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Water Users Associations in Tanzania: Local Governance for Whom?

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Abstract: In order to implement Integrated Water Resources Management (IWRM) according to good practice, governments and development agencies have promoted the setting-up of Water Users Associations (WUAs) as a broadly applicable model for water management at the local level. WUAs are promoted as key to the rolling out of IWRM principles through a participative process. Using intensive qualitative data, this paper discusses Tanzanian WUAs in light of the Regulatory Framework within which they operate. I argue that although the government's objectives are to achieve an equitable and sustainable allocation of water resources, the formalisation of water allocation has led to the exclusion of specific water users. This paper focuses on the Great Ruaha River Catchment (GRRC), where water scarcity has led to competition between investors and small-scale water users. The GRRC is an environment in which formal and informal practices overlap, due to legal pluralism and the incremental implementation of water governance frameworks. This study calls for a reassessment of the role of WUAs in Tanzania. There is a clear gap between the theoretical clarity of tasks handed to WUAs (particularly their role in formalising access to water), and the messiness of everyday practice.

Keywords: Water Users Association; Tanzania; Integrated Water Resources Management; regulatory water management; water allocation

1. Infrastructural Modernisation and Formalisation of Water Access

Across the world, the wellbeing of societies depends heavily upon the ability to harness water as a productive resource. Concerns over whether there is sufficient quantity and quality of water resources to meet the needs of society have grown and entered the realm of uncertainty due to climate change and increasing demand for this resource. This has particularly been the case for sub-Saharan African countries [1]. Rapid population growth and urbanisation in sub-Saharan Africa—where climate variability is high—increases the need to think carefully about water challenges. East African countries' development goals—including Tanzania's—may indeed be jeopardised by water challenges [2,3] and threats to biodiversity. The loss of biodiversity triggered by depleted water resources would affect ecosystem services stemming from rivers and the country's national economy. Both environmental tourism and most of the Tanzanian population's livelihoods (directly dependent on agricultural production) indeed rely on healthy ecosystems [4].

Though finite, water is essential to enable the development ambitions of Tanzania. With its plans to unlock its development potential particularly through the agricultural sector, Tanzania has been intensifying the use of its resources to increase food production [5,6]. Tanzania has developed numerous irrigation development programmes [7–10], and is counting on foreign direct investment (channelled through the Tanzania Investment Centre) to support the development of the agricultural sector, in particular the development of modern irrigation systems for sustained growth, poverty reduction and rural development [11].

Historically, the modernisation of Tanzania's agricultural sector has been led by large government investments in modern irrigation infrastructure, mainly National Agricultural Cooperation (NAFCO) farms. From the 1990s, these farms have gradually become privatised through foreign direct investment. State-controlled development for the modernisation of irrigation has successfully depoliticised irrigation interventions, backgrounding that in fact, 90% of farm produce results from traditional agriculture (non-modernised) [12].

Despite not knowing what water resources are available [13] (p. 2135), Tanzania is aligned with other sub-Saharan countries in wanting to join a new African Green Revolution, drawing from the untapped potential of irrigation. The prevailing view is that with the help of the private sector, the right technologies and institutions will allow for this growth [13,14]. Since colonial times, Tanzania has maintained its dominant narrative, which encourages the transformation of small-scale agriculture (see [15,16]). Current policies and programmes which support this vision are the Tanzania Development Vision 2025 [17]; the Agricultural Sector Development Programme of 2006 [7]; Kilimo Kwanza in 2009 [8]; the Southern Agricultural Growth Corridor of 2010 [10]; and Big Results Now (2012) [18]. Despite contested access to resources, and complex plural realities [19], these policies encourage the transition of the smallholder farmer to commercial production and investments, including through the modernisation of customary institutions [20]. Tanzania's National Irrigation Policy of 2010 [20] goes as far as saying that traditional irrigation is inefficient and inadequate, and that irrigation schemes need to improve both infrastructure and management with the help of the private sector, non-governmental organisations (NGOs), or faith-based organisations.

The state's ambition to control modern agricultural development (large-scale and expensive) leaves no space to question whether farmer-led developments (incremental and adaptive) stemming from the numerous smallholder farmers may be a better approach to address food production [21]. Despite possible alternatives to agricultural development, Tanzania's decision-makers have integrated a neo-colonial approach to development, whereby (international) experts have been able to keep agricultural issues within the engineering paradigm opened in colonial times, suggesting solutions within their realm of capabilities [12]. Scott referred to this faith in science and technology for development as 'high modernism' [22]. This approach discredits forms of knowledge which are not 'expert'-led [22]: As mentioned above, the government of Tanzania and agribusiness generally view traditional irrigation and furrow systems as wasteful [8]. With a focus on water-saving technologies and water use efficiency, canal lining and drip irrigation technology have been encouraged under the banner of 'more crop per drop', emphasising the underlying idea of increased economic output per drop of water. But who, within and outside of Tanzania, is benefiting from this economic output?

Mosse [23] has argued that water access and control is shaped by institutional configurations that reflect dominant narratives. It is the unequal opportunity for bargaining that allows one narrative to take over another [24]. De Bont et al. [11] have demonstrated the power of narratives by analysing how they have been used to reallocate scarce resources from small farmers to agribusinesses in Tanzania. Scoones et al. [25] identify the narrative of 'efficiency' in strategically shifting water allocation, whilst Mehta [26] explains how 'scarcity' is used in different ways to resolve competing uses of water (physical scarcity, economic scarcity, adaptive capacity and sociopolitical scarcity). Building on this knowledge, Harrison and Mdee [27] reveal how legislative frameworks based upon formalisation have inadequately responded to water allocation considerations within Tanzania. Indeed, the regulatory approach to water allocation leads to a prioritisation of users [28]: This paper shows how certain water users are privileged, whilst others are rendered illegal by this bureaucratic process.

