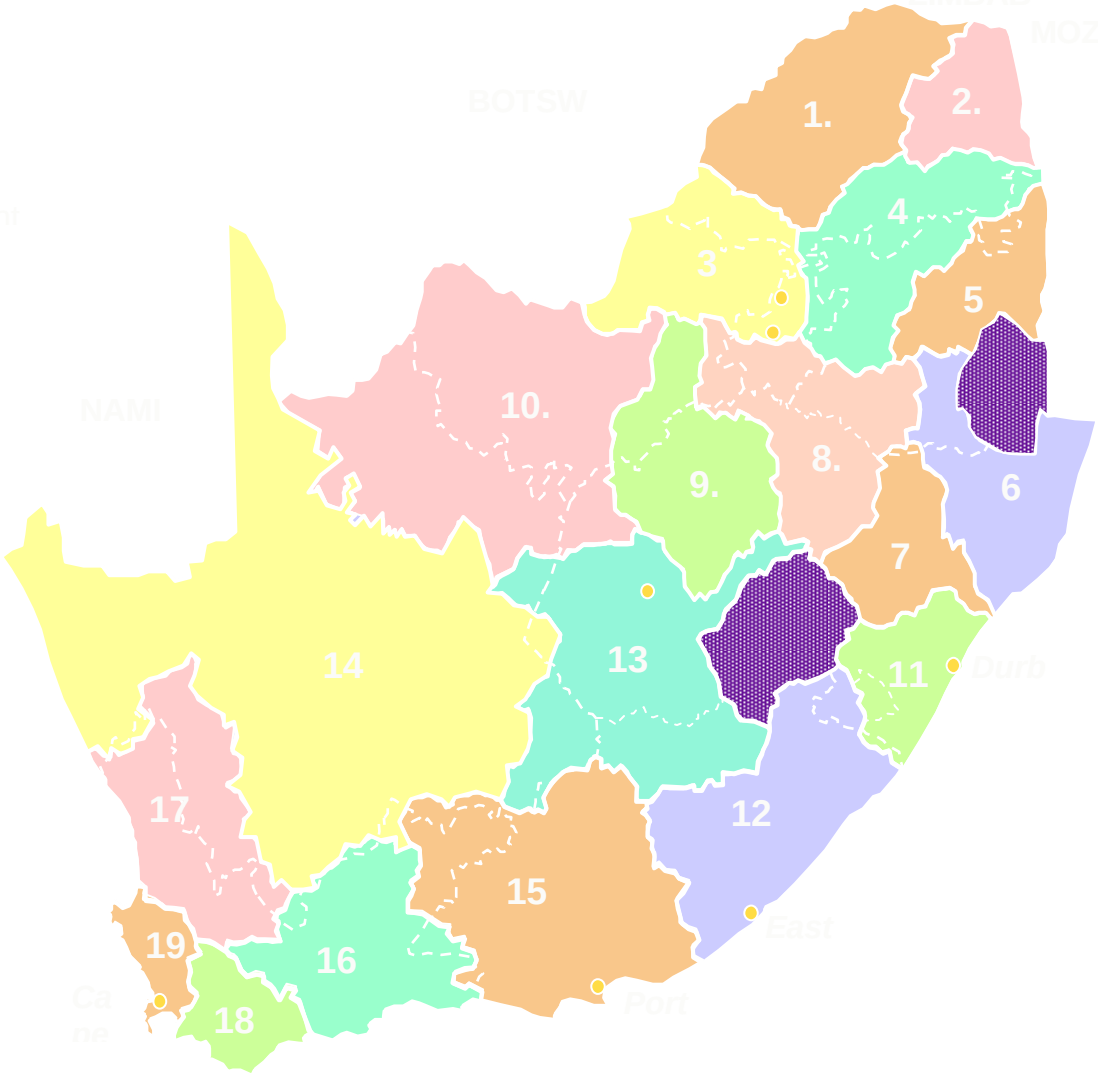
APPENDICES

Appendix 1: The National Water Act No. 36 of 1998's demarcation of Water Management Areas

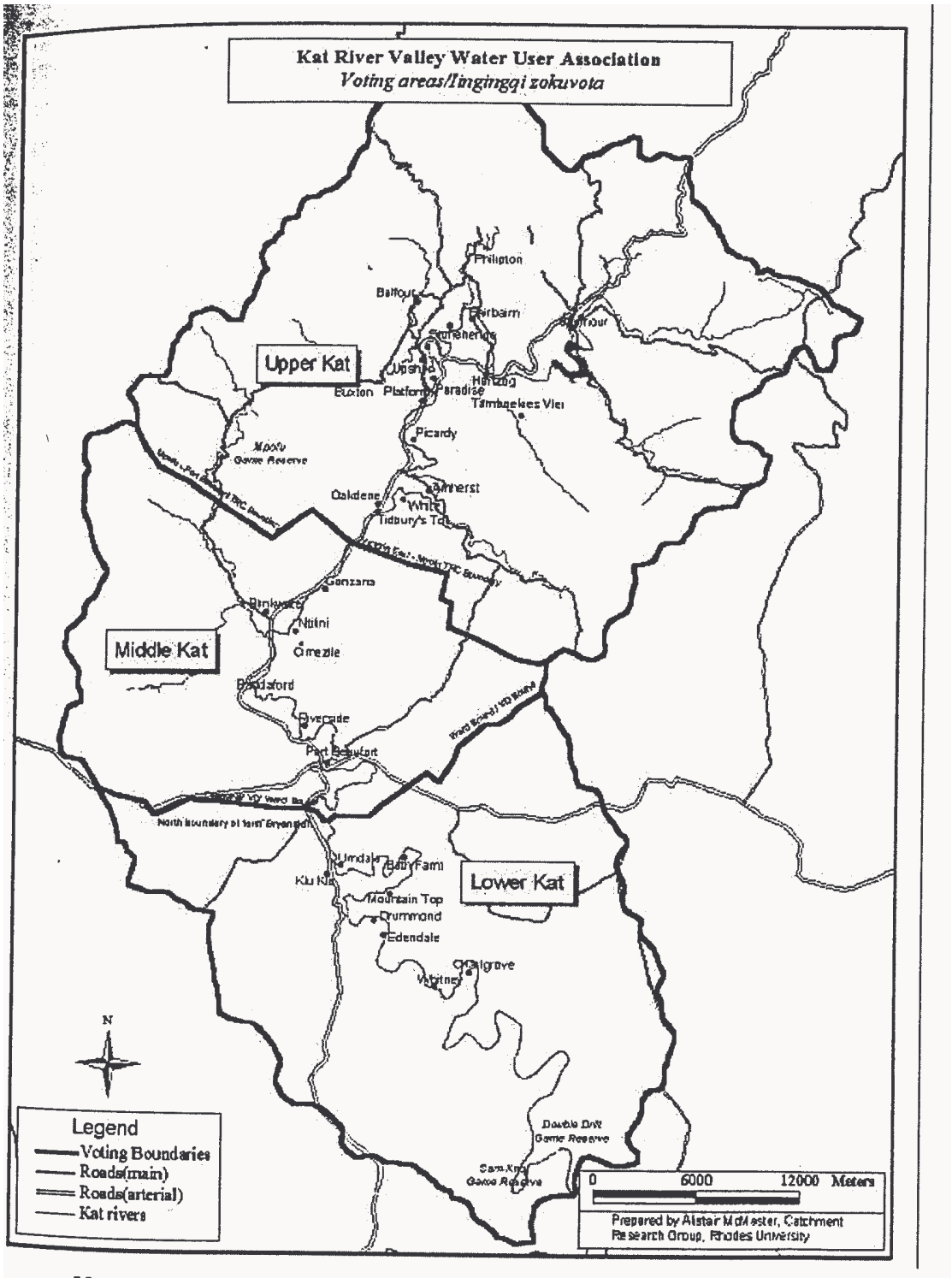


(Source: DWAF, 2004)

The numbered areas on the map are the Water Management Areas as demarcated by the National Water Policy

The Kat River Valley is in Area Number 15: The Fish to Tsitsikama Water Management Area

Appendix 2: The map of the Kat River Valley



(Source: KRV WUA, 2001)

Appendix 3: A Citrus farm in the KRV

Appendix 4: A section of the Seymour township

Appendix 5: A section of Fairburn village

Appendix 6: Seymour graves in the dam

The whitish graves at the bottom of the picture are for white people. Further on the left are graves for black people partially submerged in the water.

