Chapter 1

Nature and Role of Water Institutions — Implications to Irrigation Water Management in Zimbabwe

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Additional information is available at the end of the chapter

1. Introduction

About 60% of the Southern African region is semi-arid or arid and suffers from periodic droughts [1]. This is compounded by the scarcity and poor management of irrigation water resources. The challenges of water scarcity for agricultural purposes present negative consequences on the general populace, more particularly in the rural areas. It is in these areas that the majority practise agriculture for their livelihoods with regards to food and incomes [2]. This has led to a decline in agricultural productivity. Declining agricultural productivity among smallholder farmers in Africa remains a major bottleneck in the development of the continent [3]. Agricultural production is dominated by rain-fed agriculture and irrigation systems are limited [4].

To this effect, management of agricultural water particularly in rain-fed systems remains imperative for improved farm level yields because the bulk of the food comes from rain-fed agriculture [2, 3]. Yet, evidence of the problems of water management is found throughout history [5]. Effective management of agricultural water requires continuous backup from policies and institutional frameworks [2, 3, 6]. Scholars have argued that institutions are very important to improve management problems [7, 8]. How to incorporate and sustain institutional innovations to ensure efficient use and management of irrigation water under diverse ecological, economic, social, and political constraints is an on-going debate on irrigation water resource development [9]. Efficient use and management of irrigation water require changes in institutions and new institutions [10].

In light of the above, a series of institutional arrangements have been presented as panaceas to improve water management: strong government agencies, user organizations, and water markets [5]. These approaches have conversely failed to achieve the required outcomes basically because of the variability of local situations and the difficulty associated with

transferring institutions from one context to another were not considered [5]. Moreover, research has confirmed that lack of enabling policies and effective institutional frameworks are a major contributor towards poor management and utilisation of agricultural water in Sub-Saharan Africa [3, 6].

In light of the above, it is therefore important to understand that addressing the challenges that are associated with water management, there is need to consider the localised rules and norms and the authorities that therefore enforce them. This is over and above implementing appropriate and relevant technologies [11]. Therefore, there is need for instituting effective localised governance the effective application of community rules. Thus, this chapter seeks to investigate the nature and role of water management institutions to foster sustainable agricultural water resources management, particularly in Zimbabwe after the "fast" track land reform programme. The subsequent section discusses the major water reforms in Zimbabwe.

1.1. Redressing past water injustices in Zimbabwe

For close to two decades after independence water resource management continued to be governed by the 1976 Water Act. The need for water reform eventually emanated from the need to 'redress colonial injustices in the water sector' [12, 13, 14]. Increased continual privileged access to water by the white large-scale commercial agriculture for commercial interests called for an urgent need to reform the irrigation water sector in Zimbabwe. This was to be augmented by establishing a legal framework that would also guarantee an equal access to water for all Zimbabweans. Ensuring equitable access to water for rural people for productive uses contributes to the improvement of their livelihoods derived from the use of water. The water reforms that culminated in the 1998 Water Act began as a reaction to the 1991/92 drought, the worst in the country's history [15]. Within this context, the 1976 Water Act was repealed by the 1998 Water Act and the Zimbabwe National Water Authority (ZINWA) Act. The Water Act of 1998 set the parameters of access and use of water as well as the establishment of Catchment and Sub-catchment areas based on hydrological boundaries.

1.2. Institutions: Nature and role

This chapter adopts a definition of institutions that encompasses both [16] and [17]. [17]'s definition implies that interactions with the environment are secondary to political, economic and social interactions whereas [16] notes that institutions are rules that can be used at multiple levels of analysis and such a definition does not seem to place priority of one factor over another. The major role of institutions in a society is to reduce uncertainty by establishing structure to human interaction [18].

The difference between formal and informal institutions is one of degree, not of kind, and in many cases some informal institutions gradually become part of their formal counterparts and some formal institutions take informal forms. Informal institutions are also considered extensions and local-level translations of formal institutions and are not purposively designed but evolve through spontaneous interaction, whereas formal institutions can be purposively designed [18, 19].

2. Effectiveness of institutions: A critical review

2.1. Formal institutions

A survey was conducted by [20] based on a technical and institutional evaluation of the Geray irrigation scheme in West Gojjam zone, Amhara region, Ethiopia. The results indicate that the scheme had been managed by the Water Users Association for four years, despite the fact that it had existed for 27 years. The overall performance of the Water Users Association in terms of managing the schemes was very poor. Water Users Association had no legal authority to enforce its by-laws.

In Harayana, India, [21] employed descriptive analysis to argue that the fact that the poorer households participated in water projects, this did not however, protect their interests. Community based organisations did not basically provide efficient irrigation services compared to the services provided by private organisations. Allocation of water, collection of irrigation service fees, and maintenance of irrigation infrastructure by contractors was more effective than by the community. In contrast, an almost similar study by [22] evaluated the performance of smallholder irrigation systems in Zimbabwe. The results showed that the farmer managed irrigation system performed better consistently than the government managed irrigation system.

In Sri Lanka, a study by [23] revealed that there were many problems in agency managed irrigation. Poor maintenance of irrigation facilities under public provision is a salient feature in many countries. There was heavy subsidisation of the irrigation management in Sri Lanka which had a poor record of cost recovery. Less than 50 percent of the maintenance costs have been collected from farmers at any time [24]. Similarly, as observed by [25], another major deficiency has been the pricing policies in irrigation. Pricing is not related to scarcity or the cost of delivery. Flat rate pricing means the marginal cost is zero which created inefficiency in water use.

2.2. Informal institutions

Several studies have acknowledged the fact that informal local level institutions can make a difference in water management [26, 27, 28, 29, 30, 31, 32]. However, the majority of practitioners and policy-makers advocate for the formal state-based water rights in water management issues, while avoiding consideration of the localised informal norms and rules. On the other hand, the researchers who were pro-informal arrangements seem not to put their support on advocating for adoption of the localised best practices, rather, they opt for amalgamation of the (new) formal and (existing) informal arrangements. However, acknowledging the local rules and norms as legitimate by the formal law, the way they are implemented will suppress the dynamics that are fundamental of local arrangements and thus negatively affects local rights, hence poor irrigation water management.

In efforts to fully understand the importance of informal rules, [33] examined gender issues and women's participation in irrigated agriculture in Carchi, Ecuador, using a combination of qualitative and quantitative methods of analyses. The findings showed that women's participation in water user associations is low, and culture plays a strong role in terms of their

decision-making power. In addition, women tried to solve their irrigation-related problems through informal ways where they had more decision making power.

3. Conceptional framework: Institutional Decomposition Analysis (IDA)

In this study, and as employed by [34], the Institutional Decomposition Analysis (IDA) for measuring the effectiveness of water management institutions was decomposed into informal and formal institutions components. The later was further decomposed into three institutional components; *irrigation water law, irrigation water policy, and irrigation water administration*. The institutional facets were decomposed further to identify their institutional aspects (Figure 1). This framework provides a basis for a quantitative evaluation of both the institutional and the institution performance linkages.