Several voices have emerged, questioning irrigation development as imagined by the Tanzanian government in its policies: Firstly, in opposition to the engineering paradigm, several authors [11,29,30] have argued that furrow systems are not as wasteful as has been suggested, since the upstream percolations allow for dry water savings downstream through the re-emergence of the water in downstream springs. Additionally, the findings from a major study in the area state that "smallholder farmers tend to be more water use efficient that the large NAFCO farms. This is primarily because

their access to water is often constrained, so that they have no choice but to be more careful with their 'supply'" [31] (p. 38). Moreover, the report states that the productivity of rice per unit of water is not lower than in the NAFCO farms. Woodhouse et al. [21] therefore call for a re-appraisal of small-scale producers' roles and techniques for irrigation initiatives in sub-Saharan Africa, arguing, inter alia, that smallholder farmers are playing a substantial role in irrigation development, without (major) external influence, and with important implications for rural development. Secondly, the model of public-private partnership (PPP) is criticised from various angles, as it raises a range of questions concerning the economic and social trade-offs of water [32]. The alliance of the nation-state with large businesses may increase water scarcity for smaller users, who see their entitlements to water reduced [33]. Tanzania seeks to remediate this issue by formalising access to water. However, authors have raised concerns over this point, as customary water users are at risk of expropriation from land and water if they do not formalise their access to water [24]. This task is a difficult one, as much land is subject to negotiation (public, state-owned, or customary), and as a result, the formalisation of rights has impeded access for customary users [13]. Water scarcity is therefore political, and competing uses must be resolved, considering that some users may not be able to articulate their needs [13]. Van Koppen et al. [34] have recently assessed that IWRM in Tanzania has to date mostly benefited large commercial farms, and hindered smallholder farmers. The public sector must therefore reflect on how to shape the nature of the supporting environment for private investments in irrigation, including playing a role in balancing access to resources [13].

2. The Case of the Great Ruaha River Catchment

The case of the Great Ruaha River Catchment (GRRC) in the Southern Highlands of Tanzania is a suitable example to discuss the governance of water used for agricultural purposes, within a catchment closed (to additional water withdrawal) in the dry season. Since 1993, the Great Ruaha River has stopped flowing during varying periods of the dry season, rendering the river seasonal. The Ruaha National Park and the Tanzania Electric Supply Company raised immediate concerns due to the reduced supply for animals in the park, and hydroelectric supply for the two downstream dams, namely Mtera and Kidatu. Electricity supplies to Dar es Salaam and Zanzibar had to be rationed by 1994 [35]. The electric supply company, the national park, and researchers based in Dar es Salaam blamed immigrant livestock keepers for desiccating the Usangu wetland that provides flow to the Great Ruaha river [35]. This narrative has been strongly contested since, although the exact reasons for the change in the Great Ruaha river flows are still debated [35,36]. The reason which has been most supported by scientific documentation is the dry season abstractions for irrigation of the rivers leading to the Usangu wetland [35,37,38]. Today, the water scarcity issue facing the GRRC—also known as the 'bread-basket of Tanzania'—is tackled by the principles of Integrated Water Resources Management (IWRM).

The evaluation of water governance processes within this agricultural area of high importance provides insights on the implementation and outcomes of the IWRM framework. Water allocation has been discussed in Tanzania before (see [39–41]), where policy and implementation were shown to be incoherent, due to a lack of implementation capacity and a heavy reliance on donors and NGOs to co-produce public goods [41]. The concept of 'isomorphic mimicry' is useful in describing the current situation whereby Tanzanian legislation, policies and institutions mimic both the shape and the appearance of best practice, but in fact do not play out as designed (for the development and application of this concept, see [42–44]). The specific role of Water Users Associations (WUAs) in shaping water allocation, however, still lacks analysis, particularly in a dynamic environment such as the Great Ruaha River Catchment. Suffering from seasonal physical water scarcity resulting in competition between investors and small-scale water users (socio-political scarcity), the GRRC is also an environment in which formal and informal practices overlap, due to legal pluralism and an incremental implementation of water governance frameworks. These water governance issues are

influenced by the plural legal, institutional and infrastructural landscapes typically found in previously colonised territories.

Indeed, although today the system of access and use of water resources in the GRRC is formalised by the Tanzania National Water Policy of 2002 [45] and the Water Act of 2009 [46], following the principles of Integrated Water Resources Management, water resources management was governed by a customary system in the pre-colonial period [47–51]. It is the German and British settlers who formalised water law, vesting it in the colonial government [52]. At independence, the Tanzanian government upheld this principle, by vesting all water resources in the United Republic in 1974 [52]. From 1981, the central government divided the management of water resources into nine basins, headed by Basin Water Boards and Water Offices. In reality, customary approaches to water management continued to evolve in parallel to the colonial and State-initiated reforms [53].

Within this plural waterscape, McCartney et al. [31] argue that the formal water rights system currently in place (based upon the measured availability of water) is inappropriate for demand management. This is due to the unsuitability of a water rights and fees system in this context: Compliance is impossible with the current monitoring capacity of the basin board, and price incentives are failing to regulate water use [31]. This situation has resulted in a double standard for water allocation, where informal practices prevail at the local level, whilst formalities are followed at regional levels. WUAs, as participative bodies attached to the regional basin authority, struggle between their regulatory role and their community advocates roles. Consequentially, initiatives to secure water access trespass WUAs to reach higher basin authorities.