Appendix 7: Age versus individual income: scatter plot and historigram per age group

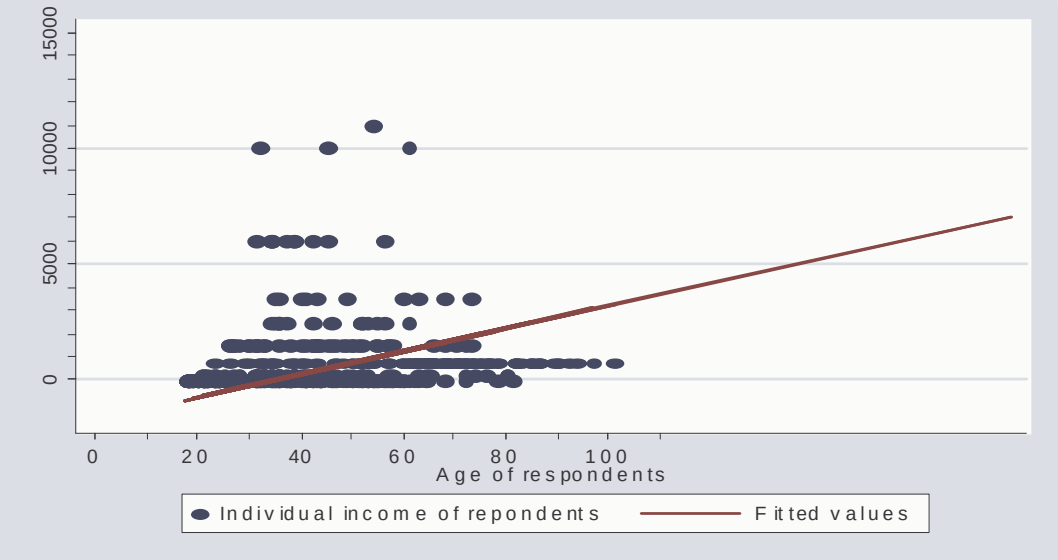


Fig a. The best fit line between income and age

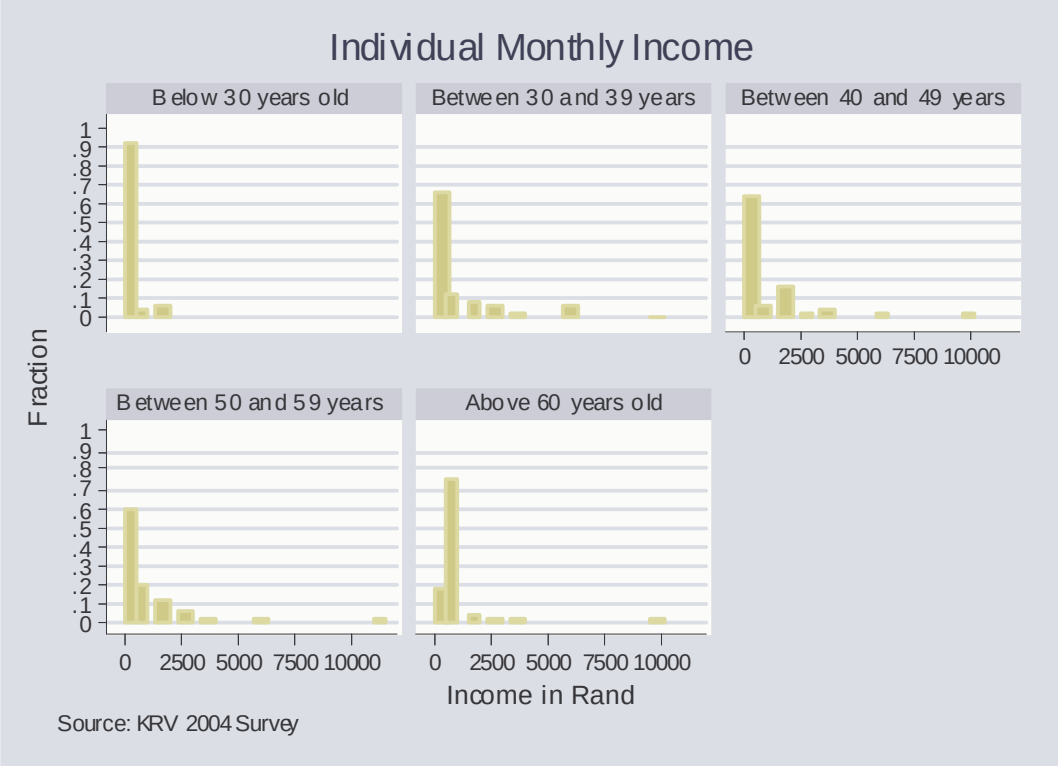


Fig b. The income distribution per age groups

The historigrams illustrate why the best line fit is positively sloped. As age increases monthly incomes are slightly more spread (i.e. more people reported higher than zero incomes), but the large income inequalities remain. The majority of incomes are zero for all age groups except for over the age of 60 years old at R800 (mostly pension grants)

Appendix 8: Seymour income-overall participation correlation coefficients

AREA	AGE GROUPS	GENDER	COR VALUE
SEYMOUR * Highest values	**18-29**	Male	0.01
		Female	-0.19
	30-39	Male	0.72*
		Female	-0.25
	40-49	Male	-0.14
		Female	-0.48
	50-59	Male	-0.53
		Female	-0.23
	> 60	Male	0.03
		Female	0.01

Appendix 9: Income by age: regression model output

Source	SS	df	MS	Number of obs = 526
				F(1, 524) = 13.84
Model	23985190.8	1	23985190.8	Prob > F = 0.0002
Residual	908118091	524	1733049.79	R-squared = 0.0257
				Adj R-squared = 0.0239
Total	932103281	525	1775434.82	Root MSE = 1316.5

Income	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Age	11.33968	3.048138	3.72	0.000	5.351606	17.32775
Cons	163.5371	146.4179	1.12	0.265	-124.1011	451.1753

Reading the important regression output codes:

Firstly, Simple OLS regression (*Ordinary Least Square regression*), is a procedure that determines the best fitting regression line between two variables, in the above case: income and age. The predicted linear fit is of the form:

Y = a + bX.
Or depending on the number of independent variables:
Y = a + b1X1 + b2X2 + ... + bkXk

Therefore:
Coef: is the slope b of the predicted line given the scattered points of the interrogated variables.
Cons: is the y-intercept, if x was zero, sometimes because in real life, x cannot be zero Cons maybe meaningless, however, the value will still be generated by the computer.

R-squared: the R-squared value tells by how much would our guess on income (Y) improve if we knew the individual's age (X). We saw in chapter five that age and income are differently related depending on age-group and area of resident, at times the relationships were negative and also highly positive but for the universal population the relationship was low and so is the prediction at about 3 percent.

The t value: From the probability of the t-value, we can tell that either the constant (y-intercept) or the coefficient (slope) is significant (+) or (-).
'SS' is the sum-of-squares, which is sum of the squared distance between each observation point and the mean value of income.
'Model' sums the squares of the distances between the mean value of income and the "best-fit" line.
'Residual' sums the squares of the distances between the "best-fit" line and all individual income.
'df 'stands for degrees of freedom, which is number of observations in the sample minus the number of independent constraints. The number of degrees of freedom serves as a flexibility measure in the t distribution.
'MS' is the mean of squares or simply SS divided by df.

(Source: University of Cape Town, 2004)

Appendix 10: Environmental participation by gender, age and area of enumeration

AREA	AGE GROUPS	GENDER	EPP SCORES
SEYMOUR	**20-30**	Male	16.96
		Female	16.64
	31-40	Male	18.16*
		Female	17.32
	41-50	Male	16.61
		Female	17.45
	51-60	Male	17.17
		Female	16.47
	> 60	Male	17.80
		Female	17.51
KRV VILLAGES	**20-30**	Male	16.54
		Female	17.39
	31-40	Male	18.14
		Female	18.80
	41-50	Male	20.50*
		Female	19.61
	51-60	Male	18.40
		Female	17.31
* Highest values	**> 60**	Male	19.20
		Female	17.10

Appendix 11: Regression output: Environmental Participation over Environmental Education for village males between 30 to 39 years old

Source	SS	df	MS	Number of obs = 21
				F(1, 19) = 12.82
Model	88.8689492	1	88.8689492	Prob > F = 0.0020
Residual	131.702479	19	6.93170944	R-squared = 0.4029
				Adj R-squared = 0.3715
Total	220.571429	20	11.0285714	Root MSE = 2.6328

EPP	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Env_educ	0.8016529	0.2238884	3.58	0.002	0.3330492	1.270257
Cons	15.16529	1.01075	15.00	0.000	13.04977	17.28081

Range of EPP variable: (0, 27)
Range of Enviro education: (0,7)

On average, a one-unit increase of environmental education increases environmental participation by 0.8 units for the village males between the ages of 30 and 39 years. The probability of the observed data fitting into a linear model is 40% (R^2=0.4029). This linear probability is higher than that observed for women over sixty in the villages as illustrated in appendix 12. The correlation value between the EPP and Environmental education variables for this sample was also higher at 0.6 compared to 0.3 for appendix 12.