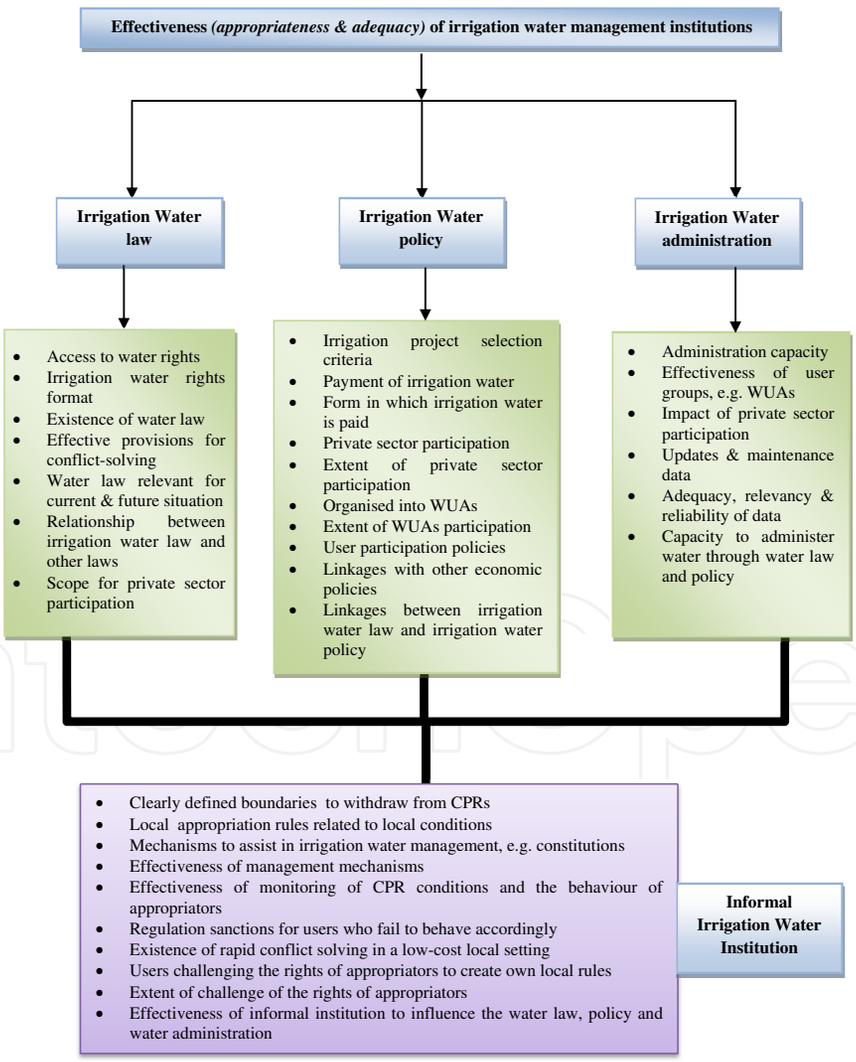

Figure 1. Conceptual framework

4. Methodology

4.1. Model specification

The dependent variable, effectiveness of the relevant formal and informal institution components, were assessed based on a ten-point Likert scale, 1 signifying an extremely non-effective institution and 10 signifying an extremely formal institution. A value of five implied an undecided or a neutral perception. The following set of equations describes the functional relationships of the formal irrigation institutions.

$$Effectiveness\ of\ IWMI\ =\ function\ (LOIWL,\ POIWP,\ AOIWA,\ INFWI)$$

The equation is based on the conceptual framework shown in figure 1

The definitions of the independent variables are listed in Figure 1 and Tables 1 - 4. The variables are grouped into categories of:

- Dummy variables. The value of 1 indicates the existence of a given institutional aspect; zero otherwise.
- Scale variables. A numerical value of 0 -10 is assigned for each category. A value of zero indicates the worst situation and 10 indicates an ideal situation. The intermediate values taken by the scale variables can be interpreted as the extent the actual situation deviates from either the worst or the ideal situation.

When these equations are estimated using Ordinary Least Squares (OLS), the sign and size of their coefficients provide insights into the relative role that various institutional aspects play in influencing the performance of the formal irrigation water institutions.

Explanatory Variable	Acronym	Data type	Variable evaluation criteria
Access to water rights	LAWR	Dummy	1 = yes; 0 = otherwise
Format of water rights	LFWR	Dummy	0 = no rights; 1 = unclear/scattered rights; 2 = common state property; 3 = riparian system; 4 = correlative (proportional) sharing; 5 = licenses/permits
Awareness of the existence of irrigation water law	LEWL	Dummy	1 = yes; 0 = otherwise
Provisions effective for conflict resolution mechanisms	LCRM	Scale	Captured in terms of judgemental perception; scale of 0 – 10

Explanatory Variable	Acronym	Data type	Variable evaluation criteria
Water law relevant for irrigation water users under current and future situation	LRCF	Scale	Captured in terms of judgemental perception; scale of 0 - 10
Relationship of water law with other laws to promote irrigation water management	LLOL	Scale	Captured in terms of judgemental perception; scale of 0 - 10
Water law provisions to promote private sector participation	LPPS	Scale	Captured in terms of judgemental perception; scale of 0 – 10

Table 1. Irrigation water law component (LOIWL) with explanatory variable evaluation criteria

Explanatory variable	Acronym	Data type	Variable evaluation criteria
Irrigation project selection criterion is economic-oriented	PPSC	Dummy	1 = yes 0 = otherwise
Pay for use of irrigation water	PUIW	Dummy	1 = yes 0 = otherwise
Form in which irrigation water if paid for	PFIP	Dummy	0 = full subsidy (no payment) 1 = partial recovery 2 = full-cost recovery
Impact of the policy for promoting private sector participation	PGPP	Scale	Captured in terms of judgemental perception on a scale of 0 – 10
Extensiveness of private sector participation in irrigation water management	PEPP	Scale	Captured in terms of judgemental perception; scale of 0 – 10
Organised into Water Users Associations (WUAs)	PWUA	Dummy	1 = yes 0 = otherwise
Extensiveness of WUAs' participation in irrigation water management	PEWA	Scale	Captured in terms of judgemental perception; scale of 0 – 10
Impact of the policy for promoting users' participation	PIUP	Scale	Captured in terms of judgemental perception; scale of 0 – 10
Extent of influence of other policies* on irrigation water policy	PEOP	Scale	Captured in terms of judgemental perception; scale of 0 - 10
Extent of linkages between irrigation water law and irrigation water policy	PWPL	Scale	Captured in terms of judgemental perception; scale of 0 - 10

Some of these policies to be considered include: fiscal policies, economic policies, investment policies, etc

Table 2. Irrigation water policy component (POIMP) and independent variable evaluation criteria