3. Formalisation of Water Access through Water Users Associations?

Formalisation of access is gradually taking place in the GRRC, and responsibilities are given to the Water Users Associations to facilitate its implementation. WUAs are designed as the lowest participative organisations for water resources management within defined basins. They cover segments of watersheds, and are broadly responsible for water conservation activities, conflict management over water issues, and water allocation to irrigators through a permitting system. The Water Resources Management Act of 2009 allows WUAs to 'acquire and operate a permit' [46] (80.1), and to have a say during the permit distribution process managed by the basin authority. Furthermore, WUAs must theoretically check that water users—including irrigation schemes—abstract water within the frame of the allocated water permit. The state has a binary approach to the classification of water abstraction types: Various methods of abstraction are categorised as legal or illegal. Access to water is legal when holding a permit, and illegal in the absence of a permit. Any type of entity can hold a permit (e.g., a registered business, a registered cooperative, an individual). There are two components of a water permit: The holding of the permit, and the volume right (within a defined time frame counted in years and defined seasonally by months). This means that the permitting authority must have an idea of how much volume can be allocated at what time of the year, as well as being able to monitor that the abstraction is in accordance with the permit. In theory, and according to the Water Resources Management Act of 2009 [46], the WUA should be the entity advising the basin authority on these tasks, as a close watcher of daily abstractions.

Since 2002, Tanzania's Water Policy [45] allows for the following instruments to be used for the management of its water resources, and the implementation of its policy:

1. Technological instruments, such as abstraction gates, flow metering and cleaner production technologies.
2. Economic instruments, such as water pricing, charges, penalties, incentives, water conservation and allocation.
3. Administrative instruments, such as information management and monitoring systems, water resource plans, models, decision support systems and guidelines.

4. Legal instruments, such as restrictions and prohibitions imposed by regulators and government (licences for abstractions, discharge permits, codes, standards, environmental impact assessments).
5. Regulatory instruments, such as management structures and procedures, the application and granting of permits, water rights prioritisation systems, standards and control for abstractions, reducing water use and waste loads, control of discharges and standards of water for specific uses.
6. Participatory instruments, such as sensitisation, community education, consultations and discussions.

These instruments form a regulatory model of water resources management: Statutory control is used for the allocation of water through a system of permitting abstractions. A legal permission is thus required from a statutory authority, defining the terms of abstraction of water. The decision of this authority is based on current uses (through the monitoring of water flow and abstraction), and the public interest. It is through application and annual use fees that the basin authority funds its monitoring, enforcement and planning activities [54]. Formal water rights are obtained by paying a one-off administration charge to the basin authority, who in exchange gives a written document that grants a legal entitlement to the water user, which specifies the amount of water that can be abstracted, for specific purposes and under conditions of time [55]. In addition, the grantee pays an annual flat rate and an annual fee proportionate to the average annual volume of water being used [31,55]. The basin authority does not guarantee the availability of the volume of water allowed to be abstracted.

In practice however, the volumetric-based water fee is difficult to implement, due to the incapacity of the basin to monitor abstraction intakes. Indeed, abstraction from unimproved intakes is difficult to measure due to haphazard infrastructure. Moreover, the basin authority does not have the financial capacity to monitor all abstraction points, even those which are easy to measure, such as improved intakes. In some cases—and particularly with unimproved irrigation schemes—a yearly flat rate applies, with a cap on the maximum abstraction of discharge. Above the cap, a volumetric fee is applied [56]. Without any water measuring devices, this system is close to impossible to implement.

The basin authority is hoping to counteract its lack of capacity by using participatory instruments. These participatory instruments possess the double advantage of raising awareness about regulatory controls, while also involving stakeholders in the process of decision making and the implementation of the water policy. The formation of WUAs has therefore been a key development aiming at increasing participation: They are used as two-way information platforms between water users and the regulatory authority [54].

This paper therefore outlines how water related policies—particularly the formal regulatory framework—are played out in practice by WUAs, in a changing agricultural landscape. The Section 1 of the results focuses on the Mbarali sub-catchment (visible in Figure 1); whilst the Section 2 of the results focuses on the Ndembera sub-catchment, visible in Figure 1.

The analysis of this qualitative data shows a risk of increasing inequities by formalising water rights. Indeed, based on the role of WUAs in the formalisation of rights, there is a clear gap between the theoretical clarity of this task, and the messiness of everyday practice. This paper therefore concludes that in their current form, WUAs are unable to undertake the role of monitoring formal water rights.

