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WATER INSTITUTIONS, MARKETS AND DECENTRALISED RESOURCE MANAGEMENT : PROSPECTS FOR INNOVATIVE POLICY REFORMS IN IRRIGATED AGRICULTURE¹

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Increasing scarcity and competition for water resources has led to international recognition that public policies must change to manage water as an economic commodity. An analysis of natural resources and markets shows that limited potential exists in a regional context for trade in 'virtual water' through food imports. Policy options for intra- and intersectoral water reallocation must therefore receive priority attention. Based on experiences in other countries, emphasis is placed on successful innovations of markets in tradable water rights, local management, user-based performance assessment and water saving technologies in irrigated agriculture. The recently published National Water Policy for South Africa and draft National Water Bill that has been released for discussion are accordingly evaluated. With application of the theory of New Institutional Economics, a number of deficiencies in the accepted principles and policy measures become apparent. It is clear that the proposed water licences are insecure; this will not induce efficient market allocations nor will it enable effective participation of water users in water management. Further economic contributions in policy making are required for the design of unattenuated water entitlements in order to achieve correct pricing incentives.

WATERINSTITUSIES, MARKTE EN GEDENSENTRALISEERDE HULPBRONBESTUUR: VOORUITSIGTE VIR INNOVERENDE BELEIDSHERVORMING IN BESPROEIJINGSLANDBOU

Toenemende skaarsheid en mededinging vir waterhulpbronne het gelei tot internasionale aanvaarding dat openbare beleide moet verander om water as 'n ekonomiese kommoditeit te bestuur. 'n Ontleding van natuurlike hulpbronne en markte toon dat binne 'n streek konteks beperkte potensiaal bestaan vir handel in 'virtuele water' deur middel van voedsel invoere. Beleidsopsies vir intra- en intersektorale water herallokasies moet derhalwe prioriteit aandag ontvang. Gebaseer op ondervinding in ander lande, moet suksesvolle innovasies van markte in verhandelbare waterregte, plaaslike bestuur, verbruikergedrewe prestasie beoordeling en waterbesparende tegnologie in besproeiingslandbou beklemtoon word. Die onlangs gepubliseerde Nasionale Waterbeleid vir Suid-Afrika en die konsep Nasionale Waterwetgewing wat vir bespreking vrygestel is, word dienooreenstemmend geëvalueer. Deur toepassing van die teorie van Nuwe Institusionele Ekonomie, word 'n aantal tekortkominge in die aanvaarde beginsels en beleidmaatreëls opvallend. Dit is duidelik dat die voorgestelde waterlisensies geen

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sekuriteit meebring nie; dit sal nie doeltreffende mark allokasies bevorder nie en ook nie effektiewe deelname deur watergebruikers in waterbestuur bewerkstellig nie. Verdere ekonomiese bydraes vir beleidmaking word vereis vir die ontwerp van onverswakke waterregte ten einde korrekte insentiewe vir prysbepaling te verkry.

"Rain can make the difference between good crops and food security, or drought and famine. Water shortage can cause conflict - between individuals, communities, countries and/or regions. The irony is that water is also nurturing, linking communities hundreds of kilometres apart, by lakes and rivers, and fostering kinship and trade relations" (Mbuende in Chenye & Johnson, 1996).

1. INTRODUCTION

The guiding principles accepted at the International Conference on Water and the Environment, included the recognition that water has an economic value and, therefore, should be considered as an economic good. In order to achieve sustainable food production and rural development through efficient water allocation, the main strategies should ensure that water users realise the scarcity value of the resource. Measures such as legal entitlements for access to water resources, charging systems for demand management and cost-recovery for operation and maintenance of supply will have to be introduced, with due consideration of cultural, social and ecological values of water (United Nations, 1992:14, 34). Furthermore, in a policy analysis matrix for the purpose of reforming water resources policy, it is proposed that four main categories of actions must be taken. Noteworthy components under the institutional and economic categories are laws clarifying ownership of rights and specific incentives of prices and markets. It is emphasised that policy review will entail some actions in all categories but that the balance and detail of measures will vary between countries (Food and Agriculture Organisation, 1995:27-43).

In South Africa the White Paper on a National Water Policy (Department of Water Affairs and Forestry, 1997a) has recently been published, and drafts of a National Water Bill (1997) and a Resource Pricing Policy for Water (Department of Water Affairs and Forestry, 1997b) have selectively been released for discussion. The purpose of this paper is to evaluate specific policy principles and measures with reference to the following framework for improving integrated water resources management (Serageldin, 1995:228-231):

First, changing the emphasis to the design of appropriate institutions, proper incentives, pricing and regulation of markets to improve the allocation of water amongst competing users and uses.

Second, decentralising water services to a community level, promoting participation through ownership and accountability and transferring functions to self-financing private organisations.

Third, recognising the interaction between water use sectors and the ecosystem as a source of water within river catchments.

2. WATER ALLOCATION POLICY

The water economy in South Africa has developed from an expansionary to a maturing phase. This means that, subject to some qualifications given below, a situation of *water scarcity* exists, i.e. more water is needed than can be delivered at a given time, place and quality. Accordingly, water management must change from a structural engineering approach of water provision to an institutional economic approach of balancing demand with supply of water. Attention must, therefore, focus on adaptation of water institutions to achieve objectives of more efficient and equitable utilisation and reallocation of available water resources (Backeberg, 1994:1-63).

2.1 Regional context of domestic water policy

Water allocation has gained prominence on the public policy agenda because of a combination of occurrence of extreme droughts, unequal access to water in rural areas, shifts in the contribution of water use sectors to economic growth and sharing of rivers with neighbouring countries. Awareness is further heightened by a skewed distribution of surface water resources between catchment areas of the inland plateau relative to those of the escarpment and coast of South Africa, and relative low internal renewable water resources per capita in comparison with other countries in the Southern African Development Community (SADC) (see Table 1). With total annual available water resources of 1206 m³ per capita, South Africa is already water stressed, and is near the limit of 1000 m³ per capita per year below which countries are considered to be water scarce (Livingston, 1995:208-209, Meinzen-Dick & Rosegrant 1996:1; Abernethy, 1997:13). However, it must be realised that this figure is an average with cyclical variations, and that only an estimated 744 m³ per capita per year is utilizable with current technology, of which approximately 85,8% is already exploited. Nonetheless, if current water use patterns with distorted price signals and tariff levels continue in future, absolute water scarcity will occur and the resulting conflicts between water uses will certainly increase.

Table 1: Use of land and water resources for irrigation and domestic purposes in SADC countries

Country	Land area (1,000 km ²) 1993	Irrigated land (as % of arable land area) 1993	Annual internal renewable water resources per capita (m ³) 1995	Annual freshwater withdrawals per capita (m ³) 1980-89	Irrigation water use (as % of total use) 1995
Angola	1 247	2.5	16 618	52	27.2
Botswana	567	0.5	1 588	100	31.3
Lesotho	30	0.9	2 551	31	59.7
Malawi	94	1.7	1 678	20	70.6
Mauritius	2	17.0	1 979	410	-
Mozambique	784	4.0	12 997	53	93.5
Namibia	823	0.9	333	166	46.1
South Africa	1 221	10.3	1 206	410	42.3
Swaziland	17	35.8	5 275	408	64.8
Tanzania	884	5.0	2 998	36	85.5
Zambia	743	0.9	12 267	86	72.1
Zimbabwe	387	7.0	1 776	138	86.8
AVERAGE		7.2	5 106	159	56.7

Source: Chenye & Johnson (1996)

2.1.1 Potential for trade in 'virtual water'

Given the constraints of the natural resources land and water, the high proportion of irrigation water use, the relative decline of the contribution of agriculture to the gross domestic product (GDP) and competition with alternative higher valued users in most other economic sectors, it is obviously necessary to consider other options than increased investment for irrigated food production. Effective economic input in policy making must "recognise that water management takes place in open political economies, not in closed hydrological and engineered systems" and that food trade provides a potential solution to temporary or permanent water deficits. This line of argument has led to formulation of the concept of 'virtual water', i.e. the water required for and contained in e.g. cereal imports and the statement "that the political economy of water in certain countries is subordinate to the political economy of global trade in food staples". *The question is whether the option of food trade, or the*

availability of virtual water, will allow balancing of water budgets in water scarce economies and can thereby defer policy measures in respect of water allocation? (Allan, 1996:3-8).