Explanatory variable	Acronym	Data type	Variable evaluation criteria
Capacity of the administration of irrigation water at scheme level	ACIW	Scale	Captured in terms of judgemental perception; scale of 0 – 10
Effectiveness of user groups (WUAs) in administration of irrigation water	AEWA	Scale	Captured in terms of judgemental perception; scale of 0 – 10
Private sector participation reduces administrative & management burden	APPA	Scale	Captured in terms of judgemental perception; scale of 0 – 10
Mechanisms of collecting update and do maintenance at scheme level	AMUM	Dummy	1 = yes 0 = otherwise
Adequacy, relevance, reliability of water data in irrigation water management at scheme level	AARR	Scale	Captured in terms of judgemental perception; scale of 0 – 10
Capacity to administer irrigation water through use of the irrigation water law and policy	ACLP	Scale	Captured in terms of judgemental perception; scale of 0 – 10

Table 3. Irrigation water administration component (AOIWA) and variable evaluation criteria

Explanatory variable	Acronym	Data type	Variable evaluation criteria
Clearly defined boundaries to withdraw irrigation water CPRs	ICPR	Dummy	1 = existing; 0 = otherwise
Existing appropriation rules related to the local conditions	IARL	Dummy	1 = existing; 0 = otherwise
Existing mechanisms, e.g. constitutions to assist in irrigation water management	IMSL	Dummy	1 = existing; 0 = otherwise
Effectiveness of management mechanisms in water management	IEMM	Scale	Captured in terms of judgemental perception on a scale of 0 – 10
Effectiveness of monitoring, conditions and the behaviour of appropriators	IEMA	Scale	Captured in terms of judgemental perception on a scale of 0 – 10
Existence of regulation sanctions for users who fail to act accordingly	IERS	Dummy	1 = existing; 0 = otherwise
Existence of rapid access to conflict solving in the low-cost, local setting	IECS	Dummy	1 = existing; 0 = otherwise
Users challenging rights of appropriators to create own local-based institutions	ICRA	Dummy	Captured in terms of judgemental perception on a scale of 0 – 10
Extent of challenge of the rights of appropriators to create own institutions	IECA	Scale	Captured in terms of judgemental perception on a scale of 0 – 10
Effectiveness of informal institutions to influence law, policy and administration	IOEI	Scale	Captured in terms of judgemental perception on a scale of 0 – 10

Table 4. Informal irrigation water management institutions and variable evaluation criteria

4.2. Data collection

The research study was carried-out in Mashonaland East Province, Zimbabwe. Zimbabwe is divided into five broad Natural Regions (NR) in which the dominant natural factor conditioning agricultural production is climate; mainly rainfall.

Stratified sampling was done to categorise irrigation schemes into the three strata:

- A1 landless people;
- A2, commercial settlement schemes - small, medium, and large scale; and lastly
- Communal/resettled farmers.

From each stratum, random sampling was done to select the target irrigation schemes[1] in the province. The sample population for the study is depicted in Table 5. A total of 120 questionnaires were administered. The key instrument for data collection was a structured questionnaire which solicited both qualitative and quantitative data.

Type of ownership	Number of schemes targeted
A1* irrigation schemes	36
A2 irrigation schemes	43
Communal/resettled irrigation schemes	41
Total questionnaires	**120**

*Schemes under A1 category and collectively operated

Table 5. Stratification of the study population

5. Descriptive results

The descriptive results are summarized in Tables 6 – 9.

Irrigation water law variables	Acronyms	Type of data	Mean values	Standard Deviation	Range	
					Min	Max
Access to water rights	LAWR	Dummy	0.371	0.236	0	1
Format of water rights	LFWR	Dummy	1.340	0.117	0	5
Existence of irrigation water law	LEWL	Dummy	0.313	0.461	0	1

1 For a scheme to be selected for the study, it should have been functional for at least the past 5 years and at the time of the interview.

Irrigation water law variables	Acronyms	Type of data	Mean values	Standard Deviation	Range	
					Min	Max
Provisions effective for solving conflicts among irrigation water users	LCRM	Scale	3.641	3.314	0	10
Water law relevant for irrigation water users under current and future situation	LRCF	Scale	2.414	1.423	0	10
Irrigation water law relationship with other laws to promote water management	LLOL	Scale	4.341	2.532	0	10
Water law provisions to promote private sector participation	LSPS	Scale	5.266	2.160	0	10

Source: survey data

Table 6. Descriptive statistics: perceptional -based legal, institutional, and performance variables

Irrigation water law variables	Acronyms	Type of data	Mean values	Standard Deviation	Range	
					Min	Max
Project selection criterion is economic-oriented	PPSC	Dummy	*0.214*	*0.428*	0	1
Pay for use of irrigation water	PUIW	Dummy	*0.384*	*0.413*	0	1
Form in which irrigation water is paid	PFIP	Dummy	*1.361*	*0.381*	0	2
Polices favourable for promoting private sector participation	PGPP	Scale	*3.148*	*3.861*	0	10
Extensiveness of private sector participation	PEPP	Scale	*3.266*	*2.184*	0	10
Organised into Water Users Association (WUA)	PWUA	Dummy	*0.318*	*0.426*	0	1
Extensiveness of WUAs participation	PEWA	Scale	*2.048*	*0.176*	0	10

Irrigation water law variables	Acronyms	Type of data	Mean values	Standard Deviation	Range	
					Min	Max
Policies favourable for users participation	PGUP	Scale	*3.648*	*2.481*	0	10
Effect of other polices like fiscal and economic policies	PEOP	Scale	*6.516*	*2.662*	0	10
Water policy links well with water law	PWPL	Scale	*2.018*	*0.748*	0	10

Source: survey data

Table 7. Descriptive statistics: perceptional-based policy institutional and performance variables

Irrigation water law variables	Acronyms	Type of data	Mean values	Standard Deviation	Range	
					Min	Max
Capacity of the administration of irrigation water at scheme level	ACIW	Scale	*6.162*	*2.242*	0	10
Effectiveness of user groups or WUAs in administration of irrigation water	AEWA	Scale	*4.733*	*2.149*	0	10
Private sector participation reduces burden on irrigation water administration and management	APPA	Scale	*5.147*	*1.240*	0	10
Mechanisms of collecting updates and do maintenance of irrigation water at scheme level	AMUM	Dummy	*0.234*	*0.108*	0	1
Adequacy, relevance and reliability of water data in irrigation water management at scheme level	AARR	Scale	*3.624*	*2.813*	0	10
Capacity to effectively administer irrigation water through use of the irrigation water law and policy	ACLP	Scale	*3.162*	*2.198*	0	10

Source: survey data (2012)

Table 8. Perceptional-based administration institutional and performance variables