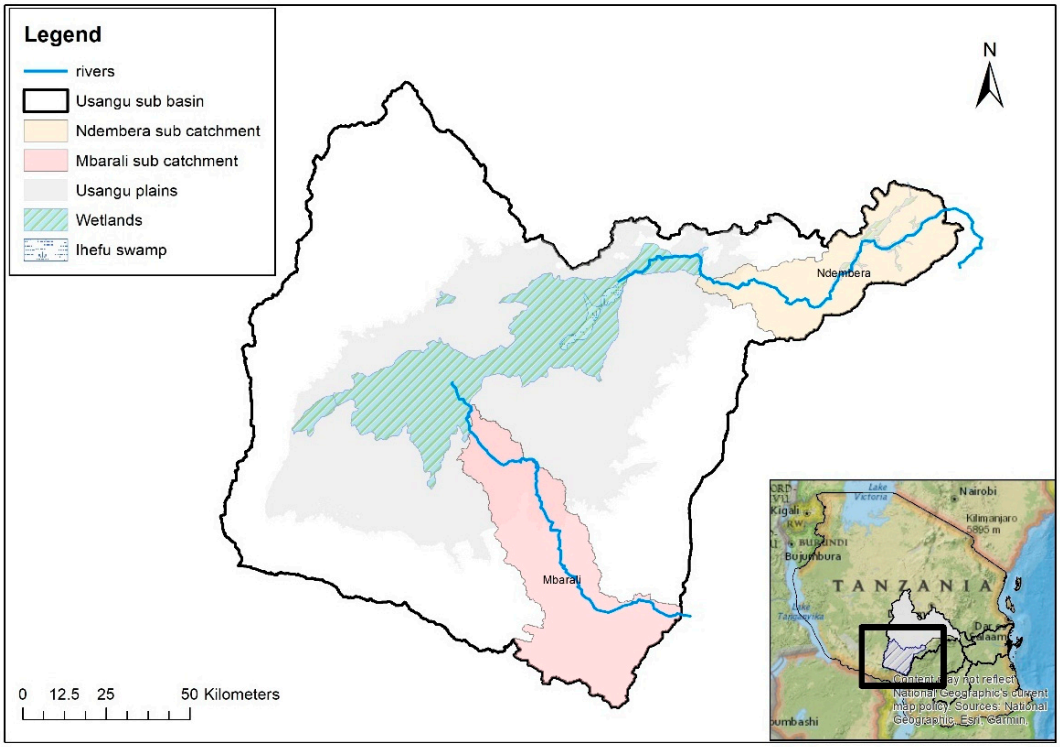

Figure 1. Mbarali and Ndembera rivers within the Usangu sub-basin, part of the Great Ruaha River Catchment (GRRC). Source: Produced by the author.

4. Methods

This paper is based on my doctoral work investigating Water Users Associations (WUAs) over the period 2015–2019. The initiative to assess the functionalities of WUAs stemmed from the United Kingdom branch of the World Wide Fund for Nature (WWF-UK), who have been supporting their setting-up and follow-up in the Ndembera sub-catchment and subsequently the Mbarali sub-catchment since the early 2000s. With a base in Iringa and Rujewa at the WWF's field offices, I however undertook qualitative data collection independently. The data was collected over several time periods: August 2015, March 2016, May to September 2016, April–May 2017 and finally April–May 2018. The study used intensive qualitative data, based on diary note keeping of the shadowing and participant observation of a range of stakeholders based in the Great Ruaha River Catchment (GRRC). The study furthermore bases its findings upon 86 semi-structured interviews ranging between 15 min to 4 h, and including several repeat interviews with key informants (e.g., WUA leadership, district facilitators, basin community development staff and hydrologists). Interviewees were selected based on the following criteria: Range of water user types (e.g., formalised irrigators, illegal water users, pastoralists); institutionalised water stakeholders (e.g., WUAs, water permit holders, the energy parastatal Tanzania Electric Supply Company Limited (TANESCO) running the downstream dam); government bodies and parastatals responsible for water issues (e.g., Rufiji Basin Water Board; Mbarali district officers; Zonal Irrigation Unit); international funders of water-related programs in the catchment (e.g., WWF, United Kingdom Department for International Development (DFID)).

Several respondents were selected from each key stakeholder group, including several people from each organisation (for example the Chairman, the Secretary, and a lay member of each WUA). Finally, seven focus groups and three transect walks were undertaken over the study period.

5. Results

5.1. Permitting Failures in the Mbarali Sub-Catchment

Two WUAs are taken as case studies for the assessment of how permitting, as part of the regulatory framework, is played out in practice through the participative instrument of the basin authority.

5.1.1. The Case of an Upstream WUA

In the early 2000s, following the setup of an upstream WUA by an international NGO, water fees were collected by the WUA and brought to the basin authority (located a full day of public transportation away). The WUA soon ceased collecting fees, as it lacked recognition through a form of compensation (it was expecting the basin authority would cover travel expenses, for example). Permitting, as well as fee collection, is now undertaken directly by the basin office. However, and as noted previously, it is practically very difficult to monitor unimproved infrastructures, as intakes change shape and form, sometimes daily. In addition to irrigation schemes intakes, there are other types of irrigation methods, such as the use of pipes (directing water through gravitation), pumps in the rivers, and a local practice called bottom-valley cultivation (locally known as *vinyungu*). The basin officers are mostly not involved with regulating the irrigation pipes, and do not undertake spot checks for bottom-valley cultivation.

At the scale of this upstream WUA, most of the monitoring thus takes the form of conflict resolution when downstream users or irrigation scheme tail-enders complain about a lack of water. Beyond this scale, there is no real management of up/down stream negotiation and agreements, as no umbrella WUA has been constituted for this sub-catchment (Mbarali). Figure 2 points to the various irrigation methods used in the upstream areas of the sub-catchment, and their status in terms of being permitted or not. The use of the term 'unpermitted' literally signifies not permitted/not allowed. As customary rights are officially recognised at the same value as formal law rights, having unpermitted abstraction should not be deemed illegal. However, the basin authority gave five years to customary water users to officialise their water abstraction into permits, subsequently rendering any unpermitted water use illegal. The term 'unpermitted', thus today in practice signifies 'illegal'. It is clear from Figure 2 that the permitting system is not applied uniformly across the different water-use types. After more than a decade of WUA activity in the upstream areas of the sub-catchment, the practical application of the regulatory framework through permitting is still failing.

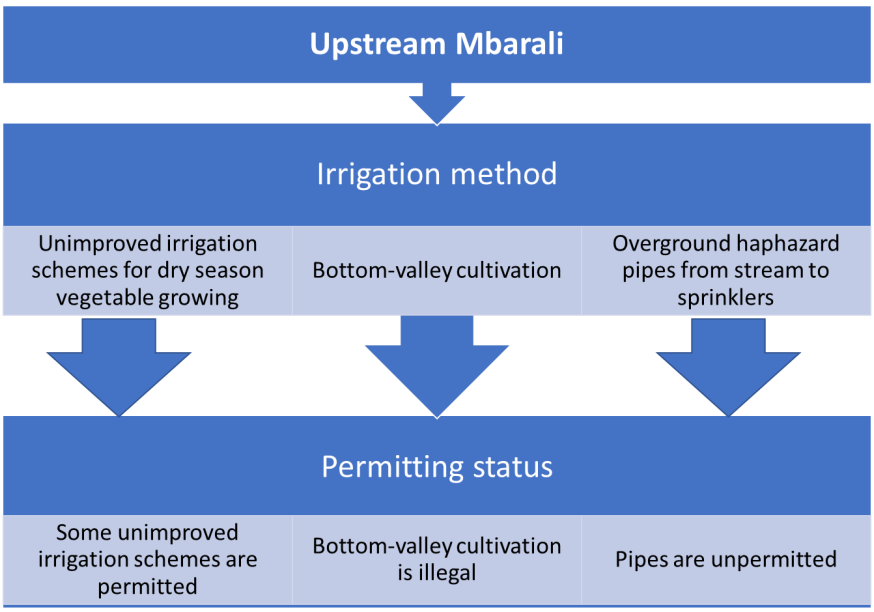

Figure 2. Permitting status by irrigation method in upstream Mbarali. Source: Produced by the author.