2.1.2 Realities of natural resources and markets

In the Southern African region, the better soils and higher rainfall zone with potential for increased agricultural production are found from central Angola, across Zambia and northern Mozambique into southern Tanzania (Van Rooyen, 1997:185-186). With the exclusion of Swaziland, the highest annual internal renewable water resources per capita are also available within the same countries and, excluding Angola, the percentage of water used for irrigation is highest (see Table 1). In the region as a whole, less than 45% of the 6.6 million ha potential irrigated land is currently irrigated (Rosegrant & Perez, 1995 in Meinzen-Dick & Rosegrant, 1996:2). However, as stated by Van Rooyen (1997:186-187) "The locality of physical infrastructure - roads, electricity, water systems and markets - are not correlated with these high potential areas". Although resources are under-utilised, expansion of the area cultivated should not be seen as a source of growth in agricultural production. A holistic approach of infrastructure development, upliftment of organisational capacity and support services, land reclamation and technological improvement is required.

Officially recorded grain trade, contradicted somewhat by informal trade figures, imply that countries in the region are producing for own consumption (Van Rooyen, 1997:188). Projections by the International Food Policy Research Institute also show that cereal imports to the region will increase by 250% from 2.8 million tonne in 1990 to 7.2 million tonne in 2020 (Meinzen-Dick & Rosegrant, 1996:3).

It appears that at present there are no real prospects for South Africa to import 'virtual water' in the form of cereals from SADC countries. Rather, all countries are dependent on global trade of grain. Given the differences in the natural resource base and present production patterns, considerable trade potential exists between these countries regarding imports to South Africa of other crops such as vegetables, sugar, coffee, tea and rice (Van Rooyen, 1997:193). In contrast, approximately 90% of the national production of citrus, grapes, sub-tropical and deciduous fruit is under irrigation, of which major portions are exported (Backeberg *et al.*, 1996:37, 49). In all these cases trade in food products will have to be preceded by quantifying the net impact on the balance of payments, assessing the economic performance of competitors, both exporters and importers, in global trade and projecting price trends due to international

agreements on tariffs and market deregulation. It must, therefore, be emphasised that the diversity and strength of the economy of a country will determine the possibility to rely on importation of 'virtual water' (Allan, 1996:8-10).

2.1.3 *Priorities for improved irrigation efficiency*

Under these circumstances the implication is that some of the needed growth in food production, particularly staple crops, will have to come from increased production under irrigation. In addition, there are convincing counter arguments against a preference for importing 'virtual water' and in support of continued local irrigated crop production. These are

- (1) the importance of economic linkages for development of rural economies;
 - (2) stabilisation of food production during seasonal or periodic droughts;
 - (3) utilisation of existing investments to full capacity;
 - (4) opportunities for employment, income earning and food security;
 - (5) processing raw materials and value adding on a local level;
 - (6) reduction of imports of staple crops with a competitive advantage; and
 - (7) diversification to higher valued crops for exports
- (Backeberg *et al.*, 1996:9-10; Meinzen-Dick & Rosegrant, 1996:4).

For South Africa there is very little scope for expansion of land under irrigation because of water limitations, but opportunities exist for more efficient utilisation of water (Backeberg *et al.*, 1996:25-44). Water policies must evolve that will maintain growth in irrigated agricultural production, while facilitating efficient and equitable intersectoral allocations. *The policy option of water reallocation is, therefore, of prime importance for water management.* But it remains problematic because it requires that political and economic trade-offs must be made, which pose the challenge of finding win-win solutions. Attention must be given to the strategies or decision rules for apportionment and transfer of water resources, with emphasis on the rights and incentives of water users (Allan, 1996:6; Meinzen-Dick & Rosegrant, 1996:6).

2.2 **Framework for innovative reform**

Irrigated agriculture will without doubt have to contribute proportionally

more to food production because of population growth, higher standards of living and increased per capita consumption. At the same time it can be expected that competition will lead to a reduction in the quantity and quality of water available for production of field, industrial and horticultural crops. This twofold challenge to produce more food with less water will require entrepreneurship with high management standards and the creation of an enabling environment through institutional reform. Water institutions can promote order and relative certainty but they can also establish impediments to efficient resource use. Poorly designed and functioning institutions generate pressures for innovation in policy to realise the potential of investments in water resources (Livingston, 1995:203-204).

Questions arise about the desired direction of change regarding lawfully exercised water rights, legislative prescriptions and regulations? Lessons can be learned from successful innovations in irrigation of Latin American countries in areas such as water rights and markets, local management, user-based performance assessment and water-efficient technologies. This framework to guide reform is illustrated in Figure 1, and consists of the following innovations and interactions:

The process is initiated by moving from a system where water rights are state owned, to a system of private enterprise and market orientated water rights. Water rights are legally transferable and can be traded in the market process. This is accompanied by transfer of responsibility to manage irrigation schemes by representatives of farming communities. It provides both incentives to take decisions in own interests, but leading farmers are also accountable to water users. Water management on a local level requires performance assessment of investment in water works and provision of water services. Correct price signals of the value of water rights and cost of water supply finally stimulates introduction of water-saving technologies (Lenton & Garcés-Restrepo, 1995:495-511).

An attempt will now be made to contextualise these innovations for the process of reform in South Africa.

3. ECONOMIC APPROACHES TO WATER MANAGEMENT

Since the 1950's there has been increasing emphasis on considering the appropriate set of property rights for the formulation of policies for economic management of natural resources. Four broad *types* of property rights are described in the literature namely private, common, state and open-access property (Tisdell & Roy, 1997:28-32). The economics of property rights

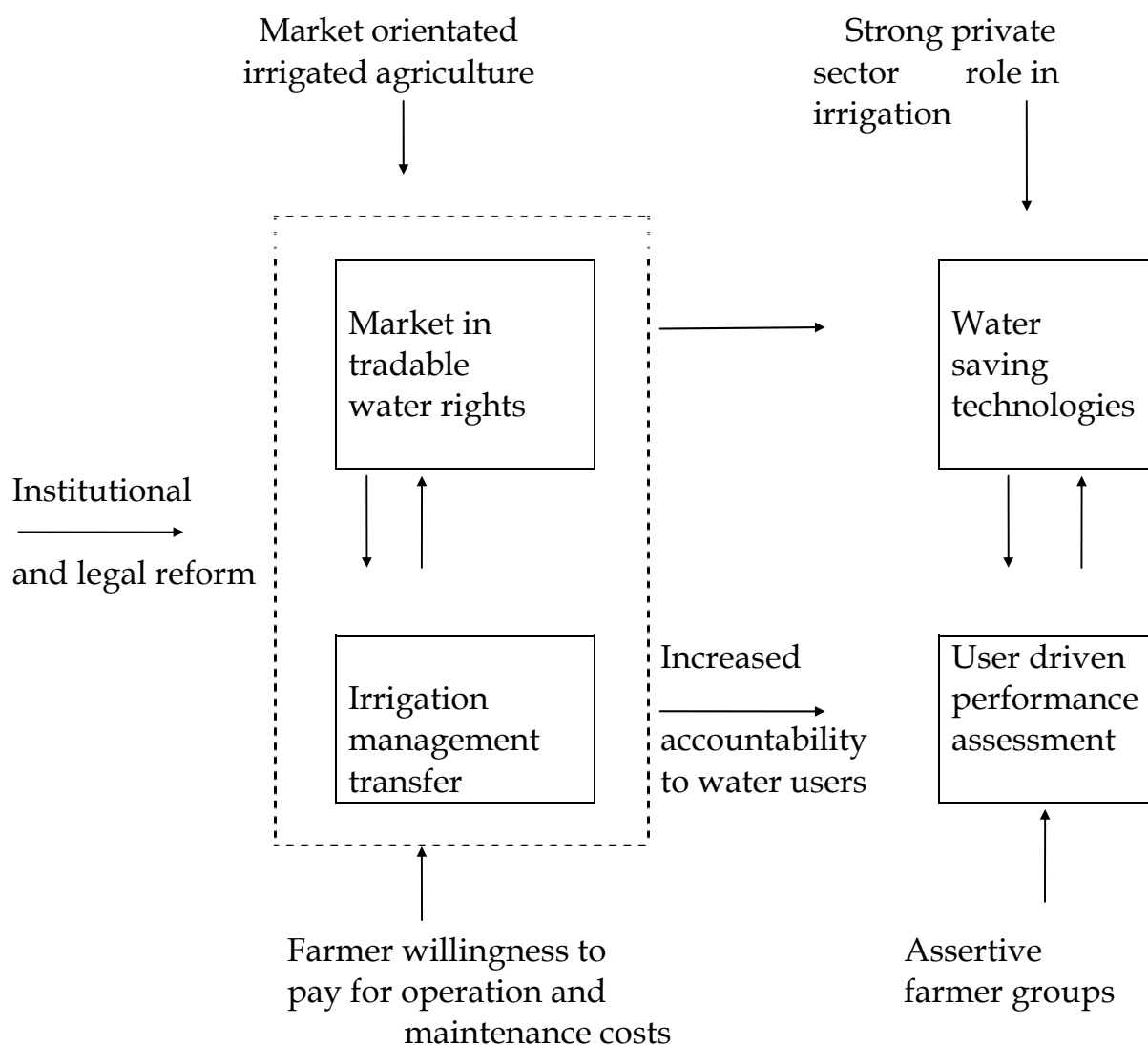


Figure 1: Framework for innovative policy reform in irrigated agriculture

Source: Adapted from Lenton & Garcés-Restrepo (1995)

makes it clear that *ownership matters*, where the rights of ownership consist of three elements or parts: The right to *use* the asset or resource; the right to *appropriate returns* from the asset or resource; and the right to *change the form or content* of the asset or resource (Furubont & Pejovich 1974:4). Property rights therefore refer to a bundle of entitlements that define the rights, privileges, obligations and limitations of the owner. The *structure* of property rights that could produce efficient allocations has four main characteristics:

- (1) Universality, i.e. all resources are privately owned, and all entitlements are completely specified;

- (2) Exclusivity, i.e. all benefits and costs as a result of owning the resources should accrue to the owner, either directly through use or indirectly by lease or sale to others;
- (3) Enforceability, i.e. all resources should be secure from encroachment or involuntary seizure by others;
- (4) Transferability, i.e. all resources should be voluntarily exchangeable from one owner to another (Tietenberg, 1992:45-47).

Scholarly thought according to the New Institutional Economics School inquires whether mistaken property rights assignments are responsible for perverse incentives and resource misallocations. In addition to ownership, transaction cost economics acknowledges that *contractual arrangements matter*. Institutions must be created for *private ordering* rather than court ordering, in an adaptive, sequential decision-making and dispute resolution process (Williamson, 1985:26-29).

3.1 Water rights

Water rights are real property rights, but the elements, structure and type of property rights need to be analysed further: *First*, water rights as *usufructuary rights* are generally accepted but the decision-making powers to lease or sell some or all rights, are in most cases attenuated or at least severely limited. *Second*, the quantity and variability of water to which a holder of rights is entitled is often vaguely specified; decisions to use and develop water resources can cause costs and benefits that are external to the private firm; tenure and legal insecurity may exist; and legislative prescriptions can create obstacles through high transaction costs or even prevent lawful transfers. *Third*, water resources are usually public property, but individuals or groups can gain access through assignment of private or common property or other specified forms of entitlement (McCormick, 1994:954-956).

There are clearly different perspectives of hydrology, law and politics on the appropriate design of water rights. *Altogether these will determine the extent to which water resources can be treated as an economic commodity.*

3.1.1 Hydrology and specification of water rights

Complications arise due to the *natural characteristics of water* and technical requirements for storage and distribution of water. Variable rainfall and river flow in especially semi-arid areas often requires construction of large-scale

water works. Water is, therefore, a fugitive resource of which the quantity, quality, location and timing of availability is uncertain. Water is not perfectly divisible which by necessity implies group involvement. Productive decisions are also not independent because abstraction, use and returnflow affect all users.

The institutional approach to physical security may be based on *proportionality* or *priority*: Although a case has been made for retrospective application of the Western USA common law systems of prior appropriation in irrigation areas of the inland plateau of South Africa (Backeberg 1994: 299 - 310) experience in Chile and Australia indicates that a system of proportional water rights is of more practical relevance. *In the case of proportionality, water rights are defined as a percent of the water available in any given year.* The water right can be expressed as percent of volume or percent of stream or canal flow, for a water supply with a specified level of assurance per unit of time. When the source of supply is insufficient to satisfy a permanent right fully, the available volume or flow is spread proportionally, which means that uncertainty of variable water is shared among water users. The problem of indivisibility and interdependence are addressed by defining all rights as full diversion rights that are proportional to stream or canal flow. There are no rights to returnflow, but provisions are made to protect third-party interests from potential damage (see also sections 3.2 and 3.4.3). (Livingston, 1995:204-206, Lenton & Garcés-Restrepo 1995:503, Rosegrant & Schleyer, 1994:13-17; Dudley, 1992:189-197).

Rational methods of allocation can only be established after quantification of water resources. *Water data systems* on e.g. existing water use, runoff of different land uses and quality changes must be prepared for a meaningful water rights system (Abernethy, 1997:11). The implication is that the *hydrology* of all river systems must be analysed on a priority basis according to the prevailing level of competition. All lawfully exercised water rights (riparian rights, quotas or permits) must be quantified in terms of percent of river flow or dam capacity together with the long-term expected variation. This is certainly a tremendous task, which is even more challenging if it is noted that it has reportedly not been successfully completed over the last forty years, in spite of legislative requirements within government water control areas.

3.1.2 *Law and institutional forms of water rights*

The system of *water rights law* in South Africa has undergone evolutionary change over nearly three and a half centuries. Initially water rights were common to all and owned by the state, i.e. held to the benefit of all members of society. This was replaced by riparian ownership where a group of private

landowners had common property rights to surface water while private property rights presumably applied to groundwater. Thereafter government control over all water resources was gradually expanded through water legislation and regulations, with attenuation of ownership which is arguably based on the judicial interpretation of water rights as public property. It must be concluded, however, that water rights have not been adapted to hydrological circumstances and that there was a lack of enforcement of legislation. Institutional failures have led to encroachment of surface water rights, treatment of groundwater as open-access property and over-exploitation of water resources (Backeberg, 1994:64-96).

More recently constitutional reform has given impetus to a comprehensive water law review, publication of two consecutive discussion documents (Department of Water Affairs and Forestry, 1995 and 1996) and acceptance of a set of twenty-eight principles (Department of Water Affairs and Forestry, 1997a:35-36). Of particular relevance and interest are Principles 2, 3, 12 and 13, which effectively *converts all water rights to public property* subject to government control; authorises only use rights which shall not be in perpetuity and continues with attenuation by eliminating ownership; makes the government ultimately responsible for water allocation; and elevates public interest above private interests for the evaluation of efficiency, equity and sustainability. In the National Water Bill (1997) it is consequently stated, amongst others, that water is not capable of private ownership (S.5(1)); recognition is given to existing lawful water use (S.24 (3)(a)(i)); but the whole or any part of water resources may be designated for licensing (S.39 (1)(a)); *water licences* may be issued for a fixed term of not longer than forty years with expiry or an indefinite term with notice for termination (S.44(1)(a) and (b)); water licences are issued for a specific quantity of water, storage capacity, percentage of flow, rate of abstraction or quantity per hectare (S.44 (2)(e)); water licences do not give a guarantee of the calculated assurance of supply or quality of water (S.44(5) (a)-(c)); and lastly the use of water may by notice be temporarily controlled, limited or prohibited (S.60). This confirms that private control over water management is prevented by *weakening and limiting water rights*, although the proposed water licences are specified in some detail.

3.1.3 Politics and ownership of water rights

In the past the reason for the preference for government control above private control was because of limited natural resources and so-called threatening water shortages (Backeberg, 1994:93-94). The *political motivation* in the new dispensation for *additional drastic changes to ownership of water rights* is found in the Property clause of the Bill of Rights of the Constitution (Republic of South

Africa, 1996). It is explicitly stated that "no provision of this section may impede the state from taking legislative and other measures to achieve land, water and related reform ... " (S.25 (8)). In the National Water Policy (Department of Water Affairs and Forestry, 1997a:7-8), reference is made to the distinction in the above clause between expropriation and deprivation. Expropriation is considered to be "the complete removal of an established property right", while deprivations "merely limit the extent of use of property". Apparently it is maintained that a water right is not a property right but only an entitlement to use water. This entitlement will only be recognised if it is exercised beneficially. Awarding licences with limited duration to existing water use rights is finally purported to be a deprivation (Department of Water Affairs and Forestry, 1997a:15). This must be contrasted to Chilean law where water is considered a public resource but individuals can obtain private rights. The Constitution (passed in 1980 and modified in 1988) specifically provides that "the right of private individuals, or enterprises, over water, recognised or established by law, grant these holders the property over them" (Schleyer, 1994:66-67).

The system of water licensing now proposed for South Africa is very similar to that which was applied in Australia until the mid 1980's. It is typified by insecure water entitlements and bureaucratic management of water resources (Pigram, 1993:1313 and Livingston, 1995:207). However, the recent direction of reform in Australia is in agreement with disciplinary thought in New Institutional Economics, and is confirmed by the content of a Policy Position Paper for implementing systems of water allocations and entitlements. Only one principle will be highlighted to compare the crucial difference in thinking: Principle 3 states that water entitlements should be clearly specified in terms of rights and conditions of *ownership tenure*, which should be perpetual, but subject to review ability with sufficient notice being given for that purpose (ARMCANZ 1995:8). The findings and recommendations have in the mean time been endorsed by the Council of Australian Governments, and signals an urgency to achieve efficient, sustainable use of water (Pigram, 1997:81-85).