Informal irrigation water institution variables	Acronyms	Type of data	Mean values	Standard Deviation	Range	
					Min	Max
Clearly defined boundaries to withdraw irrigation water from Common Pool Resources (CPRs)	ICPR	Dummy	*0.314*	*0.238*	0	1
Existing appropriation rules related to the local conditions	IARL	Dummy	*0.421*	*0.162*	0	1
Mechanisms, e.g. constitutions to assist in irrigation water management at scheme level	IMSL	Dummy	*0.204*	*0.191*	0	1
Effectiveness of management mechanisms in water management	IEMM	Scale	*4.184*	*3.005*	0	10
Effectiveness of monitoring conditions and the behaviour of appropriators at scheme level	IEMA	Scale	*3.881*	*2.748*	0	10
Existence of regulation sanctions at scheme level for users who fail to act accordingly	IERS	Dummy	*0.508*	*0.263*	0	1
Existence of rapid access to conflict solving in the low-cost, local setting	IECS	Dummy	*0.381*	*0.024*	0	1
Users challenging the rights of appropriators to create own local-based institutions suited to own local set-up	ICRA	Dummy	*0.215*	*0.138*	0	1
Extent of challenge of the rights of appropriators to create own institution based on diverse local set-ups	IECA	Scale	*3.587*	*2.782*	0	10
Effectiveness of informal institutions to influence the irrigation water law, policy and administration	IOEI	Scale	*4.499*	*1.033*	0	10

Source: survey data (2012)

Table 9. Perceptional-based informal water institution and performance variables.

5.1. Formal institutions

5.1.1. Legal variables

Water rights are mechanisms through which a user can access water for a particular use without jeopardising another user's right [35]. The descriptive statistics reveal that most users

had little or no access to water rights (mean value = 0.37). During the colonial history of Zimbabwe, black indigenous farmers were disadvantaged because they had not applied for water rights [36] and when they applied for water rights, most of the water was committed to rights held by white farmers, which were issued in perpetuity and could not be revoked. Smallholder farmers were also disenfranchised because the legal systems introduced in the colonial and post-colonial states failed to acknowledge traditional water management practices [37]. In addition, [38] also report that the water rights of the indigenous population which predated the settler claims, were disregarded, thus leaving most farmers without water rights. Farmers' rights are found to be unclear/scattered or absent as shown by a mean value of 1.34, skewed towards the worst situation. Lack of clearly defined and well-enforced property rights significantly increase risks [39]. Unclear rights increase risks of farmers mismanaging water resources because they do not have a sense of ownership.

A mean value of 0.31 for the awareness of the existence of water law suggests that most users are not fully aware of the existence of the water law. The "Fast-Track Land Reform Programme" (FTLRP) brought in producers who may not have been aware of the existence of the water law. Human actors have bounded rationality (Simon, 1957) rather than perfect knowledge. Human actors lack complete knowledge to assess their decision alternatives due to their cognitive limitations, time and information constraints [40, 41].

There were weak provisions for conflict-solving within the water law (mean value = 3.64), suggesting that users may seek arbitration from legal courts. However, formal courts tend to nullify the rulings of informal arbitration [41]. This may imply perpetuation of conflict, eventually leading to poor irrigation water management.

The results reveal an irrelevant irrigation water law for current and future users (mean value = 2.41). This result can imply a lack of enforcement of the 1998 Water Act, despite the Act being regarded as technically sound, with a solid base for sustainable and efficient utilisation of water resources. Vital sections of the Act have not been fully enforced; hence, its founding principles are not supported. For example, the Water Fund has collected insufficient revenue to support statutory functions.

In the theory of economics of institutions and economic growth, [42] argued that institutions need continual adaptation in the face of changing environment of technology to promote economic growth, particularly in Zimbabwe where there has been an emergence of new irrigation farmers as a result of the land reform programmes. The results also reveal a weak relationship between irrigation water law and other economic laws (mean value = 4.34) such as environmental and energy laws, suggesting a lack of co-ordination of the laws, hence poor irrigation water management.

The water law provided for private sector participation in irrigation water resources management (mean value = 5.27). This can be explained by the fact that water reforms in Zimbabwe introduced radical changes regarding the participation and representation of users in the management of water. The 1998 Water Act provided a legal basis for the participation of previously excluded water users, namely communal, resettlement and small-scale commercial

farmers. This inclusiveness has encouraged local level participation in water management at sub-catchment council levels.

5.1.2. Policy variables

The descriptive statistics indicate that the project selection criterion was not economic-orientated (mean value = 0.21). In Zimbabwe, challenges exist in prioritisation of the development of water/irrigation projects according to well defined criteria [43] based on proper assessments of irrigation investments and projects, including their financial feasibility.

Generally, the purpose of paying for water use is to ensure sustainability of services, water conservation, and mitigation of damages [44]. However, the results depict non-commitment or non-payment of user fees (mean value = 0.38). Even the creation of the Water Fund embedded in the 1998 Water Act with the objectives of collecting levies, fees, government contributions and other support towards water service provision did not help as financial inflows have been minimal [45]. Similarly, new users are reluctant to pay for water use as water rights had not been paid previously. There is not a culture of paying for commercial use of water by water users [43]. Moreover, many farmers stopped paying for irrigation water after their farms were invaded during the FTLRP [44]. In addition, most farmers in Zimbabwe have refused to pay for water use, arguing that water is a natural resource that comes from "God", and even if they pay, the revenue is not re-invested back into their schemes. In response, many governments have moved away from imposing the full costs upon water users of irrigation for political reasons because farmers resist charges [45].

The findings reveal that payment of water was done on a partial recovery basis (mean = 1.36). This could emanate from political interference in pricing of water in Zimbabwe where politicians, in a bid to retain popularity, aim to keep the price of water as low as possible [43]. Even if users pay for irrigation water, a challenge lies on ensuring that at least part of the water revenue is re-invested in water management so as to improve and make the irrigation water policy an effective tool in irrigation water management [43].

As revealed by the results, the new irrigation policy did not fully provide for private sector participation (mean value = 3.15). After FTLRP, challenges existed in determining respective roles of the private and public sectors in irrigation [43]. The existing gap in roles played by the private and public sectors negatively affect irrigation water management objectives. Moreover, the results indicate poor participation of the private sector in water management issues (mean value = 3.27). As such, the irrigation water policy should provide for effective private sector participation on water management issues.

User groups, or Water Users Associations (WUAs), can play a crucial role in the management of irrigation water resources as most people feel a stronger sense of identity and belongingness. However, the results indicate that fewer farmers are organised into water user groups (mean value -0.32). This could be explained by the fact that it is difficult to identify and classify water user groups from which the representatives are chosen to constitute the sub-catchment. This is basically the challenge in spite of the 1998 Water Act provisions. For instance, the Water Act actually provided for the involvement of the farmers at communal level, however, the

committees that are constituted at a local level hardly function and barely get recognition at catchment council meetings.

The current water policy lacks clear user participation provisions (mean value = 3.65). Regardless of the 1998 Water Act having the provisions for involvement and active representation of water users, the law has been overwhelmed by challenges. A good example is a case where new water users who lack financial resources to travel and attend sub-catchment council meetings, thus inhibiting them to attend the important meetings. In addition, the farmers indicate that other economic policies have an impact on the irrigation water policy (mean value = 6.52). Thus, water policy should clearly define how other policies are related with regards to water management objectives.

