

Ghana's Water Institutions in the Process of Reform: from the International to the Local Level

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1 Introduction

Ghana and Burkina Faso are classified as countries that will face water stress by the year 2025.¹ Population growth and economic development are causing relatively rapid increases in water demand in the domestic, agricultural, mining and industrial sectors, as well as for hydropower generation. These uses conflict with each other. Additionally, municipal and industrial pollution is reducing the availability of water as a resource. Political and economic management strategies are called for to increase water use efficiency. As in many other developing countries in the world, water reforms have been initiated in Ghana with a view to bringing about improvements in water management and water-related institutions.

In order to identify the main weaknesses of the water management sector in Ghana, the World Bank and the Ghanaian Ministry of Works and Housing initiated the Water Resources Management Study in 1995, which was partially funded by various international donors. Consequently, concepts for institutional water reforms were introduced in Ghana, extending from the international to the local level.

No efficient water management is possible at the international level if corresponding regulations are not also implemented at the local level. Among the different levels of an administrative system, the so-called *meso*-level is of special importance in ensuring the implementation of formal regulations, for it is at this level that formal and informal institutions meet. The main objective of the present article is to

highlight the strengths and weaknesses of the Ghanaian approach and to call attention to the difficulties that may arise when objectives need to be coordinated across different levels. The example of irrigated agriculture in the Volta basin is used to illustrate this.

The paper is structured as follows: background information on the study area is presented in Section 2. Sections 3 and 4 describe the general (top-down) reforms of the Ghanaian water sector at the international and the national level respectively, and Section 5 discusses issues arising from the coordination of these two levels. In Section 6, the example of irrigated agriculture in the Volta Basin is used to highlight institutional changes occurring at the *meso*- and the local level and to demonstrate that informal institutions, including local regulations and authorities, are of crucial importance for the implementation of formal reforms and regulations. It will be shown that, at the district level, cooperation with local authorities and integration of their management approaches into the formal regulations is possible, though rarely undertaken. Without taking informal institutions at the local level into consideration, it is not possible to implement reforms in a top-down approach. Based on this observation, Section 7 takes a closer look at the management and operation of irrigation schemes at the community level and describes how current trends towards devolution and participatory management are affecting decision-making at the community level. It goes on to discuss some factors determining the success of community-based irrigation management. It is argued that lessons learned at the community level may provide useful insights for decision-making at the higher levels. Finally, conclusions and issues for further research are presented in Section 8.

The present article looks at two different research projects working on water policy issues in the Volta Basin and attempts to link them. One is the GLOWA-Volta (*Globaler Wasserkreislauf*) project, funded by the German Ministry of Education and Research (BMBF), which seeks to develop a scientifically sound decision support system (DSS) for the management of water resources in the Volta Basin. The DSS simulates water availability and

1 Cf. Hirji (1998).

demand throughout the basin under different global change scenarios and helps define optimal resource management strategies to achieve desired goals. The institutional analysis presented in Sections 2 through 6 by Annette van Edig and Wolfram Laube seeks to define realistic new water-policy scenarios based on the institutional settings and rules in the riparian countries of the Volta Basin. The second research project, led by Stefanie Engel and funded by the Robert-Bosch Foundation, analyses the impacts of decentralization and of devolution on natural resource management at the local level. The part of the project focusing on participatory irrigation management in Ghana provides the basis for Section 7 of the present article.