Appendix 12: Regression output: Environmental Participation over Environmental Education for village females over 60 years old

Source	SS	df	MS	Number of obs =38
				F(1, 36) = 6.35
Model	61.1054918	1	61.1054918	Prob > F = 0.0163
Residual	346.473456	36	9.62426266	R-squared = 0.1499
				Adj R-squared = 0.1263
Total	407.578947	37	11.0156472	Root MSE = 3.1023

EPP	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Env_educ	0.7485521	0.2970747	2.52	0.016	0.1460567	1.351048
Cons	15.72635	0.7434681	21.15	0.000	14.21853	17.23417

Range of EPP variable: (0, 27)
Range of Enviro education: (0,7)

On average, a one-unit increase of environmental education increases environmental participation by 0.74 units for the village females over the age of 60 years old. The probability of the observed data fitting into a linear model is low at 14% (R^2=0.14). This linear probability is lower than that observed for the village males between the ages of 30 to 39 years old in appendix 11.

In any case, both the villages and Seymour, mid-aged males' participation levels over environmental education were higher than for females and older respondents. This is illustrated by fig 5.1 and discussed in section 5.5.3

Appendix 13: The Questionnaire used in the KRV 2004 survey

Good morning/afternoon your household has been randomly selected to participate in the Kat River Valley 2004 survey/study.

The objectives of the study from this survey:

The survey tool will ask you questions relating to the following and other:

a. Your living environment, water uses, and personal information;
b. Your knowledge and feelings about the new water law and;
c. Your property rights, such as deeds on land, business, irrigation equipment etc.;
d. Your participation in community organisations;
e. Your personal economic value of the environment, etc.

The information gathered through this study will be carefully studied and the results will be used in:

a) a Masters degree thesis and
b) a report to the Water Research Commission.

The reports will discuss, from results, the different factors affecting or relating to public participation in the studied areas. Based on the factors, recommendations will be given in written reports on how factors with a negative contribution can be altered or eliminated and how positive factors can be enhanced so that the level of public participation in platforms created for the implementation of the New Water Law (e.g. CF, WUA and CMA) is effectively increased.

Throughout the survey and in the writing of the reports we guarantee to keep your identity confidential.

If you need to ask more questions relating to the survey please phone either 046 6224014 (Institute for Water Research) or 0836704287 (Nhlanhla Mbatha)

THE KAT RIVER VALLEY (KRV) 2004 SURVEY:

ADULTS (18 YEARS AND ABOVE)

[WRITE WITH **PENCIL**!]

To be filled in by Interviewer:

1. HOUSEHOLD ID:…….

2. NAME OF PRIMARY RESPONDENT……CODE…..……..
3. ENUMERATION AREA…..…..……. NAME OF PLACE……
4. DATE OF VISIT ……..…….....
   DATE OF SECOND VISIT (if necessary)…..…….
5. INTERVIEWER NAME/CODE.....…….
6. INTERVIEW START TIME……..…
8. FAMILY POSITION OF PRIMARYRESPONDENT……
9. YOUR PHONE NUMBER OR CELL…….
9. INTERVIEW END TIME…….…….……...…

To be filled in by checker

CHECK BACK
1. NAME OF CHECKER….…….
2. DATE CHECKED…….……

To be filled in by capturer

DATA CAPTURE

1. NAME OF CAPTURER……
2. DATE CAPTURED……...

LIST OF MODULES

SECTION 1

1. **DEMOGRAPHICS:**

1.1 FAMILY DWELLING
1.2 FAMILY HISTORY
1.3 HOUSEHOLD MEMBER CHARACTERISTICS
1.4 ENVIRONMENTAL EDUCATION/AWARENESS AND WORK EXPERIENCE
1.5 LANGUAGE COMPETENCY
1.6 WATER SOURCE AND USE

2. WATER POLICY INDIVIDUAL ATTITUDES ON ASPECTS OF THE LAW

2.1 KNOWLEDGE OF AND ATTITUDE TOWARDS THE WATER LAW
2.2 KNOWLEDGE/ATTITUDE TOWARDS WATER ORGANISATIONS IN KRV

3. LONG TERM PROPERTY INVESTMENTS (IMMOVABLE PROPERTY BUT INCLUDING LIVESTOCK) (LEGAL AND PERCEIVED)

3.1 ATTITUDE TOWARDS COMMON, PRIVATE PROPERTY RIGHTS AND OPEN ACCESS
3.2 CURRENT COMMON, PRIVATE AND PERCEIVED PROPERTY RIGHTS
3.3 FUTURE EXPECTED COMMON, PRIVATE AND PERCEIVED PROPERTY RIGHTS
3.4 HISTORICAL/CULTURAL/SOCIAL ATTACHMENTS

4. PUBLIC PARTICIPATION

4.1 GENERAL PUBLIC PARTICIPATION (i.e. NOT ENVIRONMENT RELATED)
4.2 PUBLIC PARTICIPATION IN ENVIRONMENTAL ISSUES COMMUNITY MEETINGS
4.3 LANGUAGE ISSUES IN PUBLIC PARTICIPATION

SECTION 2

5. INDIVIDUAL ENVIRONMENTAL USES AND VALUES

5.1 ENVIRONMENTAL USES
5.2 BACKGROUND POLICY INFORMATION TO RESPONDENT
5.3 INDIVIDUAL ENVIRONMENTAL VALUES

A. DEMOGRAPHICS:

1.1 Family dwelling (**mark before entering the house**)

FORMAL		*TICK*
Brick house on a separate stand	1	
Detached Brick house in backyard	2	
Flat/room on separate stand	3	
Flat/room in backyard	4	
Other specify	5	
INFORMAL		
Traditional mud house on separate stand	6	
Traditional mud house on common stand	7	
Informal structure/ e.g. shack in squatter settlement	8	
Informal structure/ e.g. shack in the backyard of formal house	9	
Other specify	10	

1.2 WATER SOURCE/USE

1.2.1 Where does your family find its water for **HOUSEHOLD** use?

WATER SOURCE		*TICK*
Directly from The Kat River	1	
Directly from another stream in the valley	2	
Piped from the Kat River	3	
Piped from another stream in the valley	4	
Piped and purified from the Kat River (e.g. Seymour Dam)	5	
Piped and purified from another stream in the valley (another dam)	6	
Boreholes / Groundwater	7	
Rain water	8	
Don’t know	9	

1.2.2 Where does your family find its water for other uses E.G. **IRRIGATION etc.**?

WATER SOURCE		*TICK*
Directly from The Kat River	1	
Directly from another stream in the valley	2	
Piped from the Kat River	3	
Piped from another stream in the valley	4	
Piped and purified from the Kat River (e.g. Seymour Dam)	5	
Piped and purified from another stream in the valley (another dam)	6	
Boreholes /Groundwater	7	
Rain water	8	
Don't know	9	

1.2.3 (instruction to interviewer!) Write in full any other information not captured by the above questions **(1.2):**

1.3 FAMILY HISTORY (**to be answered by head or wife or other responsible member of household)**

1.3.1 Did this family move from somewhere else before settling in this area?

1. Yes	2. No	3. Don't know

1.3.2
If yes, how long ago did the family settle here? (**if answer 1.3.1 is No (2) tick 7 in 1.3.2)**

Over 50 years	7	
Over 40 years	6	
Over 30 years	5	
Over 20 years	4	
Over 10 years	3	
Over 5 years	2	
Less than 5 years	1	
Don't know	0	

1.3.3 If yes, why did the family move from old area to this area?
(**if answer 1.3.1 is No (2) tick 99 in 1.3.3)**

Moved by government	1		Pensioned from old job	8	
Moved for a job	2		Not allowed to stay in old area	9	
Moved to join other family	3		Wanted my own place	10	
Could not afford to rent	4		Evicted from old area	11	
Married and wanted own area	5		Moved because of violence	12	
Was retrenched / fired in old job	6		Other specify	13	
Moved to start a business	7		Don't know	0	
			Not applicable	99	

1.3.4 Does this family have other relatives present in the Kat River Valley?

1. Yes	2. No	3. Don't know

e. If Yes to 1.3.4 who are they and what is your relationship to them?