3.1.4 *Economic implications of insecure water rights*

The main economic consequences of the inappropriate reform of water institutions in South Africa, are a devaluation of some farming properties, due to covert expropriation without compensation of unexercised riparian water rights. Furthermore, and a situation which will probably be found more widely, the incentive for investment by owners in irrigated agriculture is significantly reduced. The argument is that deprivation because of limited duration of water licences is comparable to a non-compensable regulation (see

Figure 2). With deprivation, the private investor bears all the risk that the value of investments will be lost. Revenues obtainable cannot be in the highest valued use and investment levels are relatively lower. If uncertainty prevails over renewal of water licences, as appears to be the case, profit maximising investments will be somewhere between I_1 and I_2 (Cooter & Ulen, 1988:198-201).

Figure 2: Negative effect of deprivation on incentives for private investment

Source: Adapted from Cooter & Ulen (1988)

The assignment of insecure water licences will in all likelihood lead to a further weakening of water rights and reduction of benefits. It is exactly the opposite of the advantages of permanent water rights as argued by Rosegrant & Schleyer (1994:3). Permanent water rights have the following consequences:

- (a) empowerment of water users;
- (b) provision of investment incentives;
- (c) improvement of water use efficiencies;
- (d) consent to any reallocation; and
- (e) compensation for any transfer (including expropriation in the public interest)

3.2 Water markets

The problem of water scarcity is essentially one of conflict between different uses and users in or between catchment areas; conflict between present and

future generations of people; conflict between application of human and capital resources for water resource development relative to other investments; and conflict between economic prosperity and preservation of ecosystems. This conflict can be resolved through judicial, bureaucratic and market processes (Backeberg, 1994:60-62). Choice and implementation of the combination of allocative mechanisms is dependent on political will and commitment (Morris, 1996:228-234; Abernethy, 1997:12). So far the policy in South Africa has been that allocation must be regulated by means of judicial and bureaucratic procedures. This can be illustrated by two cases: Under riparian ownership the reasonable and proportional share of water rights of e.g. adjacent owners can be exchanged without objection, but is subject to jurisdiction of the courts of law and transaction costs are usually so high that market trades are rare (Backeberg, 1994:90, 93, 230). With successive centralised control and bureaucratic water resource management, the official standpoint was publicly stated that functions of allocation of e.g. surplus water rights in government water control areas must be performed administratively by using legislative powers (Backeberg, 1994:314). It is also acknowledged that the recently proposed legislative authorisation of water licences is in many countries "generally accepted" or "the most common water allocation mechanism" (Morris, 1996:232 and Frederiksen, 1992:7-10). However, it has already been pointed out above, that market reallocation through tradable water rights is a feasible alternative and preferable to centralised control and regulation.

This assertion is supported by the two-way classification of water resources according to non-rivalry/rivalry and non-exclusion/exclusion (Randall, 1983:134-138). Applying the reasoning to the present stage of development of the water economy, the deduction is that competition exists for water resources, exclusion of those who do not hold water rights is possible, but there are also individuals or groups who benefit without carrying the full costs. Water resources must therefore be classified as a *merit resource*, where supply and demand are not solely left to market forces, government also has to provide support services, but the boundary between private and public functions can adjust over time (Backeberg, 1994:232-234).

3.2.1 Transactions and water pricing

The market process, although not perfect (see section 3.4.3), is the most effective means for the allocation of property rights of scarce resources, including the right to water. With fully specified ownership rights, control is exercised over water resources and access is gained to a stream of net benefits or economic rents over time. If water rights are transferable, owners are

exposed to the opportunity costs of the value in current use. The different alternatives which various individuals identify, determine the degree of competition. As is the case in any market orientated economic activity, entrepreneurial initiative and identification of new opportunities or under-utilised resources, is the driving force in market trade of water rights. After valuation of benefits and costs, a process of bargaining between willing buyers and sellers leads to a *transaction*, i.e. agreement and exchange of *rights* at a *price*. *Voluntary trade is, therefore, the allocative mechanism according to which apportioned water rights can lawfully be transferred on mutually beneficial terms* (Schmid, 1978 in Backeberg, 1995:166-172).

The ability to appropriate all benefits from use and lease or sale arrangements of water rights is the incentive to improve private interests. This is the pre-requisite for reallocation of water rights from lower to higher valued crops within irrigated agriculture and from irrigation to industrial or domestic uses. It leads to efficient, flexible use of water resources and productivity growth of the economy under circumstances of limited, variable water supply. Both the possibility that market transactions in water rights can in fact be undertaken and the possible causes that few transactions actually take place, must be emphasised.

3.2.2 Requirements and achievements of water markets

In order to satisfy the requirements of exclusivity, enforceability and tradability it has been explained what reform of central control of water rights through adjustment of public ownership and change in mindset for performance of administrative functions, are necessary to initiate a water market in South Africa (Backeberg, 1994:285-313). Experiences in countries such as Chile and Australia, which are comparable in climatological, social or economical terms, prove that the policy option of market allocation is not only a theoretical possibility, provided certain practical requirements are met:

- (1) *Infrastructure* must be in place and must have the capacity to deliver water. This obviously affects the mobility of water and therefore marketability of rights. For this reason water sale or rental markets are readily established within existing distribution systems and the same use sector. Any improvements or new structures required for the physical distribution of water should be part of the cost which is discounted in setting the price (Simpson, 1994:99 and Livingston, 1995:214).
- (2) *Transaction costs* are often of such a substantial amount that they can prevent market transfers altogether. Typical costs which must be

incurred include the cost of identifying a potential buyer or seller, obtaining hydrological, technical, financial and economic information, fulfilling legal or administrative formalities and registering the water right. All these transaction costs have been given as reasons why few market transfers take place, even though differences in value of water rights for alternative uses are present (Livingston, 1995:214-215).

- (3) *Flexibility* must be obtained by allowing adaptation to changing climatic and economic circumstances. This means that water rights (or water licences) must not be legally linked to land or use at a particular location. This can prevent transfers between farms or irrigation schemes or irrigation and municipal use (Pigram, 1993:1315 and Livingston, 1995:209). It also implies that additional rights or licences can be held to counter drought risk. Such precautions are particularly relevant when timely projections are made of dry climatic cycles, such as those caused by the El Nino phenomenon.
- (4) *Administrative* procedures must be specified according to which applications can be made and approval given for transfers of water rights. A government agency must maintain a register of the identity of water users and particulars of water rights in an impartial, fair and reliable manner. Apart from sanctioning transactions, it may also be involved in enforcing legislation or regulations and prevent abuses (Simpson, 1994:98-99). If disputes arise about administrative directives, provisions must be made for review, which includes recourse to courts of law.

Considering the pre-requisites of secure entitlements, efficiency incentives, available infrastructure, greater flexibility and low transaction costs, it is not surprising that *rental transactions* have been reported for Chile on the same irrigation scheme in different agricultural regions. Shifts in cropping patterns brought about by increasing prices on local and international markets have led to *sale transactions* between e.g. fruit farmers who require more water and grain farmers who have no suitable land (Schleyer & Rosegrant, 1996:40-41). Based on information of active water rights trading, case studies were done to assess the impact of water markets and transaction costs. Substantial *economic gains-from-trade* were found, both between water users and water use sectors and rents were earned by both buyers and sellers (Hearne & Easter, 1997:187-198). Within the constraints set for transferable water entitlements in different Australian States, the extent of trade in entitlements has been subdued and appears to be *dependent on seasonal climatic conditions and economic circumstances* such as relative market prices of crops. Tradability has apparently not been as

revolutionary as predicted, but still a useful reform in enabling greater flexibility and decentralisation of water management (Musgrave, 1997:434-440).

3.2.3 Transitional and new marketing arrangements

Despite the clear advantages of market allocation processes, this approach will only begin if government controls are relaxed and purposeful action within the suggested framework of reform is taken. In this regard it is interesting that in an internal Memorandum (Department of Water Affairs and Forestry, 1993) delegated powers were specified for approval of temporary (lease) or permanent (sale) transactions of water use rights or water quotas. Following this more pragmatic approach, permanent transfers were recorded in irrigation areas of government water control areas of e.g. the middle Orange River, Crocodile River and Berg River (Water Research Commission, 1995). This was apparently activated by water scarcity during severely dry seasons in 1994/95, economic pressures due to high fixed costs and more profitable cropping alternatives such as citrus and table grapes. Available sale values for the middle Orange River are on average R2 079 for a water quota of 10 000 m³ in 1995 (with a variation from R660 to R5 500), which converts to a rental value of 2.08c per m³ per year at a real discount rate of 10%. This can be compared with a shadow price of 3.5c per m³ per year calculated for a typical cropping pattern of wheat, cotton, potatoes and maize near Douglas on the Orange River with the aid of whole farming models applying dynamic-deterministic linear programming techniques (Kirsten & Backeberg, 1988). Although these market trades must be subjected to further analysis, (Water Research Commission, 1997) initial indications are that tenure insecurity of water use rights and business or financial risks are reflected in the market price and this price differential is more significant because of the time value of money.