5.1.2. The Case of a Downstream WUA

This WUA is situated downstream of the Mbarali river. It was formed in 2011 and inaugurated in 2013. The WUA was never trained to collect water fees on behalf of the Rufiji Basin Water Board (RBWB). This is surprising, as the WUA was constituted after the Water Resources Management Act of 2009 [46], where it is clearly stipulated that this is one of the tasks of the WUA. The upstream WUA, on the other hand, although constituted before the 2009 Act, was collecting fees for the basin authority in the early 2000s. It is furthermore unclear to what extent there is any monitoring of unimproved irrigation schemes from the basin office and this downstream WUA. For improved schemes, there is a close monitoring of intakes, particularly during peak times (at the yearly abstraction starting date and ending date written on the permit).

The checking of abstraction is mostly undertaken by the basin office, though the WUA is periodically invited to accompany the basin officers. The WUA is in fact not given the tools to monitor abstraction through its members or leaders. It is only in extreme cases—such as a delayed start and end date of abstraction (when water users abstract outside of the permitted time frame), or if strict restrictions have been applied due to a drought—that the WUA will communicate issues to the basin office. The basin office has however been systematically unresponsive to the letters sent by the WUA. Recently, an NGO has provided smartphones to this downstream WUA to rapidly assess the abstraction rates of the three main intakes within the town of the WUA. The data collected from the smartphones is however directly sent to the basin office, with no feedback to the WUA about the result of the data collection. This clearly disempowers the WUA from acting upon any collected results.

Although the downstream WUA leaders state that riverbank farming with water pumps is subject to their daily monitoring, this seems highly unlikely, given the distances needed to walk and other professional activities to which the leaders must attend, such as farming their own land. However, there is little doubt that the WUA members do occasionally monitor riverbanks and water pumps, in order to earn some income from fining those who are pumping water without a permit. These types of occasional snap controls are also undertaken by the basin office employees.

The downstream WUA argues that there are no exceptions to riverbank farming—illegal in Tanzania—although the WUA's own vegetable garden is clearly visible within 60 m of the river bank. There is in fact a universal occurrence of riverbank cultivation, which is clearly not being controlled, as the gardens are visible from the basin authority's sub-office in the same town. It appears that there is an unspoken and informal acceptance of the practice.

The abstractors beyond the official irrigation schemes using water from outtake canals are up to several hours walking distance through the schemes; they are never visited by the WUA or by the basin officials. Conflicts on those lands have emerged due to farmers diverting outtake canals to their farms, thereby 'stealing' water from one of the old NAFCO farms having been privatised. These conflicts, which have led to several deaths, were never resolved with the help of the WUA. This violence existing at the edge of the schemes illustrates the scale of impacts of the modernisation of infrastructure along with the formalisation of water permitting. At the scheme level, modernised infrastructure linked to privatisation has diminished the yields of bottom-enders, and thus jeopardised their livelihood. These changes are not noticeable in the upper reaches, as the modernistic tool (i.e., simple pipes) does not allow for as much abstraction and exclusion of other users.

Figure 3 describes irrigation methods and their permitting status for the downstream areas of the Mbarali sub-catchment.

Both Figures 2 and 3 point to the failure of the water permitting system: Whilst some actors are integrated within the formal framework for water resources management (formal water users), others are negotiating their space within the framework (WUAs), and others yet are contesting the formal system (outtake canal users; other unpermitted water users; WUAs consciously accepting unpermitted abstraction).