Family Surname	**Relationship**
1.	
2.	
3.	
4.	
5.	

1.3.5 (instruction to interviewer!) Write in full any other information not captured by the above questions **(1.3):**

1.4 House member characteristics (INSTRUCTION! Ask HEAD or WIFE or other **RESPONSIBLE MEMBER**)

1.4.1 **Hh** **ROSTER NUMBER**	**1.4.2** **NAME**	**1.4.3** **AGE**	**1.4.4** **GENDER** **M=1 F=2 O=3**	**1.4.5** **RELASHIP** **TO Head** 1-head 2-husband or wife 3-son/daughter 4-brother/sister 5-father/mother 6-grand parent 7-grand child 8-other relative 9-non relative	**1.4.6** **RACE** 1. Black 2. Colou 3. Indian 4. White 5. Other 6. N/A	**1.4.7** **LAB-OUR ACTIVITY** 1. Professional eg teacher/police **2.** Farming for others/market-**commercia**l **3.** Farming for family-**subsistence** **4**. Animal Husbandry/herding **5.** Processing food for storage **(for a farmer)** **6.** Other work on farm (specify) **7.**Domestic **8**.Weaving/Sawing **9**. Family Business-**other than farming** **10.** Self-employment/**specify** 11. Non Agricultural wage 12. Community project 13. Water/land project 14. Other cash earning activity 15. Free gathering of fruit and food 16 no labour activity 17 school/colleg	**1.4.8** **Mon-thly INCMON** **1**.No income **2**.R1-500 **3**.501-800 **4**.801-1500 **5**.1501-2500 **6**.2501-3500 **7**.3501-6000 **8.** 6001-10000 **9**. above 10000	**1.4.9** **Highest level of education** **1**. none **2.** Sub A-B **3**. Std1 **4**. Std2 **5**.Std3 **6**.Std4 **7**.Std5 **8**.Std6 **9**.Std7 **10**.Std8 **11**.Std9 **12**.St10 **13**. Post-MatricDip **14.** Tech Degre **15**. UniveD **16**. Other	**1.4.10** **Government Grant** **1**. pension 2.disability 3.child 4. other **(specify)**
1. head									
2.									
3.									
4.									

1.4.11 (instruction to interviewer!) Write in full any other information not captured by the above questions **(1.4)** and write to which family member the information applies:

1.5 **Environmental education / awareness and work experience**

1.5.1 **Hh** **ROSTER NUMBER**	**1.5.2a** **ENVIRONMENTAL EDUCATION** 1. formal-registered-at school/college/ university) 2. formal workshops (by NGO e.g. Rhodes/other 3. informal workshop/s by NGO 4. Private reading of journals 5. Media-Print/Visual/ Radio 6. (Combination of 2-6)* 7. Zero education	**1.5.2.b** **NUMBER OF TIMES OR DAYS in programme** **1. one year and above** **2. six months and above** **3. one month and above** **4. one week and above** **5. less than a week** **6. less than a day** **7. zero time**	**1.5.3a** **ENVIRONMENTAL WORK EXPERIENCE** 1. formal and permanent work experience 2. formal part time work experience 3. informal work experience 4. (combination of 2 and 3)* 5. Zero work experience	**1.5.3.b** **NUMBER OF TIMES OR DAYS in programme** **1. one year and above** **2. six months and above** **3. one month and above** **4. one week and above** **5. less than a week** **6. less than a day** **7. zero time**
1. (head)				
2.				
3.				
4.				
5.				
6.				

1.5.3 (instruction to interviewer!) Write in full any other information not captured by the above questions **(1.5)** and write to which family member the information applies:

1.6 **Linguistic competency**

1.6.1 **Hh** **ROSTER NUMBER**	**1.6.2** **ENGLISH** 1. SPEAK *AND* READ *AND* WRITE WELL 2.SPEAK *AND* READ WELL 3.EITHER SPEAK *OR* READ WELL 4. SPEAK *AND* READ *AND* WRITE NOT V. WELL 5.SPEAK *AND* READ NOT V WELL 6.EITHER SPEAK *OR* READ NOT V. WELL 7. ZERO COMPETENCY	**1.6.3** **AFRIKAANS** 1. SPEAK *AND* READ *AND* WRITE WELL 2.SPEAK *AND* READ WELL 3.EITHER SPEAK *OR* READ WELL 4. SPEAK *AND* READ *AND* WRITE NOT V. WELL 5.SPEAK *AND* READ NOT V WELL 6.EITHER SPEAK *OR* READ NOT V. WELL 7. ZERO COMPETENCY	**1.6.4** **XHOSA** 1. SPEAK *AND* READ *AND* WRITE WELL 2.SPEAK *AND* READ WELL 3.EITHER SPEAK *OR* READ WELL 4. SPEAK *AND* READ *AND* WRITE NOT V. WELL 5.SPEAK *AND* READ NOT V WELL 6.EITHER SPEAK *OR* READ NOT V. WELL 7. ZERO COMPETENCY	**1.6.5** **OTHER (SPECIFY)** 1. SPEAK *AND* READ *AND* WRITE WELL 2.SPEAK *AND* READ WELL 3.EITHER SPEAK *OR* READ WELL 4. SPEAK *AND* READ *AND* WRITE NOT V. WELL 5.SPEAK *AND* READ NOT V WELL 6.EITHER SPEAK *OR* READ NOT V. WELL 7. ZERO COMPETENCY
1. (head)				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

1.6.6 (instruction to interviewer!) Write in full any other information not captured by the above questions **(1.6)** and write to which family member the information applies:

2. Individual Attitudes on aspects of the New Water Law

2.1 Knowledge of and attitude towards the New Water Law (1997)

2.1.1 Hh ROSTER NUMBER	2.1.2 KNOWLEDGE OF THE NEW WATER LAW HOW WELL DO YOU KNOW THE NWP? 1. VERY WELL 2. FAMILIAR 3. NOT FAMILIAR 4. NO ANSWER AVAILABLE OR PREFER NOT TO ANSWER	2.1.3 FEELINGS ABOUT THE PARTICIPATIO-N OBJECTIVE HOW DO YOU FEEL ABOUT EVERYONE PARTICIPATING IN MANAGING THE CATCHMENT? 1. IT IS A VERY GOOD IDEA 2. IT IS O.K. 3. DON'T KNOW 4. IT IS NOT A GOOD IDEA 5. NO ANSWER OR PREFER NOT TO ANSWER	2.1.4 FEELINGS ABOUT THE EQUITY OBJCETIVE HOW DO YOU FEEL ABOUT ALLOWING EVERYONE A RIGHT TO USE WATER? 1. IT IS A VERY GOOD IDEA 2. IT IS O.K. 3. DON'T KNOW 4. IT IS NOT A GOOD IDEA 5. NO ANSWER OR PREFER NOT TO ANSWER	2.1.5 FEELINGS ABOUT CONSERVATION /RESERVE PROTECTIN OBJECTIVE HOW DO YOU FEEL ABOUT SETTING A MAXIMUM LEVEL OF WATER THAT EVERYONE (TOGETHER) CAN USE FROM THE KAT RIVER? 1. IT IS A VERY GOOD IDEA 2. IT IS O.K. 3. DON'T KNOW 4. IT IS NOT A GOOD IDEA 5. NO ANSWER OR PREFER NOT TO ANSWER
1. (head)				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

2.1.6 (instruction to interviewer!) Write in full any other information not captured by the above questions **(2.1)** and write to which family member the information applies:

2.2 Knowledge of and attitude towards water related organisations operating in the KRV

2.2.1 **Hh** **ROSTER NUMBER**	**2.2.2** **KNOWLEDGE OF THE CATCHMENT FORUM** **HOW WELL DO YOU KNOW THE ACTIVITIES OF THE CF?** **1. VERY WELL** **2. FAMILIAR** **3. NOT FAMILIAR** **4. NO ANSWER AVAILABLE OR PREFER NOT TO ANSWER**	**2.2.3** **KNOWLEDGE OF THE WATER USER ASSOCIATION** **HOW WELL DO YOU KNOW THE ACTIVITIES OR CONSTITUTION OF THE WUA?** **1. VERY WELL** **2. FAMILIAR** **3. NOT FAMILIAR** **4. NO ANSWER AVAILABLE OR PREFER NOT TO ANSWER**	**2.2.4** **FEELINGS ABOUT THE CF ACTIVITIES** **HOW DO YOU FEEL ABOUT THE WORK OR FUNCTIONS OF THE CF?** **1. IT IS DOING A VERY GOOD JOB** **2. IT'S WORK IS O.K.** **3. DON'T KNOW** **4. IT IS NOT DOING GOOD WORK** **5. NO ANSWER OR PREFER NOT TO ANSWER**	**2.2.5** **FEELINGS ABOUT THE WUA ACTIVITIES** **HOW DO YOU FEEL ABOUT THE WORK OR FUNCTIONS OF THE WUA?** **1. IT IS DOING A VERY GOOD JOB** **2. IT'S WORK IS O.K.** **3. DON'T KNOW** **4. IT IS NOT DOING GOOD WORK** **5. NO ANSWER OR PREFER NOT TO ANSWER**	**2.2.6** **FEELINGS ABOUT THE PROPOSED CMA** **HOW DO YOU FEEL ABOUT THE PROPOSED CMA TO MANAGE ALL THE KAT RIVER WATER MANAGEMENT?** **1. IT IS A VERY GOOD IDEA** **2. IT IS O.K.** **3. DON'T KNOW** **4. IT IS NOT A GOOD IDEA** **5. I DON'T KNOW ABOUT THE CMA** **6. NO ANSWER OR PREFER NOT TO ANSWER**
1. (head)					
2.					
3.					
4.					
5.					
6.					

2.2.7 (instruction to interviewer!) Write in full any other information not captured by the above questions **(2.2)** and write to which family member the information applies:

2. Long term property investments (immovable but include livestock) - (legal and perceived)

(INSTRUCTION TO INTEVIWER! *INDICATE ALL OF THE RIGHTS* **OF EACH Hh MEMBER**

3.1 ATTITUDES TOWARDS COMMON, PRIVATE PROPERTY RIGHTS AND OPEN ACCESS:

Note for interviewer and interviewee: In this survey tool, property rights in general relate to the following; a possession of a title-deed, a receipt, a lease or some other proof document that a property or some resource/object can be used by you or those you have chosen. If only you are the exclusive owner or user, then you should have private/individual rights to the property, if the document names you and somebody else as owners of the property then you have common/communal property rights to the property. However, if you (alone or as a group) don't have any title deed or proof document, however you still feel that you own some property or some object, then you only have perceived (common or private) property rights to the property.

3.1.1 **Hh** **ROSTER NUMBER**	**3.1.2** **COMMON PROPERTY RIGHTS** **HOW DO YOU FEEL ABOUT THE COMMUNAL OWNERSHIP OF ENVIRONMENTAL RESOURCES?** **1. IT IS A VERY GOOD THING** **2. IT IS O.K I HAVE NO PROBLEM WITH THAT** **3. IT IS NOT A GOOD THING** **4. I DON'T KNOW** **5. RATHER NOT SAY** **(TO INTERVIEWER! WRITE REASONS WHY AFTER CHOICE NUMBER)**	**3.1.3** **PRIVATE PROPERTY RIGHTS** **HOW DO YOU FEEL ABOUT INDIVIDUAL ENVIRONMENTAL RESOURCE OWNERSHIP?** **1. IT IS A VERY GOOD THING** **2. IT IS O.K I HAVE NO PROBLEM WITH THAT** **3. IT IS NOT A GOOD THING** **4. I DON'T KNOW** **5. RATHER NOT SAY** **TO INTERVIEWER! WRITE REASONS WHY AFTER CHOICE NUMBER)**	**3.1.4** **NO PROPERTY RIGHTS** **HOW DO YOU FEEL ABOUT ENVIRONMENTAL RESOURCES THAT NOBODY OWNS?** **1. IT IS A VERY GOOD THING** **2. IT IS O.K I HAVE NO PROBLEM WITH THAT** **3. IT IS NOT A GOOD THING** **4. I DON'T KNOW** **5. RATHER NOT SAY** **TO INTERVIEWER! WRITE REASONS WHY AFTER CHOICE NUMBER)**
1. **head**			
2.			
3.			
4.			

3.2 Current **private, common** and **perceived** property rights

3.2.1 **Hh** **R O S T E R** **N U M B E R**	**3.2.2** **LEGALLY DEFINED PRIVATE PROPERTY RIGHTS** **DO YOU HAVE LEGAL PRIVATE RIGHTS TO THE FOLLOWING:** TITLE DEED –(PERMANENT) TO: 1. LAND 2. BUSINESS 3. HOUSE/ BLD STRUCT 4. IRRIGATION EQUIP 5. SCHEDULED WATER USER RIGHTS (OLD WATER LAW) 6. OTHER ENVIRONMENTAL RESOURCE RIGHT 7. POLLUTION RIGHTS 8. LIVESTOCK 9. OTHER (SPECIFY) LEASE (TEMPORARY/RENEWABLE) TO: 10. TO LAND 11. BUSINESS 12. HOUSE/BLG STRUCT 13. IRRIGATION EQUIP 14. SCHEDULED WATER USER RIGHTS 15. OTHER ENVIRONMENTAL RESOURCE RIGHT 16. POLLUTION RIGHTS 17. LIVESTOCK 18. OTHER (SPECIFY)	**3.2.3** **LEGALLY DEFINED COMMON PROPERTY RIGHTS** **DO YOU HAVE LEGAL COMMON RIGHTS TO THE FOLLOWING:** TITLE DEED –(PERMANENT) TO: 1. LAND 2. BUSINESS 3. HOUSE/ BLD STRUCT 4. IRRIGATION EQUIP 5. SCHEDULED WATER USER RIGHTS (OLD WATER LAW) 6. OTHER ENVIRONMENTAL RESOURCE RIGHT 7. POLLUTION RIGHTS 8. LIVESTOCK 9. OTHER (SPECIFY) LEASE (TEMPORARY/RENEWABLE) TO: 10. TO LAND 11. BUSINESS 12. HOUSE/BLG STRUCT 13. IRRIGATION EQUIP 14. SCHEDULED WATER USER RIGHTS 15. OTHER ENVIRONMENTAL RESOURCE RIGHT 16. POLLUTION RIGHTS 17. LIVESTOCK 18. OTHER (SPECIFY)	**3.2.4** **PERCEIVED-(COMMON LAW) COMMON PROPERTY** **DO YOU FEEL LIKE YOU HAVE RIGHTS TO THE FOLLOWING (*THOUGH YOU DON'T HAVE LEGAL PAPERS*)** PERMANENT TO: 1. LAND 2. BUSINESS 3. HOUSE/ BLD STRUCT 4. IRRIGATION EQUIP 5. SCHEDULED WATER USER RIGHTS (OLD WATER LAW) 6. OTHER ENVIRONMENTAL RESOURCE RIGHT 7. POLLUTION RIGHTS 8. LIVESTOCK 9. OTHER (SPECIFY) (TEMPORARY) TO: 10. TO LAND 11. BUSINESS 12. HOUSE/BLG STRUCT 13. IRRIGATION EQUIP 14. SCHEDULED WATER USER RIGHTS 15. OTHER ENVIRONMENTAL RESOURCE RIGHT 16. POLLUTION RIGHTS 17. LIVESTOCK 18.OTHER (SPECIFY)
1. (head)			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