Given that reallocation of water quotas are actually being observed in practice in accordance with theoretical expectations, it is encouraging that in the National Water Policy (Department of Water Affairs and Forestry, 1997a:21-23) it is mentioned that consideration is given to apply water pricing in support of conservation and allocation policy. For this purpose "provisions will be made to allow trading in water-use allocations" but it is also stated that "trading as a price setting mechanism has its limitations ..." and "will not necessarily reflect the real value of the resource". One practical difficulty which is raised is the physical translocation of water. If a market system were to be introduced, the proposed policy is that it will be subject to control depending on whether trades are within or between water sectors or so-called

water management areas. In addition, specific precautions will have to be taken to achieve fair resource allocations, prevent further penalisation of disadvantaged communities and enrichment of privileged landowners by gaining windfall profits. No detail is given of how this will be done, but in the National Water Bill (1997) a range of prescriptions and responsibilities are given. These are on trading of an entitlement to use water (S.96); applications for trading of an entitlement and the approval thereof (S.97); and endorsement and recording of the entitlement (S.98). It appears that legislative measures to implement the above policy statements are probably the following: The Minister or a catchment management agency to which that authority has been assigned, may require an applicant to obtain and provide any information etc., and an application to trade may be refused if this is not made available.

It must be deduced that the specifications on trading of entitlements to use water are not unduly stringent. Apart from recognising that the impediment of transaction costs may already be present, the rules should be tested in practice. However, the attenuation of ownership rights and the limited duration of water use entitlements certainly means that "efficiency and effectiveness of the market will be diminished and the optimal allocation of water may not be attained" (Musgrave, 1997:435-436). Uncertainty caused by policy statements and changes in water legislation has reportedly already had the affect of suppressing if not stopping market activity in irrigation areas on e.g. the middle Orange River.

3.2.4 Supply costs and water tariff setting

For clarity in the debate, a distinction must be made between the price of water rights as determined by the market process and tariffs for water services as determined by government. If water supply costs are reflected in tariffs it will lead to efficient use of water and if scarcity values of water are reflected in market prices it will lead to efficient allocation of water. There is clearly an interaction since the value of water rights is the capitalised present value of expected nett income and is, therefore, obviously influenced by costs and tariffs to supply water.

In the Resource Pricing Policy (Department of Water Affairs and Forestry, 1997b), the standard financial costs are included but a catchment management charge and an interception levy are added. Further, in fulfilment of an economic approach to tariff setting, arguments are presented in support of introducing a resource conservation charge, which is termed an economic cost. The basis for tariffing is not per unit water, however, since it is specified

in the National Water Bill (1997) that the charge assessed is a charge on land (S.199 (1)).

Some brief comments are appropriate in evaluating these tariffs, levies or charges:

- (a) The recovery of costs, including catchment management costs on the principle of willingness to pay is acceptable, but assessment of costs must be accompanied by comparison with direct and indirect benefits. It is essential to quantify the fiscal impact to determine the level of capital cost recovery, and to devise a two-part, tiered tariff structure for capital, operation and maintenance cost (Backeberg, 1994:250-258).
- (b) The interception levy will not achieve the purpose of preventing encroachment of established water use rights and is impractical to apply or enforce. It must preferably be replaced by tradable water entitlements in which reduced run-off is quantified.
- (c) The resource conservation charge is not correctly conceptualised in trying to include the scarcity value of water in tariffs. It is clearly a tax on opportunity costs or scarcity rents, bears no relation to cost of supply, and should be scrapped since it will serve as a disincentive to transfer water rights.
- (d) The assessment of charges on land and not water disregards the link that must be established between water consumption and payment for services to deliver water. It does not address the necessity to accurately measure the volume of water used which has up to now largely been neglected.

As it is written currently the water charging policy confuses tariff setting with pricing and is misguided by attempting to increase water tariffs to reflect the value of water.

3.2.5 Marketing and administrative procedures

The balance between market and administrative allocation mechanisms will vary between countries and the degree to which either one dominates is determined by the following factors (Livingston, 1995:209-210):

- (i) The stage of development of a market based economy, historical background and experiences with command and control mechanisms;

- (ii) The organisational skills and leadership abilities of water users and government agencies;
- (iii) The technical skills, client relationships and unbiased ability of government agencies to evaluate economic gains or losses from water transfers;
- (iv) The scale of reallocations that is considered, with small transfers favouring market interaction between individuals and large transfers requiring involvement of government agencies.

In South Africa most of the factors probably tip the balance in favour of an allocative mechanism that is dominated by administrative procedures.

The careful phrasing that consideration will be given to selectively introduce an economic pricing system for water allocation also clearly demonstrates a preference for administrative price and tariff setting. This can be explained by political objectives to correct past inequalities and for reasons of efficacy (Winpenny, 1994:76-80), i.e. that the existing allocations of water rights are seen to be changing and policy goals are reached within a relative short time frame. However, there is no logical basis to envisage that government failures of political short-sightedness, rent seeking of interest groups and lack of accountability of government departments that have occurred in the past (Backeberg, 1994:191-208), cannot be repeated in future. The government will have to deliver results before the next election; small-scale farmers and especially women are already mentioned separately in policy statements; and a draft clause in the National Water Bill (1997) states that no claim for compensation for any damages sustained due to restriction or suspension of water licences can be submitted (S.200(b)).

A drastic change in approach to water management was not to be expected, and the consolation is that according to the policy guidelines, the legislative and economic instruments will be implemented in a phased process. This applies to gradual increases in water tariffs and introduction of new charges in relation to progress with water resources assessment within river catchments and water use sectors (Department of Water Affairs and Forestry, 1997b). Similarly a phased implementation of tradable water rights within irrigation schemes; between irrigation schemes in the same sub-catchment; between irrigated agriculture and other water use sectors in the same sub-catchment or catchment; and transfers between catchment areas, has already been proposed (Backeberg, 1994:310 and SANCID, 1995). In any event, the experience of successful reform of water allocation policies indicates that a

mix of market and administrative procedures are necessary as measured against a range of criteria which have been discussed (see Table 2).

Table 2: Relative performance of market versus administrative allocation mechanisms

Criteria	Market allocations	Administrative allocations
Flexibility	xx	x
Security of tenure	xxx	xx
Real opportunity cost	xx	x
Predictability	xxx	xx
Efficiency	xxx	x
Equity	x	xxx
Political and public acceptability	xx	xx
Efficacy	x	xxx
Administrative feasibility and sustainability	xx	x

Source: Le Moigne, Dinar and Giltner (1995)

Note: Ranking increases from x to xxx

3.3 Local water management

Tenure and legal security of water rights and the related pricing incentives for efficient use and transfer of water resources has wide-ranging consequences for water management. *First*, decisions regarding the type or combination of crops, the type of irrigation methods and adaptation of various production practices can be made to increase *farming profitability*. *Second*, participation of water users in integrated catchment management of surface and groundwater can be achieved by establishing *organisations* representing the interests of different water use sectors on a local level.

3.3.1 Implementation of water saving technologies

It has been estimated that on average only 45% of water diverted or extracted for irrigation actually reaches the crop. Approximately 15% is lost through river or canal distribution, 15% is lost through on-farm distribution by furrows or pipes, and 25% is lost through field application (Serageldin, 1995:226-227). Opportunities exist to improve efficiency in all three instances. The right question to ask is not how can more water be supplied to compensate for losses but how can less water be used?

Water distribution losses in rivers or canals are caused by seepage or evaporation and spillage due to incorrect timing of releases. For many irrigation areas, river distribution is an integral part of the water distribution network and losses are often unavoidable. Concrete lining of earthen canals or furrows or replacement with pipes is obviously costly and not necessarily economically justifiable. In the case of *canal distribution on irrigation schemes*, an accurate estimate of the quantity demanded is necessary in order to supply water from dams on request, timely and with the least possible distribution losses. Computerised models have been developed and are currently being implemented to manage water distribution of canal systems more efficiently (Benadé, Annandale & Van Zijl, 1997).