2 The Volta Basin

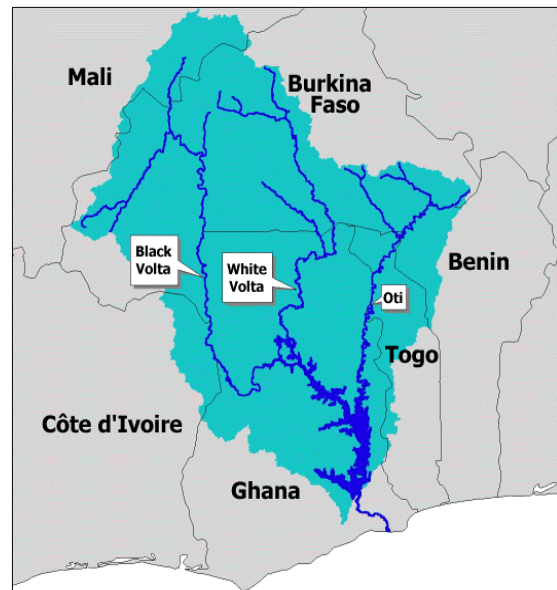
The Volta Basin covers 398.000 km² of the sub-humid to semi-arid West African savannah zone. The Volta Basin is an international catchment area shared by six riparian countries. Three Volta tributaries, the Red, White and Black Volta, feed the Akosombo dam (see Figure 1).

The wet season in the south of the catchment area extends from May to October, and from May / June to September in the north. The inter-annual variability is high for given locations, and the variability within a rainy season is very large due to the convective nature of most rainfall events.

River flow is highly sensitive to rainfall: relatively small changes in yearly rainfall cause large changes in river flow, and surface water resources in the basin are therefore very vulnerable to droughts. This has important implications for agronomic planning, but also for energy supply.

Water use and land use choices made in riparian countries and their effects on transboundary river flows are already an issue between the two major riparian countries, Ghana and Burkina Faso. Ghana is the most downstream riparian country; Ivory Coast is situated upstream from Ghana and downstream from Burkina Faso, which, along with Mali,

Figure 1: The Volta Basin



Source: <http://www.glowa-volta.de>

Benin and Togo, compose the upper riparian countries.

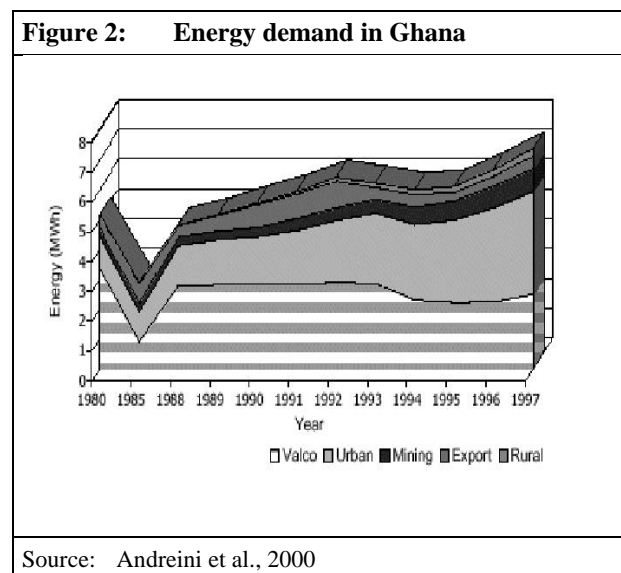
3 The International Level

Water Use Sectors and Water-related Projects in the Volta Basin

The economic development of the riparian countries in the Volta Basin and the associated increasing demand for water of their industrial, agricultural and energy sectors are a possible source of international conflict. On the other hand, national needs may also be an incentive for a riparian country to take the initiative in international cooperation, which is what Ghana has done.

The largest project in the Volta Basin is the Akosombo dam in Ghana, built in 1965. The dam reaches a height of 134 m and forms Lake Volta, which is one of the world's largest artificial lakes, covering 3.5 % of Ghana's surface area. When the dam was built, one of the main problems was the financial aspect. To help finance the project, the

Ghanaian government signed an agreement with the US aluminium-producing enterprise Henry J. Kaiser, known as VALCO in Ghana. In exchange, VALCO was granted special tax breaks and low energy tariffs for 50 years to produce energy-



intensive aluminium.² It currently consumes 45 % of the energy produced in Ghana (see Figure 2).