A weak relationship is revealed between water policy and water law (mean value = 2.02). After the FTLRP, no water law and/or policy reforms were put in place to address the needs of the new farmers introduced by the FTLRP. Irrigation water policy should link with the irrigation water law, so that the two work together in the management of irrigation water resources.

5.1.3. Administration variables

The surveyed farmers indicate the existence of capacity to manage irrigation water resources management (mean value = 6.61), in the form of users' associations, irrigation scheme constitutions, etc. Farmers indicate that water users groups or WUAs are fairly effective in ensuring effective management of water resources (mean value = 4.73). However, [46] revealed that irrigation schemes were poorly managed due to a lack of well-established organisational and institutional conditions and WUAs were not well organised. In addition, as noted by [36], Irrigation Management Committees formed to improve coordination between irrigators and water management have not been able to take over the management of schemes because of state-applied technical measures.

As revealed by the surveyed farmers, private sector participation presents an opportunity to reduce the burden on irrigation water management (mean value = 5.15). Effective participation can be achieved if supported by administrative issues that accommodate water user groups. Water administration can ensure active participation of private sector in irrigation water resources by creating an active role for the private sector players and by reducing the burden on irrigation water management.

The survey reveals a lack of updates and maintenance mechanisms (mean value = 0.23). When irrigation systems dilapidate, it can lead to poor irrigation water management, for example, through water loss in case of burst pipes. Constant and regular monitoring of irrigation systems is needed. Irrigation schemes need mechanisms of collecting irrigation water updates and doing maintenance of irrigation water. However, where updates and maintenance schedules exist, farmers have indicated they are not adequate, relevant and/or reliable. Lastly a disparity between water administration issues and the water law and policy is revealed (mean value = 3.16). The disparities or lack of co-ordination among the formal institutions affect the effectiveness of water administration to manage water resources.

5.2. Informal institutions

The evolution of institutions and their performance implications are affected strongly by their path-dependency[2] nature. Because of their path-dependent characteristics, institutions are the 'carriers of history, ' reproducing themselves well beyond the time of their usefulness [47, 48]. Since informal institutions play an important role in the incremental way in which institutions evolve, they remain a major source of path dependence [18]. In addition to informal institutions, there are such self-reinforcing mechanisms as network externalities, learning effects, and the historically derived subjective modelling of issues. Since all these mechanisms reinforce the current course of the development path, reversing the course of that path becomes extremely difficult or costly [18]. This is also reiterated in the utility of social theory to address human problems [49], and is concerned with explaining how to improve economic performance, and hence welfare, by comprehending human incentives, preferences, perceptions, beliefs and learning [49]. Table 3 presents the perceptional-based informal irrigation water institutions and performance variables.

As revealed by the CPR studies, it is difficult to implant uniform institutional arrangements from locality to locality and situation to situation as the challenges that they face vary depending on physical and community conditions [50]. While effective institutional arrangements may deviate across settings, the CPR studies have identified common ideologies of long-enduring and self-governed CPR institutions. According to [7, 51], the first design principle associated with sustainable CPR governance institutions is the establishment of clearly delineated boundaries around the resource and resource users.

A mean value of 0.314 was revealed, suggesting clearly defined boundaries to withdraw irrigation water from CPRs clear boundaries not exist. This implies that any benefits the communities produce, by their efforts, will be gained by the other users who would not have contributed to the cause. [7]. However, [52] argues that there is a finite amount of water that must be shared in common over a variety of uses and over geographic areas, based on the fact that water falls in the form of rain, flows and evaporates with no regard to any boundary.

In addition, some CPR studies have identified general principles of long-enduring, self-governed CPR institutions by establishment of clearly delineated boundaries around the resource and resource users [7, 51]. It is therefore important that informal institutions be structured in a way that will ensure CPRs users coordinate their actions to solve supply and demand dilemmas [7, 50, 53, 54]. However, [7, 51, 55] highlights that CPRs exhibit varying degrees of two key characteristics, one of which is the difficulty in excluding users, as such; it will be difficult to exclude other users from accessing water resources, thus leading to free-riding problems or insufficient maintenance of water resources. Nonetheless, there should be effective conditions in place to ensure that water, as a CPR is effectively managed through the use of informal rules.

The informal local rules that are formulated are participatory, implying that the behaviour of all the users in the community or locality must customarily live in harmony with them. In

2 Path dependency means that history does matter: the direction and scope of institutional change cannot be divorced from its early course or past history.

addition, they are rules that govern human behaviour usually at no cost and they basically are enforced by the locals themselves [35]. In some cases, local rights could also be sensitive to the vulnerable, e.g. widows and the poor. Customary local practices and structures can also contain or help avoid conflict. A mean value of 0.421 was revealed, suggesting a lack of such- or fewer local rules. The FTLRP ushered in new water users who needed time to establish their own local rules, given that they take time to evolve. Violations of rules and water use may go unnoticed and unpunished. Existence of informal rules based on local condition means that if the informal codes are violated, punishment may be enforced [7]. On the other hand, however, [56] warns on viewing any particular institutional arrangement as a panacea for solving natural resources (especially CPRs) problems due to heterogeneity and complexity of problems facing different resources, hence, the need for local-based institutions. The local institutions at interplay within a local community regulate the users who have access to the CPRs, the resource units that the authorised participants can make use of at any given time, including who will monitor and administer the rules [55].

Regulation and governing mechanisms, e.g. constitutions at scheme level assist in the management of irrigation water resources. A mean value of 0.204 suggests a lack of these management mechanisms. A study by [57] revealed that often, there was no consensus on rules among farmers and monitoring and management mechanisms were absent. The new beneficiary farmers of the FTLRP were still not aware of the importance of informal management mechanisms. Thus, it is important to ensure the new farmers understand the importance of informal management mechanisms at scheme levels to promote effective irrigation water management. Where informal management mechanisms existed, their effectiveness was crucial to ensure efficient management of water resources. A mean value of 4.184 suggested that these mechanisms were not effective enough. The FTLRP beneficiaries did not have management mechanisms and had not organised themselves into user groups, where they would formulate some management mechanism.

Effectiveness of management mechanisms depends on factors like effectiveness of monitoring conditions, behaviour of appropriators, regulation sanctions, etc. A mean value of 3.881 suggests that monitoring conditions were not effective enough to assist in the management of water. Therefore, there is need to ensure the effective monitoring conditions and the behaviours of the appropriators to ensure all users behave accordingly and promote sustainable water management.

Existence of regulation sanctions can be an effective mechanism of irrigation water management as users who rebel, default and/or fail to behave accordingly can be possibly punished. A mean value of 0.508 was revealed, suggesting some existing regulation sanctions at some schemes. However, existence of regulation sanctions does not denote effective irrigation water management, unless they are effective. It is therefore important to ensure effective local regulation sanctions to ensure irrigation water management issues.