The most important *methods of irrigation* used in South Africa are flood irrigation on 32.8% of the total area, sprinkler irrigation on 54.4% of the area and micro irrigation on 11.8% of the area (Backeberg *et al.*, 1996:29). The efficiency levels for these methods which can be technically achieved are respectively 55-65%, 70-85% and 85-95% (Reinders, 1992), but are often lower in practice. In deciding to change from one method to another, the potential saving in water is only one consideration. It also depends on management expertise, income level of crops, financing costs of capital and the availability and training of labour. Apart from the method of application, the *quantity and timing of water application* must be scheduled in relation to crop water requirements. Various computerised scheduling models are available, both as a planning tool (Crosby, 1996) and for real-time scheduling (Bennie *et al.*, 1997; Annandale, Van der Westhuizen & Olivier, 1996). However, in the past irrigation scheduling has not been generally practised due to insufficient knowledge and low water supply costs. A possible explanation for this situation is that the expected additional costs of obtaining information and using scheduling tools are higher than the expected benefit of saving water and achieving more income from crop production. This will change with increases in water tariffs due to phasing out of subsidies and farmers will have to adapt irrigation practices.

Careful assessment is necessary to determine whether additional water is made available by conservation practices of increased efficiency in use. Efficiency can be improved by better matching application of water to crop requirements and by reducing gross water requirements as determined by the method of irrigation. If this water saving impacts on downstream water users or instream flow requirements because of reduced returnflow or deep percolation, the water cannot be used for irrigation of additional land on the same farm or for market transfers to other water users or water use sectors. The important point is that water savings require a reduction in *actual use* and

other options which can be considered are switching to crops that require less water or following the practice of deficit irrigation (Whittlesey & Huffaker, 1995:1200-1202).

3.3.2 Formation of Water User Associations

Over the past twenty to thirty years it has become increasingly clear that publicly financed irrigation schemes have not performed according to expectations. Because of pressures to reduce budgets, including subsidies to agriculture, governments in many countries are implementing programmes to transfer responsibility for management of public irrigation schemes to local Water User Associations (WUA's). In some cases this transfer involves actual sale or disposal of all the public assets to the WUA, which effectively acquires ownership of the assets and complete privatisation takes place. In most cases, however, partial transfer of responsibility for operation and maintenance of the irrigation scheme is negotiated with the WUA, while the government agency retains control of water sources and the main storage and distribution network (Johnson, 1995:62). This was certainly the approach in South Africa with transfer of some government irrigation schemes since the mid 1980's.

The WUA's perform functions both for use and development of water resources as well as allocation of water rights. The involvement of water users in local water management leads to an improvement of water delivery services and a reduction in the costs of operation and maintenance. Monitoring of water use is undertaken and forums are created for the resolution of disputes. Loans or subsidies and contributions of private capital by members are negotiated for rehabilitation or refurbishment of irrigation schemes. Applications for apportionment or transfer of water rights are channelled through the WUA. In all these instances, the initial success and long-term sustainability of WUA's depends on sufficient incentives for farmers to participate (Rosegrant & Schleyer, 1994:22-23; Meinzen-Dick *et al.*, 1995:vii-xii).

The approach of integrated catchment management and participation of water users in water management on a local level have been accepted as policy (Department of Water Affairs and Forestry 1997a,29-30). In the National Water Bill (1997) provisions are also made to give statutory powers to Catchment Management Agencies (S.132-141) and Water User Associations (S.142-150). Much will depend on what powers and authority will be awarded to these organisations to perform their functions. The advantage is that for many irrigation schemes organisational capacity exists already in the form of Boards or Advisory Committees, and only transformation to WUA's is

required. Where managerial competence is lacking, as applies to most small-scale farmer irrigation schemes, special training programmes will have to be developed.

3.3.3 User-based performance assessment

Following the transfer of responsibility for management of irrigation schemes to a local level, research has been undertaken to develop tools for performance assessment and to identify irrigation performance indicators. Three broad types of performance assessments can be identified:

- (1) Operational performance assessment regarding current information on water distribution and costs;
- (2) Intervention assessments which may range from modest changes in water distribution networks to major rehabilitation of physical facilities;
- (3) Accountability assessments providing information to judge internal management processes of the organisation; relationships between the irrigation agency and its supervising body; and relationships between the farmers and the irrigation agency (Small & Svendsen, 1990:300 - 302).

This is clearly an area in which much research work will have to be done in future as WUA's are established, are required to perform efficiently and be accountable to their members.

3.4 Realities and fallacies

The present debate on the merits of market reallocation is confounded due to different premises of the various participants. Some of the important issues that must be clarified are discussed to provide a better informed perspective.

3.4.1 Initial assignment of rights

It is accepted that there is an unequal apportionment of water rights due to the constitutional history and past political inequality. Based on the principles of justice, privileged holders of water rights must be prepared to relinquish some of these rights in favour of disadvantaged individuals or groups. These adjustments cannot be made arbitrarily by government through attenuating property rights and reallocating water licences, but must be negotiated in good faith with owners of lawful water rights (Backeberg, 1994:169-170).

The reapportionment must recognise both historical use and needs of the dispossessed. Such negotiations could include reassignment of rights with and without compensation. Although it might involve sacrifices, social harmony in communities in rural areas will certainly be promoted. There must be a general acceptance of the fairness of this initial apportionment of water rights. The water rights must be quantified and formally registered. Only thereafter can a market for the rights be established (Rosegrant & Schleyer, 1994:13; Simpson, 1994:100; Anderson, 1995).

3.4.2 *Impact of rural poverty*

Apart from holding rights, individuals must also have access to funds to participate in the market process. With widespread poverty in especially rural areas, hardships are experienced and a range of policy measures must be taken to correct the situation. In the immediate short-term, grants or loans on favourable conditions can be provided to acquire water rights. Lifeline tariffs can be implemented for basic water requirements or vouchers can be made available for reimbursement by low income households to target poverty without subsidising water services. Over the medium to long-term training and extension programmes must be implemented to enable individuals to improve livelihoods by own efforts (Backeberg, 1996: 332-335).

3.4.3 *Protection of ecological balances in river systems*

In both a market and administrative system of water allocation, the requirement is that the transfer must be beneficial to the involved water users and no harm must be caused to the other water users (Frederiksen, 1992:8). The difference is that in a market process the water users decide themselves, whereas in the administrative process bureaucrats decide on behalf of water users. Put differently the question revolves around what type of property right (or socially sanctioned decision-making power) is dominant (private or public) and who's interests count most (private or public)?

The nature of water as a public resource, to which individuals can have access through private or common property rights, is central to the challenge which must be addressed when changing water allocation to a market based system. In the market process water rights are transferred in the private interest but subject to the obligation to respect the interest of others. *Unless that third-party interest is specified in some detail, the ability to transfer is uncertain and can lead to less efficient markets* (Mc Cormick, 1994:957).

Much of the debate on third-party interests has centred around maintenance of the ecological balance in river systems. This involves *firstly* prevention of deterioration in water quality and increasing health threats as caused by point and non-point pollution. *Secondly*, it requires specifying instream flow requirements to support plant, fish and animal life, protect biodiversity and promote recreation.

In the National Water Policy (Department of Water Affairs and Forestry, 1997a:16) water rights are allocated for basic human needs and for protection of ecosystems. This is distinguished from all other allocations and defined as the reserve. For the former, the quantity and reliability of supply, provision for population changes and improvement in basic services will have to be taken into account. For the latter, the exact quantity of water will vary with the time of year, habitat requirements, sediment and salt balances and other factors specific to each river system (Postel, 1995:21-22). As is the case with the quantification of water entitlements, there is an urgency to determine basic human needs and instream flow requirements for river catchments that are under stress. In catchment areas where groundwater and surface water are over-utilised, meeting the minimum requirements of the reserve will probably involve shifting water resources away from amongst others irrigated agriculture.

Based on the polluter pays principle, the most widely advocated economic instruments for point source pollution are emission charges and marketable effluent permits. Non-point pollution control options are voluntary approaches (using education, moral persuasion and technical assistance) and taxes or charges which are levied on either inputs or pollution outputs (Stringer, 1997:24-28). Charges always have a double effect because they act as an incentive to change behaviour and they raise funds (OECD, 1991:63-68). Financial provisions in the National Water Bill (1997) include a system of waste charges which may take into account incentives to minimise waste discharges to water resources and impacts on water resources (S.196 (2)(f)(ii)). Funds collected under the above section may only be used in the particular catchment for the purpose for which it was charged (S.197).

It appears that the third-party interests are adequately described but still need to be defined in more detail. Incentives can be applied to internalise external effects of private economic activity. Thereby this particular source of market failure can be eliminated or at least substantially reduced.