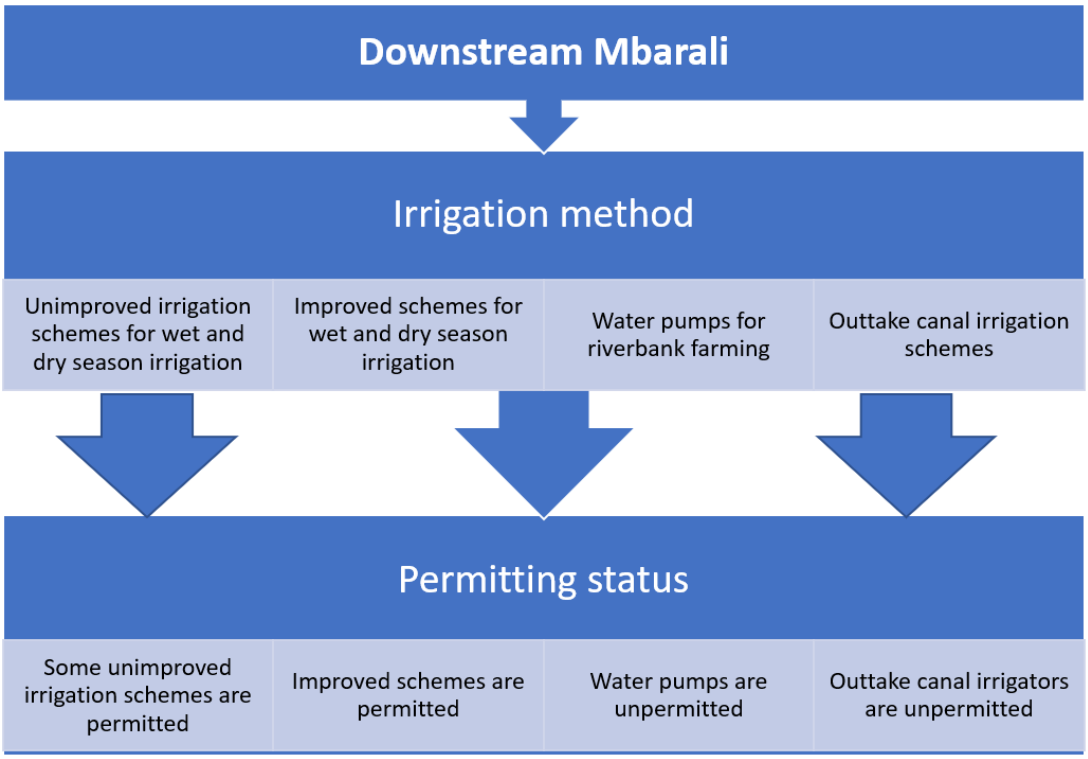

Figure 3. Permitting status by irrigation method in downstream Mbarali. Source: Produced by the author.

WUAs should be instrumental to the basin authority for the monitoring of water abstractions. Embedded geographically and socially within communities, WUAs are key partners for the monitoring of water abstraction, especially considering the lack of financial and human resources of the basin office.

Indeed, it appears that users out of physical reach of the basin office (such as upstream Mbarali) are less compliant towards paying water fees than downstream Mbarali river water users, who are a short distance from the sub-office. Nonetheless, the basin office is extremely hesitant to hand water permitting over to WUAs. The most advanced cases of WUA involvement in water permitting in other parts of the GRRC are where the WUA chairmen collect fees on behalf of the basin office and retain a percentage for the service. The main reason for not handing over this task to other WUAs is said to be due to problems of accountability and lack of knowledge on how to do bookkeeping: The basin office's relationship with the WUA handling fees is trusting, whereas with others there have been some issues in transferring funds. Although this reason makes a case about accountability, it also appears symptomatic of bureaucratic turf wars.

5.2. Power Imbalances between Water Users: A Relationship between a Commercial Farm and a WUA, Upper Reaches of the Ndembera Sub-Catchment

This section illustrates the power imbalances affecting the work of WUAs. The case study shows the ways in which the regulatory approach and the participatory model work in practice, based on the case of a WUA in the upper reaches of the Ndembera sub-catchment.

This WUA was formed in 2006 and covers about 20 localities in the upstream areas of the Ndembera sub-catchment (the number of villages change as population growth transforms hamlets into villages rapidly). Each village has representatives responsible for bringing problems to the board. The WUA secretary is currently a ward councillor, and the WUA chairman was one of the main village's chairmen from 1987 to 1996. WUA elections are meant to be held every three years, but there have never been elections since the formation of the WUA. The chairman of the WUA reports that the main activities of the WUA involve educating the community on water resources management in order to

prevent damaging activities—for example, forest burning and cultivating within 60 m of water sources. Water sources are also fenced to protect them from being polluted. There is little communication with the basin office, although it is only about 30 min away by bus. The WUA is however very much in contact with village governments. The WUA chairman says that the frequent turnover of village government leaders jeopardises a cooperative relationship. Relationships with large scale irrigators vary, but overall there is an awareness of the roles of the WUA. The WUA receives some membership fees, although most small users refuse to pay the membership, as they do not understand why the fee is not included in the water permit they pay to the basin office, or to the domestic water supply company. Under this WUA's jurisdiction, there are conflicts between large and small-scale irrigators, as well as bottom-valley cultivation farmers: Some larger farmers are obtaining water rights despite their negative impact on smaller farmers downstream. Furthermore, downstream farmers do not have water permits, hindering them from officially claiming a water right.

One of the major commercial irrigation farms abstracts almost 10 million litres of water a day for irrigation in the dry season, between May and December. An environmental impact assessment was undertaken for further abstraction, and a water right was granted. However, the village has been vetoing it for the past 18 months, as they question measurements made by the basin office (which means that 120 dry season hectares that should be irrigating are on standby). The district and regional commissioners, as well as one of the main bodies facilitating foreign investment in agriculture in the region, have been involved in this issue. Another subject of contention is the unclear action plan to tackle bottom-valley cultivation, as everyone seems to agree to its necessity, as well as its negative role in drying up the river (N.B. no substantive research on its effects on river flows has been undertaken).

Commercial farmers would rather be part of a committee where they can co-manage/lobby on water issues at a higher level—with the basin authority—as opposed to using the WUA as a platform. For the commercial farms, permit application and measurements were undertaken without the WUA, whilst other irrigators do not have permits.

Commercial farmers view the WUA as a community development organisation, and not the implementation/regulatory arm of the basin authority (they would prefer paying an aggregated fee, rather than paying a fee to WUAs and another one to the basin office for the abstraction permit). This vision seems to be shared with domestic water users, small-scale irrigators and bottom-valley farmers who refuse to pay the membership fee of the WUA because they already pay for domestic water at the village, or water permitting fees to the basin authorities.

This case study opens the discussion in the following section, on the outcomes of the Regulatory Framework, and the practical difficulties in implementing it.

Practical Difficulties in Implementing the Regulatory Framework

The introduction to this paper has highlighted the plurality of arrangements to access water, including plural infrastructures, as well as historical and contemporary articulations of legal arrangements. In this section, I argue that the gradual development of technology (such as improved irrigation infrastructure), combined with the formalisation of water rights, guarantee access to water to those who navigate those systems. The consolidation of water access for some is due to their close alignment to the regulatory strategies implemented by state authorities. Discourses around water wastage by formally unregistered users have led the latter to become outcasts to the water permitting system. Hence, water users with the financial capital for built irrigation infrastructure are more water secure.