In addition to existence of regulation the sanctions, rapid access mechanisms to conflict solving without following long procedures or protocols can effective in the management of water resources. A mean value of 0.381 suggests non-existence of rapid conflict conflict-solving

mechanisms. Lack of rapid conflict-solving mechanisms in a low-cost and local setting could have an adverse effect on irrigation water management. This encourages local users to by-pass traditional mechanisms in hope of achieving a winner-takes-all decision [35]. However, formal courts seem to have tendencies to overturn informal court decisions, in turn, may exacerbate conflict at local level rather than resolve it. In addition, these channels maybe costly and users may not be able to afford the expensive and lengthy procedures to solve conflicts, as such, may leave some of the conflicts unsolved and this negatively impacts on irrigation water management objectives.

According to the transaction cost theory, functioning of institutions depends on the costliness of enforcement [18]. Users need to create their own cheap set of rules that govern how they manage local water resources. Users will have confidence in their own rules and thus effectively implement them to ensure users behave accordingly. Development and creation of institutions or rules aid to creating more socially acceptable (and so economically acceptable) outcomes [58]. In addition, informal rules also differ from community to community, hence, the need of local, low-cost set of rules for water users. A mean value of 0.215 was revealed, suggesting that users were not in a position to create their own set of rules to govern water management. Institutions are not necessarily or even usually created to be socially efficient; rather, they are created to serve interests of those with bargaining power to create new rules [59]. Furthermore, creation of institutions that so structure the rules and their enforcement as to alter pay-offs induces the cooperative solutions.

Ability to challenge the rights of appropriators to create own institution based on local set-ups promotes effective water management, and depends on the extent of challenge. A mean value of 3.587 suggested the extent of challenging the appropriators' rights was low. Users were weak in challenging the rights of appropriators. As such, users could not create their own effective set of rapid, low cost and locally-based informal institutions. As such, users need to be empowered in creating their own set of rules.

As discussed in section 2.2, pro-informal arrangements scholars are not pushy to support the enforcement of informal institutions, rather opting for combining the new formal and existing informal arrangements in water management. As such, overall relationship and influence of the informal institutions and the formal irrigation institutions becomes important as the former guide the day-to-day management of water resources, yet, the latter tend to over-rule the informal rules. If the formal irrigation institutions are used to govern water management, farmers still have their own set of rules which determine their behaviour in a given context. A mean value of 4.499 suggested a lack of influence of the informal institutions on the formal institutions manage irrigation water management. Nonetheless, the formal institutions draw heavily from the informal institution [59]. Lack of coherence between the informal and formal institutions potentially leads to ineffective water resources management. In addition, users also originate from diverse social communities where a set of rules vary, as such, the formal rules structures should thus consider these differences to achieve irrigation water management objectives.

6. Empirical analysis results

This section presents the empirical results as shown in Table 10 -11.

Independent / explanatory variables	Acronyms	Range	
		Coefficient	*t-ratio*
Access to water rights	LAWR	*0.151***	*2.177*
Format of water rights	LFWR	*0.083****	*1.843*
Existence of irrigation water law	LEWL	*0.728**	*2.683*
Provisions effective for solving conflicts among irrigation water users	LCRM	*0.475****	*1.617*
Water law relevant for users under current and future situation	LRCF	-0.069	-1.189
Water law relationship with other laws to promote water management	LLOL	0.418	*1.238*
Water law provisions to promote private sector participation	LSPS	*0.208**	*3.491*
Constant		**1.641***	3.019
R^2		**0.681**	
Chi-square (χ^2)		**76.521**	
Breusch-Pagan		**63.147**	
****Significant at 1%***	***Significant at 5%***	****Significant at 10%***	

(a)

Independent / explanatory variables	Acronyms	Range	
		Coefficient	*t-ratio*
Project selection criterion is economic orientated	PPSC	*0.098****	*1.653*
Pay for use of irrigation water	PUIW	*-0.079****	*-1.683*
Form in which irrigation water is paid for	PFIP	0.237	1.107
Provisions for promoting private sector participation	PGPP	*0.091****	*1.714*
Extensiveness of private sector participation in irrigation	PEPP	0.087	0.839
Organised into Water Users 'Associations (WUAs)	PWUA	*0.657**	*3.218*
Extensiveness of WUAs 'participation in irrigation water management	PEWA	*-0.181****	*-1.650*
Provisions favourable for users' participation in irrigation	PGUP	*0.128***	*2.052*
Effect of other policies like fiscal policies in water management	PEOP	*-0.121****	*-1.645*
Water policy links well with water law	PWPL	*0.201**	*3.631*

Independent / explanatory variables	Acronyms	Range	
		Coefficient	*t-ratio*
Constant		0.918**	2.241
R^2		**0.702**	
Chi-square (χ^2)		**78.023**	
Breusch-Pagan		**64.818**	
***Significant at 1%**	****Significant at 5%**	*****Significant at 10%**	
(b)			
Independent / explanatory variables	**Acronyms**	**Range**	
		Coefficient	***t-ratio***
Capacity of the administration of irrigation water at scheme level	ACIW	*1.106**	*3.886*
Effectiveness of user groups / WUAs in irrigation water administration	AEWA	*-0.063***	*-1.741*
Private sector participation reduces water management burden	APPA	-0.077	-0.806
Mechanisms of collecting updates and carry-out maintenance works	AMUM	0.093	0.904
Adequacy, relevant and reliability of water	AARR	0.043	0.998
Capacity to effectively administer irrigation water w.r.t law and policy	ACLP	-0.012	-0.363
Constant		**1.248****	2.064
R^2		**0.791**	
Chi-square (χ^2)		**73.947**	
Breusch-Pagan		**67.184**	
***Significant at 1%**	****Significant at 5%**	*****Significant at 10%**	
(c)			

Source: survey data (2012)

Table 10. (a) Empirical results on the nature of institution–performance linkages: water law institutions; (b) Empirical results on the institution-performance linkages: water policy institutions; (c) Empirical results on the nature of institution–performance linkages: water administration institutions

Independent / explanatory variables	Acronyms	Range	
		Coefficient	*t-ratio*
Clearly defined boundaries to withdraw irrigation water from CPRs	ICPR	0.167	0.388
Existing appropriation rules related to the local conditions	IARL	*0.186***	*2.238*
Existence of mechanisms, e.g. constitutions	IMSL	*0.783***	*2.724*

Independent / explanatory variables	Acronyms	Range	
		Coefficient	*t-ratio*
Effectiveness of management mechanisms in water management	IEMM	*0.319**	*4.543*
Effectiveness of monitoring, conditions & behaviour of appropriators	IEMA	*-0.163****	*-1.656*
Existence of regulation sanctions at scheme level	IERS	*0.689**	*4.891*
Existence of rapid access to conflict-solving	IECS	***1.418****	***2.860***
Users against rights of appropriators to create local-based institutions	ICRA	0.278	1.019
Effectiveness of users against rights of appropriators	IECA	0.181	1.033
Effectiveness of informal institutions on law, policy & administration	IOEI	0.127	1.203
Constant		**1.613****	**2.186**
R^2		**0.817**	
Chi-square (χ^2)		**76.377**	
Breusch-Pagan		**69.691**	
****Significant at 1%***	***Significant at 5%***	****Significant at 10%***	

Source: survey data

Table 11. Empirical results: informal institution-performance linkages

6.1. Formal institutions

6.1.1. Legal variables

A positive *regression coefficient of 0.151* at the 5% significance level suggests that access to irrigation water rights significantly strengthens the irrigation water law in the management of water resources. Private property [39, 60] Coase, 1960), just like water rights, is the most efficient system of land use. Similarly, North & Thomas (1977) support such an inference by arguing that property rights provide incentives to encourage development and cultivation.