3.4.4 Settlement of smallholders

In the process of reform towards a uniform set of policies, the institutional form ordering allocation of water rights and pricing arrangements regulating maintenance of irrigation schemes, are also essential requirements for successful smallholder settlement. Clear specification of rules and predictable outcomes commonly induce economic development through individual initiative and accumulation of surpluses. *With secure expectations of possible net benefits, small-scale farmers are willing to invest in more productive practices.* Economic development is a succession of technological changes whereby credit, seeds, fertiliser, machinery and extension advice are used to market products. The individual economic position improves if survival objectives are attained, objectives of food security can be considered, whereafter follow objectives to earn a surplus and lastly the objective to speculate (Bromley, 1982:26-37).

The case that is made against tradable water rights in developing communities is basically that transaction costs are higher than normal and that it will worsen the income distribution. However, with provision of farmer support services and participation of water users in water management, competition exists amongst members of the community to increase productivity and to be able to move from a situation of survival to surpluses. Modification of customary usufructuary rights in order to improve tenure security and apportionment of water rights to individuals or associations (for community gardens) means that those who actually cultivate the land and use water, i.e. women, obtain the scarcity rents (Rosegrant & Binswanger, 1994:1613-1623). *It is therefore a misconception that by reassigning water entitlements with limited duration and by subsidising water tariffs, that sustainable small-scale irrigation farming will be promoted.*

3.4.5 Alienation of water rights on government irrigation schemes

Reservations are often expressed that tradability of water rights on irrigation schemes which have been developed with public funds will allow enrichment of a few farmers at the expense of general taxpayers. *This perception is incorrect because it must be remembered that the net benefit of farming on these schemes is already capitalised in the land. Tradability of water rights in itself will only enable realisation of part of this capital value and does not create the value.* In addition, any subsidy which was obtained has in most cases partially or fully been recovered within the economic system through direct and indirect taxes. Most of these irrigation schemes were also constructed for political and social but not economic objectives and rational farmers optimised investment,

marketing, financing and production decisions within the given policy environment.

Tradability is in fact an incentive for more efficient utilisation and equitable reallocation of water and will therefore improve access to water resources. It is nonetheless true that subsidised input costs, including water tariffs, and price support programmes for certain irrigated crops have led to artificially high land prices. This only emphasises the point which has already been made that tradable water rights must be accompanied with a removal of subsidies and that water tariffs must be set in relation to the actual costs of water supply (Phelps *et al.*, 1978:36-39, Anderson, 1967:265-273, Wahl, 1989:127-133, 173-190; Backeberg, 1994:301-302).

4. CONCLUSION

In the water scarce economy of South Africa the conflict between water users and different water use sectors will progressively intensify. This situation emphasises the need for appropriate allocation mechanisms and an institutional economic approach to water management. The challenges for irrigated agriculture are to produce more food while competition for water gradually increases. Public policies will have to change to achieve the objective of decreasing the quantity demanded or shifting the demand for water, while maintaining growth in irrigated agriculture (Wolff, 1997:15-16).

If the principle that water is an economic good is actually implemented through realistic water policies, there are a number of requirements:

- (1) Water entitlements must be clearly specified, the durations of rights must be perpetual and water users must be empowered to take decisions through ownership;
- (2) Allocation of water rights within and between water use sectors must be enabled by the market process in which prices reflect scarcity values, while care is taken to prevent distortions caused by subsidies;
- (3) Farmers must be willing to pay for costs of water services, accept responsibility for managing water resources and properly organise on a local level;
- (4) Government's role must be to define and enforce rules, prescribe administrative procedures and facilitate the provision of hydrological, engineering, agricultural and economic support services.

There is clearly an interdependence between full property rights, efficient functioning of markets and effective participation by water users. At the current stage of water policy reform, contradictions exist since water rights are attenuated and water markets are restricted, but provisions are made for an economic approach to water pricing and involvement of users in water management. It will require more time, ten to twenty years if not more, for political perceptions to change and for appropriate institutions to be designed whereby economically and ecologically rational water allocation policies can be implemented (Allan, 1996:5; Abernethy, 1997:2). The innovations in irrigation policy of Latin American countries which certainly are of relevance to South Africa have so far either not been fully applied or it is unlikely that they will be successful. Although some improvements in the efficient use of water can be achieved, efficient and equitable reallocation of water rights within irrigated agriculture and from irrigation to industrial or domestic uses is highly improbable. Further economic inputs in the policy consultation process and a concerted research effort on the efficiency gains of property rights based water markets is consequently essential.

REFERENCES

ABERNETHY, C.L. (1997). Water management in the 21st century: Problems and challenges. *Development and Cooperation*. No 2, March/April.

AGRICULTURE AND RESOURCE MANAGEMENT COUNCIL OF AUSTRALIA AND NEW ZEALAND (ARMCANZ). (1995). *Water Allocations and Entitlements: A National Framework for the Implementation of Property Rights in Water*. Task Force on Council of Australian Governments Water Reform, Occasional Paper No 1.

ALLAN, J.A. (1996). Policy responses to the closure of water resources: Regional and global issues. *In* . Howsam, P. and Carter, R.C. (eds), *Water Policy: Allocation and Management in Practice*. London : E& FN Spon.

ANDERSON, R.L. (1967). Windfall gains from transfer of water allotments within the Colorado - Big Thompson project. *Land Economics*. 43.

ANDERSON, T.L. (1995). *Practical steps to promote water rights marketing*. Personal communication. Bozeman, Montana : Political Economy Research Centre.

ANNANDALE, J.G., VAN DER WESTHUIZEN, A.J. & OLIVIER, F.C. (1996). *Die fasilitering van tegnologie oordrag deur verbeterde besproeiingsriglyne vir groente*

en 'n meganistiese gewas-modeleringsbenadering. Verslag aan die Waternavorsingskommissie deur die Departement Plantproduksie en Grondkunde, Universiteit van Pretoria. Pretoria : WNK Verslag No 476/1/96.

BACKEBERG, G.R. (1994). *Die Politieke Ekonomie van Besproeiingsbeleid in Suid-Afrika/The Political Economy of Irrigation Policy in South Africa*. PhD thesis. University of Pretoria.

BACKEBERG, G.R. (1995). *Towards a market in water rights: A pragmatic institutional economic approach*. Discussion Paper. Johannesburg : Water Law Legal Grouping, Land and Agriculture Policy Centre.

BACKEBERG, G.R. (1996). The challenge of irrigation policy reform in the mature water economy of South Africa. In Pigram, J.J. (ed). *Security and sustainability in a mature water economy : A global perspective*. Centre for Water Policy Research, University of New England. Water and Resource Economics Consortium, Proceedings of an International Workshop. University of Melbourne.

BACKEBERG, G.R., BEMBRIDGE, T.J., BENNIE, A.T.P., GROENEWALD, J.A., HAMMES, P.S., PULLEN, R.A. & THOMPSON, H. (1996). *Policy proposal for irrigated agriculture in South Africa*. Discussion Paper. Pretoria : Water Research Commission. WRC Report No KV96/96.

BENADÉ, N., ANNANDALE, J.G. & VAN ZIJL, H. (1997). *The development of a computerised management system for irrigation schemes*. Report to the Water Research Commission by Rand Afrikaans University. Pretoria : WRC Report No 513/1/97.

BENNIE, A.T.P., VAN RENSBURG, L.D., STRYDOM, M.G. & DU PREEZ, C.C. (1997). *Reaksie van gewasse op voorafgeprogrammeerde tekortbesproeiing*. Verslag aan die Waternavorsingskommissie deur die Departement Grondkunde, Universiteit van die Oranje-Vrystaat. Pretoria : WNK Verslag No 243/1/97.

BROMLEY, D.W. (1982). *Improving irrigated agriculture : Institutional reform and the small farmer*. World Bank Staff Working Paper No 531. Washington D.C. : The World Bank.

CHENYE, M. & JOHNSON, P. (eds). (1996). *Water in Southern Africa*. Maseru/Harare : SADC/IUCN/SARDC.

COOTER, R.& ULEN, T. (1988). *Law and economics*. Glenview, Illinois/London, England : Scott, Foresman and Company.

CROSBY, C.T. (1996) *SAPWAT 1.0 - A computer program for estimating irrigation requirements in Southern Africa*. Report to the Water Research Commission by Murray, Biesenbach and Badenhorst Inc. Pretoria : WRC Report No 379/1/96.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY/DEPARTEMENT VAN WATERWESE EN BOSBOU. (1993). *Memorandum oor beleid in verband met die oordrag van waterregte ingevolge Artikel 63(6) van die Waterwet, 1956, en die verkryging van waterregte ingevolge Artikel 63 (10) van die Wet*. Omsendbrief 7 van 1993. Verwysing B31/1 : Pretoria.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY. (1995). *You and your water rights : South African Law Review*. Discussion Document : Pretoria.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY. (1996). *Water law principles*. Discussion Document : Pretoria.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY. (1997a). *White Paper on a National Water Policy for South Africa*. Pretoria.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY. (1997b). *A resource pricing policy for South African Water (Final Draft)*: Pretoria.