3.3 Future **expected** private, common and perceived property rights

3.3.1 **Hh** **ROSTER NUMBER**	**3.3.2** **LEGALLY DEFINED PRIVATE PROPERTY RIGHTS** **DO YOU EXPECT TO HAVE LEGAL PRIVATE RIGHTS IN THE FUTURE TO THE FOLLOWING:** TITLE DEED –(PERMANENT) TO: 1. LAND 2. BUSINESS 3. HOUSE/ BLD STRUCT 4. IRRIGATION EQUIP 5. SCHEDULED WATER USER RIGHTS (OLD WATER LAW) 6. OTHER ENVIRONMENTAL RESOURCE RIGHT 7. POLLUTION RIGHTS 8. LIVESTOCK 9. OTHER RIGHTS (SPECIFY) LEASE (TEMPORARY/RENEWABLE) TO: 10. TO LAND 11. BUSINESS 12. HOUSE/BLG STRUCT 13. IRRIGATION EQUIP 14. SCHEDULED WATER USER RIGHTS 15. OTHER ENVIRONMENTAL RESOURCE RIGHT 16. POLLUTION RIGHTS 17. LIVESTOCK 18. OTHERS (SPECIFY)	**3.3.3** **LEGALLY DEFINED COMMON PROPERTY RIGHTS** **DO YOU EXPECT TO HAVE LEGAL COMMON RIGHTS IN THE FUTURE TO THE FOLLOWING:** TITLE DEED –(PERMANENT) TO: 1. LAND 2. BUSINESS 3. HOUSE/ BLD STRUCT 4. IRRIGATION EQUIP 5. SCHEDULED WATER USER RIGHTS (OLD WATER LAW) 6. OTHER ENVIRONMENTAL RESOURCE RIGHT 7. POLLUTION RIGHTS 8. LIVESTOCK 9. OTHER RIGHTS (SPECIFY) LEASE (TEMPORARY/RENEWABLE) TO: 10. TO LAND 11. BUSINESS 12. HOUSE/BLG STRUCT 13. IRRIGATION EQUIP 14. SCHEDULED WATER USER RIGHTS 15. OTHER ENVIRONMENTAL RESOURCE RIGHT 16. POLLUTION RIGHTS 17. LIVESTOCK 18. OTHERS (SPECIFY)	**3.3.4** **PERCEIVED-(COMMON LAW) COMMON PROPERTY** **DO YOU EXPECT, AT SOME POINT, TO FEEL LIKE HAVE RIGHTS TO THE FOLLOWING (*THOUGH YOU WONT HAVE LEGAL PAPERS*)** TO: 1. LAND 2. BUSINESS 3. HOUSE/ BLD STRUCT 4. IRRIGATION EQUIP 5. SCHEDULED WATER USER RIGHTS (OLD WATER LAW) 6. OTHER ENVIRONMENTAL RESOURCE RIGHT 7. POLLUTION RIGHTS 8. LIVESTOCK 9. OTHER RIGHTS (SPECIFY) LEASE (TEMPORARY/RENEWABLE) TO: 10. TO LAND 11. BUSINESS 12. HOUSE/BLG STRUCT 13. IRRIGATION EQUIP 14. SCHEDULED WATER USER RIGHTS 15. OTHER ENVIRONMENTAL RESOURCE RIGHT 16. POLLUTION RIGHTS 17. LIVESTOCK 18. OTHERS (SPECIFY)
1. head)			
2.			
3.			
4.			
5.			
6.			
7.			

3.4 Historical, cultural, social attachments

3.4.1	**Is there a reason/s why you would never want to leave the Kat River area for good?** **1 YES 2 NO 3 DON'T KNOW**
1. (head)	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

3.4.2	**If you answered yes (1) above, give the most important reason or explanation to why you don't want to leave the KRV**
1. (head)	…… …… ……
2.	…… …… ……
3.	…… …… ……
4.	…… …… ……
5.	…… …… ……
6.	…… …… ……
7.	…… …… ……
8.	…… …… …… ……

4. PUBLIC PARTICIPATION

4.1 General public participation EX*CLUDE* participation in environmental resource organisations (DO NOT INCLUDE WUA, CF OR LAND CARE participation)

4.1.1 Hh ROSTER NUMBER	4.1.2 GENERAL PUBLIC PARTICIPATION DO YOU FEEL IT IS A GOOD THING FOR ONE TO BE INVOLVED IN PUBLIC MATTERS (E.G. ATTENDING COMMUNITY MEETINGS)? 1. IT IS A VERY GOOD THING TO DO 2. IT IS O.K. TO DO THAT 3. IT IS NOT A GOOD THING TO DO 4. DON'T KNOW 5. PREFER NOT TO SAY	4.1.3 KNOWLEDGE ABOUT PUBLIC EVENTS DO YOU OFTEN KNOW WHEN THERE ARE GOING TO BE COMMUNITY MEETINGS etc IN THE KRV? 1. I ALWAYS KNOW 2. SOMETIMES I KNOW 3. I AM NOT SURE 4. I NEVER KNOW 5. PREFER NOT TO SAY	4.1.4 CULTURE OF ATTENDING PUBLIC EVENTS HOW OFTEN DO YOU ATTEND PUBLIC EVENTS IN THE KRV? 1. I ALWAYS ATTEND 2. SOMETIMES I ATTEND 3. I DON'T KNOW 4. I NEVER ATTEND 5. I PREFER NOT TO SAY	4.1.5 PUBLIC ORG. MEMBERSHIP ARE YOU A MEMBER TO ANY COMMUNITY ORG IN THE KRV? 1. YES 2. I DON'T KNOW 3. NO 4. PREFER NOT TO SAY	4.1.6 PERSONAL RESPONSIBILITY IN COMMUNITY ORGANISATION DO YOU HOLD ANY COMMITTEE POSITION/S IN ANY COMMUNITY ORG? 1. YES 2. I DON'T KNOW 3. NO 4. PREFERE NOT TO SAY
1. (head)					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

4.2 Public participation with reference to ENVIRONMENTAL RESOURCES (INCLUDING WATER AND LAND RESOURCES) (E.G. WUA, CF, LAND CARE ETC)

Hh ROSTER NUMBER	**4.1.1** **ENVIRO-RESOURCE PUBLIC PARTICIPATION** DO YOU FEEL IT IS A GOOD THING FOR ONE TO BE INVOLVED IN PUBLIC RESOURCES MATTERS (E.G. ATTENDING MEETINGS)? 1. IT IS A VERY GOOD THING TO DO 2. IT IS O.K. TO DO THAT 3. IT IS NOT A GOOD THING TO DO 4. DON'T KNOW 5. PREFER NOT TO SAY	**4.1.2** **KNOWLEDGE ABOUT PUBLIC RESOURCE EVENTS** DO YOU OFTEN KNOW WHEN THERE ARE GOING TO BE COMMUNITY MEETINGS etc IN THE KRV? 1. I ALWAYS KNOW 2. SOMETIMES I KNOW 3. I AM NOT SURE 4. I NEVER KNOW 5. PREFER NOT TO SAY	**4.1.3** **CULTURE OF ATTENDING PUBLIC RESOURCE EVENTS** HOW OFTEN DO YOU ATTEND PUBLIC EVENTS IN THE KRV? 1. I ALWAYS ATTEND 2. SOMETIMES I ATTEND 3. I DON'T KNOW 4. I NEVER ATTEND 5. I PREFER NOT TO SAY	**4.1.4** **PUBLIC RESOURCE ORG. MEMBERSHIP (EG. LAND CARE, CF, WUA)** ARE YOU A MEMBER TO ANY COMMUNITY ORG IN THE KRV? 1. YES 2. I DON'T KNOW 3. NO 4. PREFER NOT TO SAY	**4.1.5** **PERSONAL RESPONSIBILITY IN COMMUNITY RESOURCE ORGANISATION** DO YOU HOLD ANY COMMITTEE POSITION/S IN ANY COMMUNITY ORG WITH OR WITHOUT PAY 1. YES 2. I DON'T KNOW 3. NO 4. PREFERE NOT TO SAY
1. (head)					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

4.3 **Language issues in public meetings**

Hh **R O S T E R** **N U M B E R**	**4.3.1** **WHAT IS THE PROCEEDING LANGUAGE USED IN THE PUBLIC MEETINGS YOU NORMALLY ATTEND?** **1. MOSTLY ENGLISH** **2. MOSTLY XHOSA** **3. MOSTLY OTHER** **4. A MIX OF LANGUAGES** **5. NOT SURE** **6. PREFER NOT TO SAY**	**4.3.2** **HOW WELL DO YOU FOLLOW / UNDERSTAND THE PROCEEDINGS (CONTENT AND LANGUAGE) IN MEETINGS YOU NORMALLY ATTEND?** **1. I FOLLOW VERY WELL** **2. SOMETIMES I DON'T FOLLOW** **3. I NEVER FOLLOW** **4. NOT SURE** **5. PREFER NOT TO SAY**	**4.3.3** **HOW MUCH DO YOU THINK YOU CONTRIBUTE IN THE MEETING PROCEDINGS YOU NORMALLY ATTEND?** **1. I CONTRIBUTE A LOT** **2. SOMETIMES I CONTRIBUTE** **3. I NEVER CONTRIBUTE** **4. NOT SURE** **5. PREFER NOT TO SAY**
1. (head)			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