A positive relationship between the water law and the format of water rights was revealed (*regression coefficient of 0.083)* at the 10% significance level. Unclear/scattered or lack of format rights, for example, may result in the water law failing to effectively manage irrigation water which can increase risks and transaction costs [39].

In his critique of instrumental rationality to further support the importance of institutions, [61] argued that the human mind fails to deliberately and analytically process all available information to choose an action that maximises utility. The study revealed that knowledge of the existence of the water law positively and significantly strengthens the effectiveness of the

irrigation water law (*regression coefficient of 0.728)* at the 1% significance level. Lack of knowledge implies individuals have incomplete information and limited capacity to process information [59], thus it is necessary to educate farmers about the water law and its existence. Farmers may also choose an alternative that maximises their personal preferences and make decisions that lead to efficient outcomes [62].

The research findings reveal that if the water law provides for conflict resolution, it positively and significantly strengthens the effectiveness of the water law in the management of water resources. This is explained by a *regression coefficient of 0.475* at the 10% significance level. Effective conflict-solving provisions within the water law can ensure that certain protocols are followed without bias towards the parts concerned.

A positive relationship, (*regression coefficient of 0.208)* at the 1% significance level implies that provisions for private sector participation significantly strengthen the irrigation water law. Clear provisions that allow effective private sector participation in agricultural water management can lead to effective water management. Water law should provide for private sector participation to be an effective institution in managing agricultural water.

6.1.2. Policy variables

The study findings revealed that the irrigation water policy is positively related to the criteria on how irrigation projects are selected (*regression coefficient of 0.098 at the 10% significance level)*. This suggests that project selection criterion significantly strengthens the effectiveness of the water policy to manage irrigation water resources. For example, if the irrigation water policy clearly defines selection of projects based on economic growth and development objectives, the water policy will become an efficient and effective water management institution.

The results of this study revealed a negative relationship between the effectiveness of the irrigation water policy and users paying for irrigation water, as shown by *regression coefficient of -0.079* at the 10% significance level. The implication is that if the irrigation water policy has clearly specified clauses on users pay principles, then it can significantly lead to effective irrigation water management. The negative relationship implies that failure of farmers to pay for water use negatively affects the effectiveness of the irrigation water policy to manage agricultural water, hence, can lead to poor irrigation water management.

There is a positive relationship between the effectiveness of the irrigation water policy and availability of provisions promoting private sector participation (*regression coefficient of 0.091)* at the 10% significance level. Unfavourable provisions may discourage private sector participation and in the long-run, may lead to ineffectiveness of the water law to manage water resources.

Organisation of farmers into Water User Associations (WUAs) positively and significantly strengthens the effectiveness of the irrigation water policy to manage irrigation water (*regression coefficient of* 0.657) at the 1% significance level. As such, favourable clauses within the irrigation water policy promoting and supporting users to organise themselves into users

groups has the potential of sustaining efficient irrigation water use as WUAs may have the opportunity to enforce the use of restricted rules and regulations.

The results revealed a negative relationship *(regression coefficient of -0.181 at the 10% significance level)* between the effectiveness of the water policy and the extent to which WUAs/user groups participate in water management. The negative relationship revealed in this study implies that the WUAs have not been effective in irrigation water management. If the irrigation water policy promotes organisation of the farmers into user groups and/or WUAs, and allows for their extensive participation, it can lead to an effective and sustained irrigation water management. In addition, a positive *regression coefficient of 0.128* at the 5% significance level implies that policy provisions that favour farmers' participation leads to effective irrigation water management.

The results of this study revealed a negative and significant relationship between the irrigation water policy and its relationship with other economic policies *(regression coefficient of -0.121 at the 10% significance level)*. Lack of enabling policies and effective institutional frameworks are major contributors towards poor management and utilisation of irrigation water [3]. Moreover, the linkage between the irrigation water- policy and law revealed a positive and significant *regression coefficient of 0.201* at the 1% significance level. If the water law relates well to the water policy, it will lead to an effective irrigation water policy that will ensure efficient and sustained water resources management.

6.1.3. Administration variables

The results revealed a positive relationship between overall irrigation water administration and administration capacity at scheme level (*regression coefficient of 1.106)* at the 1% significance level). If administration capacity exists at irrigation schemes, it strengthens the overall irrigation water administration as a water management institution. Thus, capacitating farmers with administration roles, e.g. promoting organisation of farmers WUAs at scheme level can lead to effective irrigation water management.

The results revealed a negative relationship between overall irrigation water administration and the effectiveness of user groups or WUAs in the administration of irrigation water (*regression coefficient of -0.063* at the 10% significance level). Thus, administration conditions should promote effectiveness of users to manage water resources. WUAs, for example can formulate farm plans for the area, market local produce, distribute farm inputs, formulate rules for the maintenance of irrigation infrastructure, devise procedures for the distribution of water, and impose and collect irrigation fees (Samad, 2005). The observed negative relationship implies that currently, water users are not effective in the management of water resources.

6.2. Informal institutions

According to [5], a series of institutional arrangements have been presented as panaceas to improve water management: strong government agencies, user organisations, and water markets. This is based on the fact that it is difficult to transplant institutions from one context

to the other due to diversified and different local situations. As such, this paper also analysed how significant some of these arrangements are with regards to irrigation water management.

Informal irrigation water institution can be an effective water management tool if local appropriation rules related to local conditions exist. [63] argues that people will co-operate for their common good without provision of external (state) coercion. A positive *coefficient of 0.186 at* the 5% level was revealed between the effectiveness of informal irrigation institution and the existence of localised appropriation rules. An increase by one unit point in the explanatory variable increases the effectiveness of the informal institution in managing water resources. The significant relationship suggests that creating locally-based rules makes informal irrigation institution effective in water management. Institutions contain an element of predictability as institutionalised rules and norms hold a certain level of stability [64]. In addition, as institutions change, societies adjust themselves accordingly to adapt to the changes [30, 65].

Localised appropriation rules ensure that users behave according to defined rules and regulations, failure of which punishments will be effected upon the offenders as may be defined by the rules. However, these appropriation rules or conditions need to be strongly monitored to promote effective water management. This has been revealed by a *coefficient of -0.163* at the 10% significance level. A one unit point increase in the explanatory variable results in a decrease by 0.163 in the effectiveness of the informal institutions in managing irrigation water if the local rules are not monitored effectively. This implies that the informal institutions become effective water management institution if the created local rules are effectively monitored. Effective rules encourage members to co-operate towards a group strategy because they provide certainty about expected actions of others [63, 66].