DUDLEY, N.J. (1992). An innovative institutional arrangement which incorporates the risk preferences of water users. In Haimen, Y., Moser, D. & Stakhiv, E. (eds.), *Risk-based decision making in water resources V*. New York : American Society of Civil Engineers.

FOOD AND AGRICULTURE ORGANISATION (F.A.O.). (1995). *Reforming water resources policy : A guide to methods, processes and practices*. Rome : Irrigation and Drainage Paper No 52.

FREDERIKSEN, H.D. (1992). *Water resources institutions : Some principles and practices*. World Bank Technical Paper No 191. Washington D.C. : The World Bank

FURUBOTN, E.G. & PEJOVICH, S. (1974). *The economics of property rights*. Cambridge, Massachusetts : Ballinger Publishing Company.

HEARNE, R.R. & EASTER, K.W. (1997). The economic and financial gains from water markets in Chile. *Agricultural Economics*, 15(3).

JOHNSON, S.H. (1995). Selected experiences with irrigation management transfer: Economic implications. *Water Resources Development*, 11(1).

KIRSTEN, J.F. & BACKEBERG, G.R. (1988). *Beplanning van 'n ekonomies bestaanbare boerderygrootte in die Oranje-Vaalbesproeiingsraadschema by Douglas*. Verslag No LE112/88/1. Pretoria : Direktoraat Landbouproduksie-ekonomie, Departement van Landbou en Watervoorsiening.

LE MOIGNE, G., DINAR, A. & GILTNER, S. (1995). Principles for the allocation of water among economic sectors. Paper presented at the CIHEAM International Seminar on *Economic aspects of water management in the Mediterranean Area* : Marakech, Morocco.

LENTON, R.L. & GARCÉS-RESTREPO, C. (1995). Institutional, managerial and technological innovation in Latin American irrigation: Relevance to global irrigation improvement. *Water Resources Development*, 11(4).

LIVINGSTON, M.L. (1995). Designing water institutions: Market failures and institutional response. *Water Resources Management*, 9.

MCCORMICK, Z. (1994). Institutional barriers to water marketing in the West. *Water Resources Bulletin*, 30(6).

MEINZEN-DICK, R., MENDOZA, M., SADOULET, L., ABIAD-SHIELDS, G., & SUBRAMANIAN, A. (1995). Sustainable water user associations: Lessons from a literature review. In: Subramanian, A., Jagannathan, N.V., Meinzen-Dick, R. (eds.), *User organisations for sustainable water services*. Chantilly, Virginia : World Bank Water Resources Seminar.

MEINZEN-DICK, R. & ROSEGRANT, M.W. (1996). The effective development of Southern Africa's water resources. Paper presented at the Symposium on *Meeting the Challenge of Overcoming Food Insecurity in Southern Africa*: Johannesburg.

MORRIS, J. (1996). Water policy : Economic theory and political reality. In: Howsam, P. & Carter, R.C. (eds.), *Water policy : Allocation and management in practice*. London : E & FN Spon.

MUSGRAVE, W. (1997). Decentralised mechanisms and institutions for managing water resources : Reflections on experiences from Australia. In: Parker, D.D. & Tsur, Y. (eds.), *Decentralisation and coordination of water resource management*. Boston/Dordrecht/London : Kluwer Academic Publishers.

NATIONAL WATER BILL (1997). Fourth draft for discussion. (September 1997). Pretoria : Department of Water Affairs and Forestry.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (O.E.C.D.). (1991). *Environmental policy : how to apply economic instruments* : Paris.

PHELPS, C.E., MOORE, N.Y. & GRAUBARD, M.H. (1978). *Efficient water use in California : Water rights, water districts, and water transfers*. Santa Monica : R-2386-CSA/R.T. Rand.

PIGRAM, J.J. (1993). Property rights and water markets in Australia : An evolutionary process toward institutional reform. *Water Resources Research*, 29(4).

PIGRAM, J.J. (1997). Australia's water situation: Resource allocation and management in a maturing system. In: Parker, D.D. & Tsur, Y. (eds.), *Decentralisation and coordination of water resource management*. Boston/Dordrecht/London : Kluwer Academic Publishers.

POSTEL, S. (1995). Water of strife. *Ceres*. (The F.A.O. Review), 27(6).

RANDALL, A. (1983). The problem of market failure. *Natural Resources Journal*, 23.

REINDERS, F.B. (1992). *Irrigation systems*. Silverton, Pretoria : Agring. No 10.

REPUBLIC OF SOUTH AFRICA (1996). *Constitution of the Republic of South Africa*. Act 108 of 1996. Cape Town : Constitutional Assembly.

ROSEGRANT, M.W. & SCHLEYER, R.G. (1994). *Tradable water rights : Experiences in reforming water allocation policy*. Washington D.C. : Irrigation Support Project for Asia and the Near East. US Agency for International Development.

ROSEGRANT, M.W. & BINSWANGER, H.P. (1994). Markets in tradable water rights: Potential for efficiency gains in developing country water resource allocation. *World Development*, 22(11).

SCHLEYER, R.G. (1994). Chile's market-oriented water policy: Institutional aspects and achievements. In: Le Moigne, G. Easter, K.W. Ochs, W.J. Giltner, S. (eds.), *Water policy and water markets*. Washington, D.C. : World Bank Technical Paper No 249. The World Bank.

SCHLEYER, R.G. & ROSEGRANT, M.W. (1996). Chilean water policy: The role of water rights, institutions and markets. *Water Resources Development*, 12(1).

SIMPSON, L.D. (1994). Conditions for successful water marketing. In: Le Moigne, G., Easter, K.W., Ochs, W.J., Giltner, S. (eds.), *Water Policy and Water Markets*. World Bank Technical Paper No 249. Washington D.C. : The World Bank.

SOUTH AFRICAN NATIONAL COMMITTEE ON IRRIGATION AND DRAINAGE (SANCID). (1995). *The alternative of property rights to water and the market in water rights : A response to the invitation for comment by the Minister of Water Affairs and Forestry*. Proceedings of a Workshop organised in collaboration with the Agricultural Economics Association of South Africa : Pretoria.

SCHMID, A.A. (1978). *Property, power and public choice : An inquiry into law and economics*. New York and London : Praeger Publishers.

SERAGELDIN, I. (1995). Water resources management: A new policy for a sustainable future. *Water Resources Development*, 11(3).

SMALL, L.E. & SVENDSEN, M. (1990). A framework for assessing irrigation performance. *Irrigation and Drainage Systems*, 4.

STRINGER, R. (1997). *The environment, economics and water policy*. Adelaide : Centre for International Economic Studies, University of Adelaide. Policy Discussion Paper No 97/02.

TIETENBERG, T. (1992). *Environmental and natural resource economics*. (Third Edition). New York : Harper Collins Publishers Inc.

TISDELL, C. & ROY, K. (1997). Good governance, property rights and sustainable resource use. *The South African Journal of Economics*, 65(1).

UNITED NATIONS. (1992). *International conference on water and the environment : Development issues for the 21st century* : Dublin, Ireland.

VAN ROOYEN, C.J. (1997). Challenges and roles for agriculture in the Southern African region. *Agrekon*, 36(2):181-205.

WAHL, R.W. (1989). *Markets for federal water : Subsidies, property rights, and the bureau of reclamation.* : Washington D.C. : Resources for the Future.

WATER RESEARCH COMMISSION. (1995). Exploratory investigation in preparation of a research project on the economic value of water rights. Reference K4 : Pretoria.

WATER RESEARCH COMMISSION. (1997). *The pricing of water resources in South Africa with specific reference to riparian surface water.* Research Project No K5/870, Department Agricultural Economics, University of Natal : Pietermaritzburg.

WHITTLESEY, N.K. & HUFFAKER, R.G. (1995). Water policy issues for the twenty-first century. *American Journal of Agricultural Economics*, 77.

WILLIAMSON, O.E. (1985). *The economic institutions of capitalism.* New York and London : The Free Press.

WINPENNY, J. (1994). *Managing water as an economic resource.* Overseas Development Institute. London and New York : Routledge.

WOLFF, P. (1997). Solving conflicts over water uses: Strategies for improved water management. *Development and Cooperation*. No 2 March/ April.