The haphazard following-up of WUAs opens a gap between the stated objectives of WUAs and the practical implementation of the Regulatory Framework by WUAs. One of the main outcomes of this process is that capital-rich abstractors (with modern infrastructure) have more legitimacy to access water. Based on the case study presented above, the following mechanisms offer explanations on the processes leading to this outcome:

- Lack of political will (from basin authorities) leading to a lack of capacity of WUAs:

There is a contradictory handling of the WUA for permitting: Although part of the reason for the setting-up of WUAs is the monitoring and management of water abstractions, it is clear from the case study that the basin office has very little interaction with the WUA, and that it has not delegated its regulatory function to the local institution. Officers from the basin office have pointed to the lack of trust in the bookkeeping capacities of the WUA leaders. This point may highlight the issue of long-term commitment: If elections to the WUA were every three years (as planned in the guidance manual for the constitution of WUAs), would it be viable to train new leadership so frequently? There is a trade-off between participation which produces this turn-over, and capacity building, which could build up with longer standing representatives.

- Power imbalances:

Private farms have made a point about representation and legitimacy by referring to WUAs as community organisations, and not playing in the same sphere of influence (i.e., community organisations belonging to lower levels of governance circles than agribusinesses). The abstraction veto however shows a consequential degree of influence from the local community, although it is not an articulation of the power of the WUA itself. It is indeed the village and ward councils that opposed further abstraction from this farm, and not the WUA (although in terms of individuals, there is an overlap, as the WUA secretary is the ward councillor).

- Social embeddedness:

WUAs were set up to answer these issues due to their cultural and social embeddedness, as well as legitimacy (earned by elections) within communities to implement regulations. However, the case study shows the complexity and ambiguity of socially embedding newly designed institutions: On the one hand, the social embeddedness allows for inclusion in decision-making (in the example of the veto from communities towards the agribusiness).

On the other hand, the laissez-faire approach of the WUA towards bottom-valley cultivation shows that the cultural and social embeddedness of WUAs is instead the reason why the WUA is unable to implement regulations which in fact are socially and culturally inappropriate. For example, Mehari et al. [55] (p. 303) point to the exemption from paying water fees for those classified as 'not able to pay': In their case study in the Mkoji sub-catchment, village administrations would exempt the elderly, children, disabled, those with chronic diseases and those without dry season irrigated land from paying water fees. Due to their local knowledge, WUAs are therefore crucial to undertaking water permitting—however, a hybrid adjustment of regulations is brought in by their social embeddedness.

- Decontextualised and modernist approach to addressing water allocation in a basin facing closure:

Overall, the case study is representative of the general relationship between the basin authority and its regulatory and localised arms, the WUAs. Cases of conflictual relations between investors and local communities are likely to increase, in part due to the two following reasons: Firstly, upon acquiring the permission for irrigated agricultural investment in Tanzania, investors are requested to obtain a water permit. This means that all investors (local or international agribusinesses) acquire water permits, unlike (and to a certain extent at the expense of) pre-existing water users. Thus, within this Regulatory Framework, the state gives priority over water access to investors. A wider consultation with local communities to establish fair and legal water distribution between parties is lacking. The role of the WUA is to have a say in the process, in the name of local communities. However, this task has not been performed diligently, due to the basin authority bypassing the WUA in the permitting process. None of the interviewed WUA leaders were able to give an example of a permit allocation in which they were consulted by the basin authorities. Currently, all agribusinesses and cooperative schemes interviewed in the Mbarali and Ndembera sub-catchments confirmed that although they had contact with the local WUA, their water payments were handled directly with the basin authorities. In the early 2000s, the upstream WUA in Mbarali taken as an example in this paper was one of the exceptions, as it used to collect fees from the smallholder schemes. From inception to date, the Mkoji and Kimani

sub-catchments still collect fees. This may be due to the fact that the Mkoji and Kimani WUAs were set up prior to those in the Mbarali and Ndembera sub-catchments. Secondly, the commercial farm in the case study used the term "goal-post changing" to describe the fluctuations in promises made by the Tanzanian state and its partners (namely the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), and other investor support groups) in promoting agricultural investments in Tanzania. Indeed, although the farm obtained and paid for a water permit for further irrigation, water abstraction has not been possible due to the local community's veto. This type of situation is likely to occur if there is no consultation with local communities prior to the distribution of water permits. This situation resonates with Komackech et al.'s [57] research in the Pangani basin (Tanzania): Here large-scale private irrigators have realised that adhering to state-issued water use permits is insufficient to guarantee access to water resources. Thus, in addition to complying with state water law, agribusinesses engage with smallholder farmers across the catchment. They indeed try to adhere to local systems by, inter alia, avoiding conflict and engaging into a rotational water-sharing arrangement. From the case study presented, the capacity of WUAs—as part of the regulatory strategy for water management—appears weak towards investors, whilst elected councillors seem to have more power, even in water affairs delegated to WUAs.

6. Discussion

As the regulatory system for water resources management is based on a command and control system, the basin authority needs to monitor abstractions regularly, so that it can predict and adapt the water availability for upstream and downstream users. For this reason, there is a tendency for the regulatory authority to grant permits to schemes which have controllable and measurable infrastructures, which allow for the prediction of abstraction.

Improved infrastructures have two gated intakes made of concrete: One to divert the water towards the primary canal, and the other to lead the water back into the stream for downstream use. This system allows for calculated and controlled amounts of water to reach the irrigation scheme. However, these gates need to be monitored daily, as the gatekeeper can abstract more or less than the permitted volume simply by opening the concrete gate more or less than is required (up to the limitations of the dimensions of the concrete structure). Lankford [57] (p. 96) has argued that more water is taken for larger amounts of time through improved intakes—with severe risks for downstream users in the dry season. Indeed, the most upstream of the concrete intakes may abstract up to all of the water in the stream (this is because the weir sill level is above the intake sill level, while it is also possible that the release gate may be fully closed).