Presently, the hydropower station at the dam produces 912 MW, and production is projected to increase by 15 % in the next five years. As demand for electricity is rising, new possibilities of hydropower production are being explored.³ Presently, only one dam construction project is being seriously discussed: a hydropower station on the Black Volta near Bui George. The energy produced by this dam is intended to satisfy national consumption in the north and to cover potential energy exports to Burkina Faso, Mali and Ivory Coast. However, construction of the Bui dam is being debated at both national and international levels, primarily for environmental reasons, as the construction site is located in a national park and could cause serious ecological damage.

The concept of integrated water management has only very recently been introduced in Ghana, but it is being used in the pilot study of the Densu Basin. To date, water management in Ghana has consisted of supplying water on a sectoral basis. Institutions reflected this type of management in their arrangement, in which different institutions were responsible for different sectors.

Particularly in Ghana, the major water user is *energy production*, and energy demand presently far exceeds production. Of the energy produced, 45 % is sold to VALCO and 48 % consumed by households, though only 5 % of this is consumed by rural households. Demand will rise further as the government realizes its plans to supply electricity to every household in Ghana, including those in rural areas.⁴

Severe energy crises have hit Ghana in times of droughts, with the last major national crisis taking place in 1998, and regional crises reported in 2001. During an energy crisis, the country only has 12 hours of electrical power per day. This has severe impacts on the national economy, and daily power failures have become common in urban areas like Accra. Other factors, like institutional failure, undoubtedly contribute to the poor reliability of the energy supply.

To counter its inability to produce enough energy for national needs, Ghana imports energy from Ivory Coast on a regular basis, from 6 to 10 p.m. In addition, it increasingly has to import energy during other periods of high consumption. The Volta River Authority, responsible for hydropower production and the management of the Akosombo dam, already owes Ivory Coast over US\$ 34 million for power imports. Paradoxically, current energy prices for consumers are lower than production costs and Togo and Benin import energy from Ghana, except in times of drought. However, it may be assumed that these energy-importing countries will realize hydropower projects of their own in the future. For example, Burkina Faso plans to build three dams

2 Cf. World River Review, Drought Dims Ghana's Hydroelectric Power. At: <http://www.irn.org/pubs/wrr/9511wrr.html>, p. 4.

3 Cf. *ibid*, p. 5.

4 Cf. Ofuso-Ahenkorah (1999), p. 4, and Ministry of Works and Housing (1998 a).

along the Volta, two of them to supply the capital Ouagadougou with water and one for irrigation and hydropower generation. The total amount of stored water will not be more than 149 Million cubic meters (MCM), or 3.75 % of Lake Volta⁵, but many smaller dams for household and agricultural purposes have already been constructed.⁶

In 1998, latent conflicts between Ghana and Burkina Faso surfaced when drought and the energy crisis hit Ghana. Burkina Faso's water consumption was suspected of being the main cause of reduced water levels at the Akosombo dam. In response, Ghana offered to supply Burkina Faso with energy in order to prevent the country from building the dams on a Volta tributary, which were expected to considerably reduce water flow in the Volta. Burkina Faso rejected these plans, insisting on an autonomous national energy supply. Notions of national sovereignty and fears of flooding in northern Ghana caused by sudden water releases from dams in Burkina Faso are major concerns for Ghanaian water management.

The *household water sector* is important for the inhabitants of the riparian countries, but not so much in terms of water quantity as in terms of water quality. The same holds for agriculture. Irrigated agriculture is not really important in Ghana, and this sector currently consumes only moderate amounts of water (617 MCM). This may change with the realization of Ghana's Vision 2020, according to which the agricultural area under irrigation will be extended from 10,000 to 100,000 ha. This would imply a future water consumption of up to 4,114 MCM.⁷ At the same time, industry's share of GDP is expected to increase to 37 % by 2020 and demand for industrial and urban water is projected to rise from 63 MCM in 2000 to 272 MCM in 2020.⁸

Water demand figures are not available for all riparian countries in the region; however, projections see Ivory Coast's water demand rising to 9400 MCM by 2025 and that of Burkina Faso to 860 MCM by 2010. Benin's water demand was estimated to be 15 MCM in 1997.⁹

Agricultural sector water requirements could also increase considerably in the future: Burkina Faso, Ivory Coast and Mali are three of six West African countries that presently irrigate only a little over 10 % of their irrigable land area.¹⁰ The possible expansion of irrigated areas will certainly have consequences for water use in the Volta Basin.