SECTION 2
Environmental uses and values

5. 1 ENVIRONMENTAL **USES** **(INSTRUCTION TO INTERVIEWR!-indicate all uses of each member)**

Hh **R** **O** **S** **T** **E** **R** **N** **U** **M** **B** **E** **R**	**5.1.1** **DO YOU USE (IN ANY WAY -E.G. SPIRITUAL, HOUSEHOLD CONSUMPTION, BUSINESS) THE FOLLOWING RESOURCES** **1. RIVER WATER ABSTRACTION AND RECREATION** **2. GROUND WATER ABSTRACTION** **3. WETLANDS (WATER ABSTRACTION AND RECREATION)** **4. GRAZING PASTURE** **5. FOREST WOOD HARVESTING** **6. FOREST MEDICINE HARVESTING** **7. FOREST FLOWERS ABSTRACTION** **8. RIVER SAND ABSTRACTION** **9. BUILDING STONES ABSTRACTION** **10. ENVIRONMENTAL AESTHESTICS APPRECIATION** **11. SPIRITUAL USES: BAPTISM ETC.** **12. FISHING** **13. WASTE DISPOSAL** **14. WASHING: PEOPLE, CARS, CLOTHES** **15. OTHER USES OF ENVIRO RESOURCES (SPECIFY)**
1. (head)	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

5.2 INSTRUCTION TO THE INTERVIEWER! Read out and explain the following information to respondents

BACKGROUND ENVIRONMENTAL INFORMATION

1. **Water is a scarce resource in South Africa.**
2. **Prior to 1994 access to water resources were distributed unequally among water users of different economic and racial backgrounds**
3. **Therefore in 1997 the South African government formulated a new National Water Policy (NWP) whose objectives are to protect and equally distribute water resources among all its users in a sustainable manner.**
4. **To achieve this the government divided the country into 19 Water Management Areas (WMA) to be managed by local people in a representative way**
5. **The management requires that licences to use water are issued to big users of water (like farmers with over 5 hectares of irrigation land).**
6. **The Kat River Valley is in one of the 19 WMAs.**
7. **The government needs local people to fully participate in creating a water management body and in deciding the state (quality and quantity) in which local people want the river to be maintained.**
8. **By doing this the government believes the KRV will be sustained for a long time and for the coming generations to use it.**

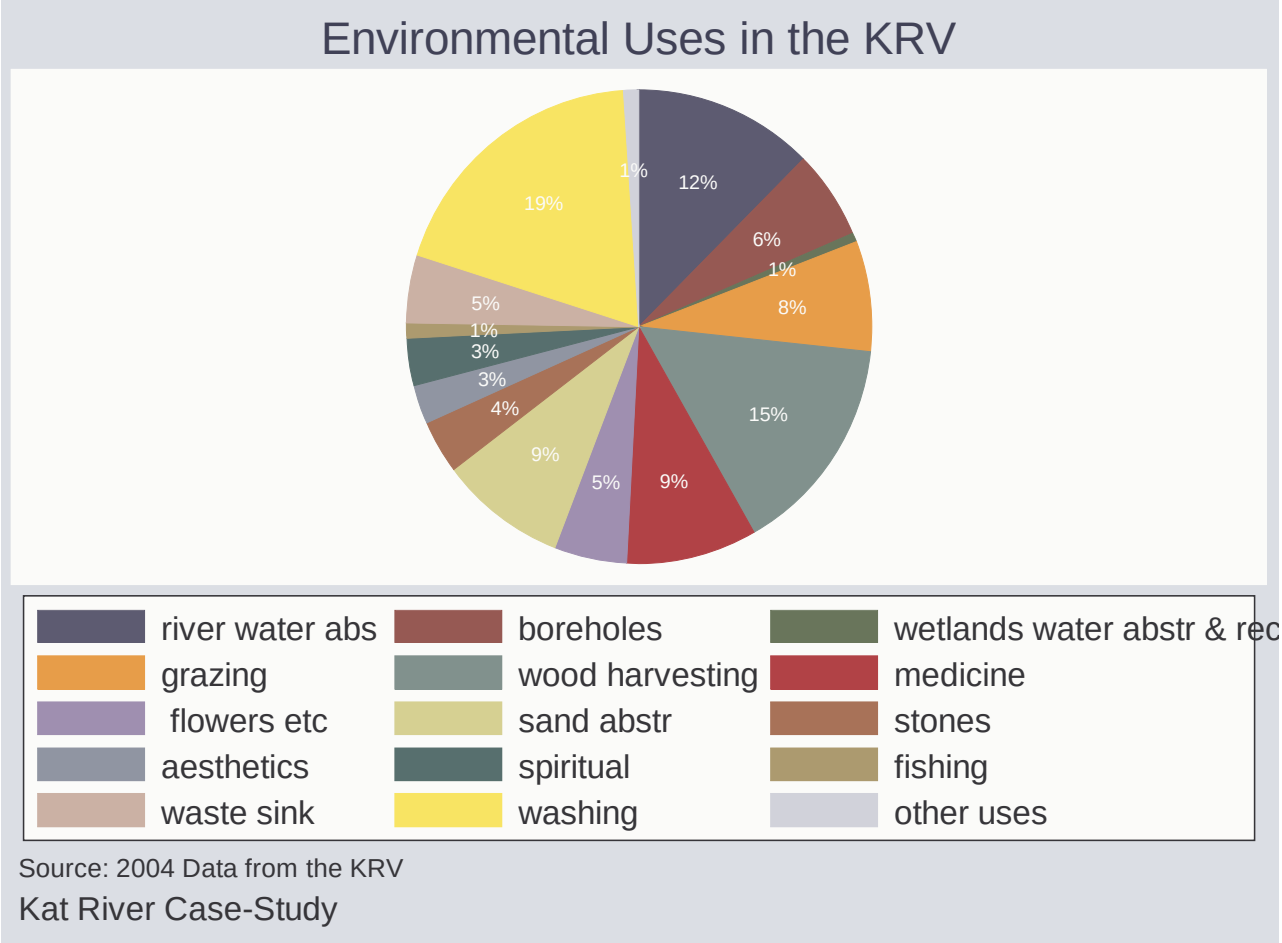
5.3. Individual environmental values for 3 aspects of the NWP

Hh **R O S T E R** **N U M B E R**	**5.2.1** **WATER LICENCE** **HOW MUCH** **1. MONEY OR** **2. LABOUR TIME OR** **3. LIVESTOCK (INCL BIRDS) OR** **4. A BAG OF: POTATOES OR CABBAGE OR OTHER (SPECIFY) OR** **5. OTHER UNIT** **ARE YOU WILLING TO PAY/SPEND TO OBTAIN A WATER LICENCE TO USE A CUBIC METER OF WATER?**	**5.2.2** **RESERVE - CONSERVATION** **HOW MUCH** **1. MONEY OR** **2. LABOUR TIME OR** **3. LIVESTOCK (INCL BIRDS) OR** **4. A BAG OF: POTATOES OR CABBAGE OR OTHER (SPECIFY) OR** **5. OTHER UNIT** **ARE YOU WILLING TO PAY/SPEND TO PREVENT THE RIVER FROM BECOMING UNUSABLE (e.g. BECAUSE OF pollution, overuse etc.?**	**5.2.3** **CATCHMENT MANAGEMENT** **HOW MUCH** **1. MONEY OR** **2. LABOUR TIME OR** **3. LIVESTOCK (INCL BIRDS) OR** **4 A BAG OF: POTATOES OR CABBAGE OR OTHER (SPECIFY) OR** **5. OTHER UNIT** **ARE YOU WILLING TO PAY/SPEND TO HAVE A WELL RUNNING CMA IN THE KRV?**
1. (head)			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

THANK YOU FOR YOUR TIME, WE HAVE COME TO THE END OF THE INTERVIEW

WRITE DOWN THE TIME YOU FINISHED……..……..