In summary, the improvement of irrigation schemes (in particular the intakes) physically enables greater abstraction at the same time, as it validates greater abstraction due to the regulatory framework bias which prioritises the permitting of improved schemes. It is important to note that the monitoring issue remains, both for improved and unimproved schemes (because of the large area for little human capacity), although improved schemes are easier to monitor (since improved intakes have measuring devices). This argument poses a challenge for irrigation improvement initiatives funded by the international development community which focus on cementing intakes and canals to improve irrigation efficiency. I argue that in particular, these initiatives do not address water scarcity issues in the GRRC. Currently, the basin office controls the intake gates irregularly (through ad-hoc visits, particularly at the end of the rainy season) due to a lack of financial means and any capacity for monitoring. With a basin size of about 21,500 km^2, (including 25 gauging stations), and the total amount of staff at the basin office not reaching more than two dozen, it is physically impossible for the basin staff to monitor intakes on a regular basis [58]. Although some areas are easily reachable in terms of distance from the basin offices and quality of roads, many schemes are still several hours' drive away.

For unimproved irrigation schemes, the estimation of the volume of water abstracted is extremely difficult to make, due to the changing nature of the structures. Sandbags or other locally available

materials are lined along the entire width of the stream in order to divert a maximum amount of the flow. The materials are regularly moved (sometimes daily), thus varying in height, compactness, location and therefore volume diverted into the primary canal [55]. This makes the allocation of water abstraction by volume (cubic metres per second) impossible to monitor and measure over the full period of irrigation [57]. As a result of their unstable infrastructure, many unimproved schemes do not obtain a formal water permit.

Finally, the granting of formal water rights assumes that water having passed through the irrigation schemes will be returned to its stream of provenance; this is due to the environmental water requirement which is given priority over irrigation, obligating the water right holder to return abstracted water [55]. However, this conditionality is difficult to implement for two reasons: (a) Unimproved abstraction structures do not enable the measurement of abstraction and return flows; and (b) most irrigation schemes (improved and unimproved) have tail-enders that abstract water from the outtake canal (when there is one). Therefore, the volume of water abstraction permitted by the water right is underestimated, as it does not reflect the reality that most of the water will not be returned to the original stream. The manager of one of the old NAFCO farms acknowledged that "there are thousands of acres downstream to the farm with irrigators, so water actually never goes back to the river. Even during the wet season, there is not much water exiting back to the river".

In sum, regulatory water resources management is difficult to implement in the GRRC's geographical, institutional and legal landscape. The regulatory framework furthermore negatively impacts equity outcomes in the catchment. Indeed, the modernisation of irrigation scheme intakes changes water distribution [57] (p. 97): Instead of a multi-intake, cascade and re-use system, single intake schemes have a hierarchical canal system. This implies that the top-end of the irrigation system receives more water, although it should be able to let it flow down to the tail-enders of the system. Furthermore, by installing outtake canals, fields adjacent to (but outside of) the scheme are officially blocked off from diverting water into their fields.

Finally, distribution is modified at the sub-catchment level, changing equitability at that scale. Indeed, cementing intakes allows upstream users to divert more water, increasing water scarcity for down-stream users [57]. At the basin scale, irrigators with concrete infrastructure have a greater share of water than other sectorial needs which cannot build an abstraction infrastructure (for example environmental needs, pastoralists and other downstream water users, such as the hydropower station). These arguments, stemming from on-site observations and discussions, and further backed by the literature, encourage a reflection on the scalability of improving irrigation schemes. The high-modernist approach promulgated by international donors has trade-offs which must be recognised at different scales within a basin.

7. Conclusions

This research has shown that the regulatory framework advantages certain actors over others, and that there is a need for the state to regulate water users based on equity. Paradoxically, the permitting system has actually maintained the state's power over resources, lending them to formal water users who have gained privileged access to water, due to the measurability of water use, the payment for its use and the concordance of built infrastructure with the model of agricultural development aimed for by the central government. I argue that although the Tanzanian government's objectives are to achieve an equitable and sustainable allocation of water resources, the formalisation of water allocation has led to the exclusion of specific water users. Furthermore, the uncertainties linked to water access have pushed away commercial investors [13].

This study calls for a reassessment of the role of WUAs in Tanzania. There is a clear gap between the theoretical clarity of tasks handed to WUAs (particularly their role in formalising access to water), and the messiness of everyday practice. Although WUAs appear to be functional due to their registered existence on paper (as officially recognised organisations with by-laws and official organisational meetings), they are in fact symptomatic of isomorphic mimicry, in that the implementation of their

by-laws is lacking. In addition, the institutional logic behind their shaping is flawed: WUAs in the GRRC are unable to function effectively, as they are held accountable upwards to the regulatory (basin) authority, and downwards to their local community claiming ancestral rights over water. The unsuitable design of WUAs has led to a situation in which the authority of the WUA is bypassed. In their current form, WUAs are inadequately shaped to undertake the role of monitoring formal water rights. Hence without its local arm, the basin authority has little leverage to control water use throughout the basin. This is problematic, considering the key role of water resources in Tanzania's aim for a new Green Revolution. Meanwhile, water investors with developed irrigation infrastructure forge their rights to water, and small-holders contest. This study therefore suggests that instead of acting as ineffective local implementers of the regulatory framework, WUAs could potentially become adaptive forces that advocate for the equitable sharing of water resources through, inter alia, the recognition of customary rights. Drawing from the smallholder innovation literature discussed earlier on [21,31], WUAs also have the potential to advise on seasonal, innovative, culturally sensitive and conservation-oriented water management practices for smallholder farmers, particularly once they have been made aware of catchment-level dynamics and interdependencies.

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