Some management mechanism, e.g. constitutions, can be effective tools of implementing and monitoring localised appropriation rules. In light of this, the analysed empirical results revealed a positive *regression coefficient 0.783* at the 5% level. The relationship implies that a one-point increase in the explanatory variable leads to a 0.783 increase in the effectiveness of the informal institutions in managing irrigation water through effective constitutions. Management mechanisms ensure localised rules are effectively implemented. The relationship also suggests that the informal rules become effective water management tools if regulation mechanisms are existent and effective. Effectiveness of management mechanisms significantly strengthens the effectiveness of informal rules in managing water resources. This has been revealed by a *regression coefficient of 0.319* at the 1% significance level. A one unit increase in the effectiveness of management mechanisms increases the effectiveness of the informal institutions by 0.319. The results suggest that the more effective the management mechanism, the more effective the informal rules.

Effectiveness of management mechanisms can be explained by existence of regulation sanctions. Effectiveness in internal governance is needed for the effective application of community rules [11]. A significant relationship has been revealed between effectiveness of informal irrigation institutions and existence of regulation sanctions, as shown by a *coefficient of 0.689* at the 1% level. Existence of regulation sanctions increases the effectiveness of the informal institutions by 0.689 given a one unit point increase in the explanatory variable.

Existence of regulation sanctions ensures implementation of informal rules as an effective tool in managing water resources.

Existence of rapid access to conflict-solving in a low-cost and local setting significantly strengthens the effectiveness of formal rules to manage water resources. A *coefficient of 1.418* at the 1% significance level suggests that a one-point increase in the existence of rapid access to conflict-solving results in a 1.148 increase in the effectiveness of the informal water institutions. This suggests that farmers simply solve their conflicts at scheme level than attempting to follow the formal channels to courts, which may take long to solve such conflicts. However, formal courts tend to nullify the rulings of informal arbitration [35]. This may imply perpetuation of conflict, eventually leading to poor irrigation water management.

7. Conclusions

The main thrust of institutional change within the irrigation water sector is to enhance the capabilities and increase the readiness of policymakers to solve the current and future agricultural water resources challenges with regards to their development and management. Given this thrust, the major goals of institutional initiatives in the water sector include: treating water as an economic good where prices are attached to use of irrigation water; inculcating a payment culture; and promoting effective, sustainable, decentralized decision structures.

Institutional reform of the magnitude required to achieve these goals is a daunting challenge in Zimbabwe, particularly with the ineffective, irrelevant and poorly functioning irrigation water institutions. The issue of how to achieve irrigation water institutional change within the constraints and opportunities of political economy continue to remain elusive to both researchers and policymakers as most smallholder irrigation farmers still remain disadvantaged with regards to irrigation water resources development and management.

It is important to note that institutions typically change incrementally rather than in discontinuous fashion [11]. Even if some change is anticipated by a new policy or law, it is fairly common that the society adopts it slowly. The main reason for this incremental change is that there are many institutional elements which are interconnected, and a change gets cushioned by many other established institutional elements. Nonetheless, the important issue for policy makers is to ensure recommended polices are put on the table for consideration, especially in Zimbabwe where policy changes are imminent due to new users in the irrigation sector.

With regards to informal institutions, there were no clear boundaries to withdraw water resources from the CPRs, compounded by lack of local appropriation rules to regulate water management. Some management mechanisms did not exist at schemes, and where they existed, they not effective in managing water resources. Monitoring conditions and the behaviour of appropriators at scheme levels was not effective, owing to lack of effective management mechanisms and regulation sanctions. Rapid conflict-solving mechanisms were non-existent at schemes. Users had little capacity to challenge the rights of appropriators to create own local rules and the extent to which they challenge was not effective. The informal

institutions were not effective enough to influence how the formal institutions manage water resources owing to the fact that the informal institutions are ignored and neglected, yet they guide the day-to-day water management activities. They are not regarded as instruments for effective irrigation water management, hence the lack of influence of the informal institutions on formal institutions. Lastly, the paper also noted the role and significance of the informal water management institutions in the effective management of water resources.

8. Policy recommendations

This research indicates that attempts to reform the water sector with the view to improve productive uses of water in rural areas, must confront the historical legacy of inequalities of access to land and water, which has continued under the FTLRP. One way of attaining improvement is to promote wide-scale participation of all stakeholders in the debate about the water reform over a long period of time. This will also entail seeking policy suggestions from all stakeholders, particularly the poor, on how water policy can be improved. Such an approach will break the stranglehold that government and donors have on the water policy-making process. In addition, issuance of water permits to water users will promote sustainable and efficient use of irrigation water resources. Water rights give farmers the sense of ownership and sense of belonging to water user groups which provides incentive to use water in a sustainable and efficient manner. The irrigation water law should provide clear provisions for the issuance of water rights.

In the Zimbabwean context, this study suggests that water reform must be linked, in innovative ways to the FTLRP, which aimed at providing access to productive land to rural people for livelihood improvement. It is the combined access to productive land and water, that water can be productively used to alleviate poverty and contribute to economic growth. Although access to fertile land is crucial to productive uses of water, new water users need access to a broad portfolio of other assets central to the productive use of water such as functioning irrigation technology and infrastructure. A new water policy should focus the development, provision and maintenance of relevant low-cost irrigation technology to communal farmers.

Water policy should provide greater local control of water charges. Revenue raised can be used to fund water development projects and maintain irrigation infrastructure within communal irrigation schemes. A policy that inculcates a culture of paying for commercial irrigation water and ensuring water revenue is re-invested in water resources development and management is needed along with the establishment of a water pricing structure that is consistent with cost and social efficiency.

There is a need to strengthen WUAs so these institutions can undertake the complex tasks of financial management and technical support to irrigation communities. These capacities are weak in most WUAs. Government can provide education to enhance local administrative, managerial, and financial capacities of participants. Water administration should encourage better coordination between public-public and public-private sectors. In areas where there is inadequate local revenue, government, private sector, NGOs and other

development agencies can fund water development and the functioning of decentralised institutions of water management. There is need for information dissemination campaigns where the regulation of water users is undertaken.

Interventions to strengthen the capacity of the informal systems in managing water resources should be formulated and implemented effectively. This is because the formal institutions draw heavily from the informal institutions if they are to effectively work. Some local arrangements such as one-to-one conflict resolution mechanisms are more efficient, more cost-effective, longer-lasting and more widely accepted among local water users than most top-down state-driven institutions. When considering formal state-based institutions, water users should not think that they are a panacea to all water management challenges. In this regard, local informal water institutions should not be discarded as primitive and obsolete tools. Local water management arrangements need to be given time to evolve, with limited interference from external agencies, as they seek to address emerging water management imperatives especially in an environment that has been overwhelmed by new users in the irrigation sector.

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