Appendix 14: Environmental use percentages for the universal sample



The Kat riverine areas are used mainly for washing/laundry, to abstract wood and water

Appendix 15: Attitudes towards the NWP by area of enumeration

Rating of: knowledge or attitude	Knowledge about the NWP %	Attitude towards participation objective %	Attitude towards equity objective %	Attitude towards resource protection objective %
Very high or very positive	2.54	56.69	77.74	50.09
Familiar or feel o.k.	17.39	15.24	8.35	12.76
Not familiar or not sure about feelings	75.91	19.70	10.02	10.88
No answer or it is a bad idea	4.17	2.04	2.04	23.45
No answer	n/a	6.32	1.86	2.81
Total	100.00	100.00	100.00	100.00

Appendix 16: Language competency

1. English language competency

Level of competency	Frequency	Percent
Speak, read and write well	173	**30.73**
Speak, read well	39	6.93
Speak well	44	7.82
Limited competency	123	21.85
Zero competency	184	**32.68**
Total	563	100.00

2. Xhosa language competency

Level of competency	Frequency	Percent
Speak, read and write well	424	**75.18**
Speak, read well	30	5.32
Speak well	60	10.64
Limited competency	39	6.91
Zero competency	11	**1.95**
Total	564	100.00

Appendix 17 A revision of the water management cycle model and a discussion of enhanced stakeholder participation

In guide one of the CMA establishment document (DWAF, 2004:3), it is proposed that before a CMA proposal is submitted to the minister, "investigations (conducted) should address the physical-technical, social, economic-financial and institutional-administrative environments associated with the relevant Water Management Area (WMA). In the interests of (social and economic) efficiency, these investigations should be at the broadest level possible, which will still require information to evaluate the viability (and potential competency) of a CMA" (DWAF, 2004:3).

For the implementation process in the future, one of the efficient ways of investigating social and economic needs is to involve local stakeholder participation in identifying and deciding about what economic projects would be most useful, relevant and sustainable in each WMA or catchment. The investigations would require, as one tool, that socio-economic surveys, similar to the KRV 2004 survey, be conducted as early as possible in phase one of establishing CMAs (table 6.2 of the thesis). These surveys, should form part of the social and economic specifications alongside the bio-physical ones, as illustrated in figure A.

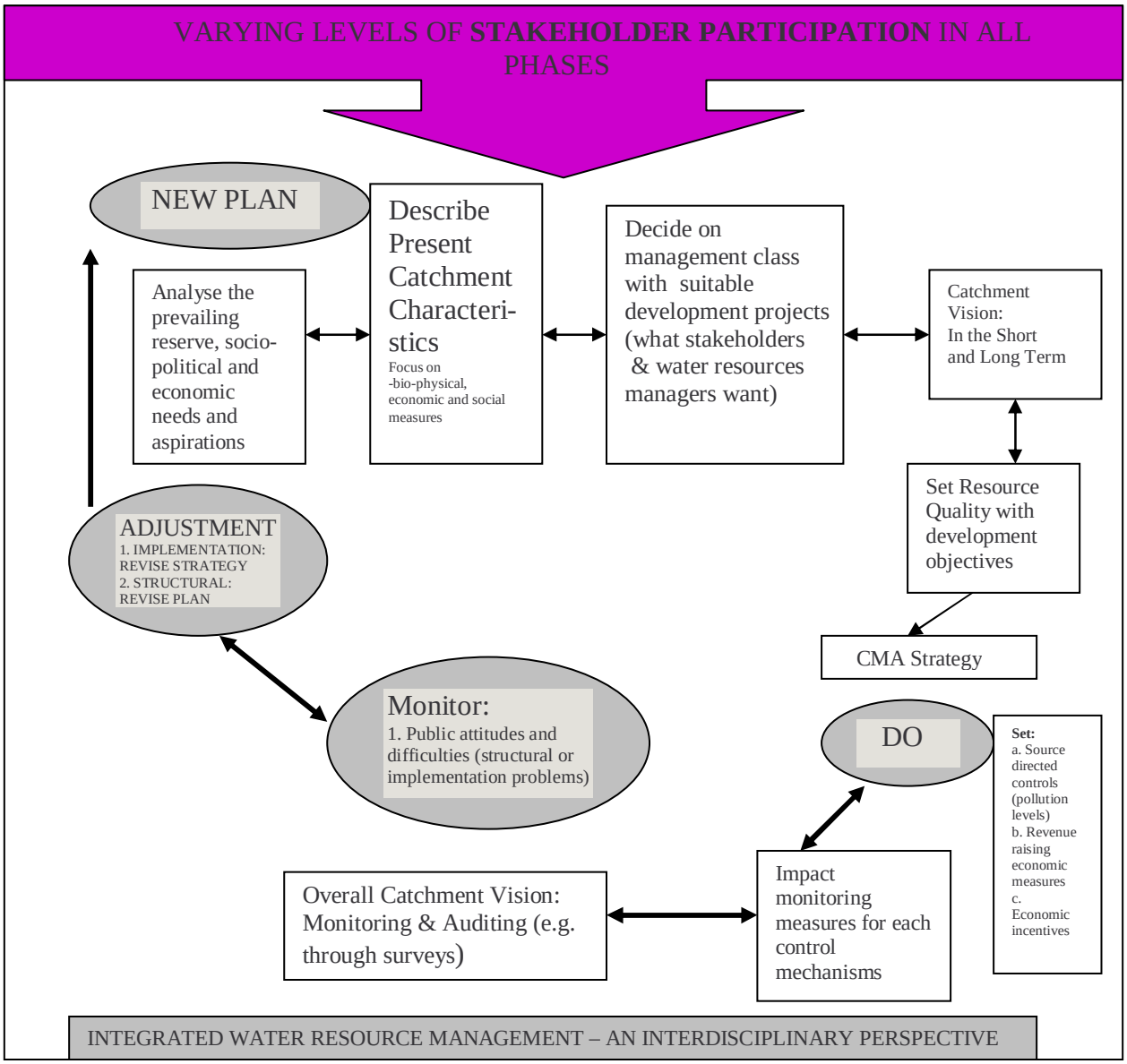


Fig A The integrated approach of ecological, economic and socio-political considerations in IWRM

(Adapted from Palmer, et al. (2003:44-45)

Figure A is a revision of a diagram by Palmer et al. (2003:44-45) discussed in section 2.4. The diagram illustrates the investigative and research work required in establishing CMAs (i.e. phase one of table 6.2). Ecological, socio-political and economic investigations are carried out, using broad local participation in the **'NEW PLAN'** stages. These investigations would assist DWAF or other experts in setting up the CMA strategies, economic water projects and appropriate economic instruments for the **'DO'** stages. Dependent on the outcomes from mechanisms set up for monitoring purposes, either limited or full participation would be required to resolve

problems associated with either strategic or structural challenges. If identified problems are as a result of an inappropriate use of economic instruments, for instance, limited participation of locals and experts would be required for solutions. On the other hand, if deep structural challenges of a socio-political, cultural and even scientific nature are identified, full stakeholder participation would be required and the implementation process would then have to return to the **'NEW PLAN'** stages. Ultimately, the adoption of an *integrated* perspective in IWRM policies as advocated by Constanza (1996), Shafik (1994), John and Pecchenino (1994), as discussed in section 2.2 of the thesis, would ensure that the prospects of a successful water policy implementation process are vastly improved.

Appendix 18 Some explanations of basic economic terms

1. **Free-riding**: "The phenomenon of misrepresenting preferences (or hiding them completely) on the expectation that a benefit may be enjoyed without having to pay for it" (Black et al., 1999:22).

2. **Pigouvian tax**: (Named after A.C. Pigou, 1920) "Such taxes … attempt to internalise externalities, that is, force parties to include the external effects of their actions in their cost and benefit calculations (Black, et al., 1999:27)".

3. **Warm-glow:** In environmental economics, the term is used to refer to the political or emotional satisfaction gained from exaggerating one's preferences for environmental goods (see Hanemann, 1994) for the term's contextual usage.

4. **Ownership of rights:** This phrase refers to a defined legal entitlement to the use or consumption of some specified resource, which may entail the complete exclusion of others from using the same resource if the rights refer to private property. Whether one decides to exercise or can exercise their ownership of rights is dependent on many factors, one of which is the State's ability to enforce the exclusion of non-owners.