Several measures have to be undertaken in order to prevent water use conflicts, the first and foremost would be the development of alternative energy sources. However, even if the energy problem were to be solved without the development of further hydropower projects in the Volta Basin, the watercourse still has to satisfy the needs of other water use sectors. Development of the river basin is essential for the economic and social progress of the respective countries, but this cannot be achieved without corresponding cooperation at international, national and local levels.

Legal and Institutional Background at the International Level

As the main conflicts are most likely to occur between Ghana and Burkina Faso, communication between these two countries was identified as a major goal of the Volta Basin Water Resources Management Initiative, an initiative launched by international donors. It has concentrated on capacity-building at the national and international levels of the two riparian countries. In 1996, first results were seen when Burkina Faso asked for Ghana's "no objection"¹¹ to plans its to build dams on the

5 Cf. Ghana World Wide Web (1998).

6 For further information on remote sensing and dam sites, cf. <http://www.glowa-volta.de>

7 Cf. Ministry of Works and Housing (1998a), p. 14.

8 Cf. Ministry of Works and Housing (1998b), p. 3.

9 Cf. *ibid*, p. 9.

10 Cf. World Water Council (2000), p. 7.

11 The no-objection rule is a principle of international law and it is also an operational rule of the World Bank Group

Ziga and Bagre rivers for hydropower and irrigation. This "no objection" by Ghana was given on the provision that Burkina Faso fulfilled certain conditions.¹² A detailed Memorandum of Understanding was signed, and a mechanism or institution will be put in place to facilitate communication between the two countries and to monitor the implementation of the terms of agreement. One major outcome of the initiative was the establishment of the Water Resources Commission in Ghana.

As national and international institutional capacity-building and initiatives are intertwined (for example in the field of data exchange), the Ghanaian Water Resources Commission (WRC), established in 1996, will deal with international and national management issues. Moreover, an International Waters Committee (IWC), part of the WRC, has been set up. The Strategy Document of the WRC identifies the three tasks of the IWC:¹³

- identifying international waters and drafting bilateral agreements;
- establishing mechanisms for informal discussions on a technical level with the riparian countries;
- examining the possibility of initiating a multinational regional agreement for the development of the Volta Basin.

A Volta River Basin Organization will be established in 2003, while various bilateral agreements are to be signed with Burkina Faso, Ivory Coast and Togo in the intervening years.¹⁴ To date, no agreements have been drafted or signed. However, according to the WRC, informal information exchanges on technical projects and the possible development of the Volta River take place frequently. The first step towards cooperation, namely mutual

trust-building between the main stakeholders, has thus been taken.

4 The National Level: the Water Resources Commission

The rationale for the reorganization of the Ghanaian water sector was a water management study initiated by several international donors in order to evaluate the efficiency of institutional arrangements in the water sector.

Based on the study's findings, the Water Resources Commission (WRC) was established in 1996 with the adoption of the Water Resources Act, and started operations in 1998. The WRC serves as an umbrella institution for national water policy in order to coordinate different government agencies and their different interests and management approaches, for example those in the private water sector (see Section 7). According to the newly drafted water policy, the WRC will have to:

- coordinate the water sector with special regard to development agencies and the exchange of data between the relevant institutions,
- work toward the integration of all stakeholders in the sector, while respecting traditional norms and customs,
- guarantee access to safe drinking water and sanitation,
- supervise water quality, and
- improve cooperation with the Public Utilities Regulatory Commission (PURC), which supervises water-pricing.

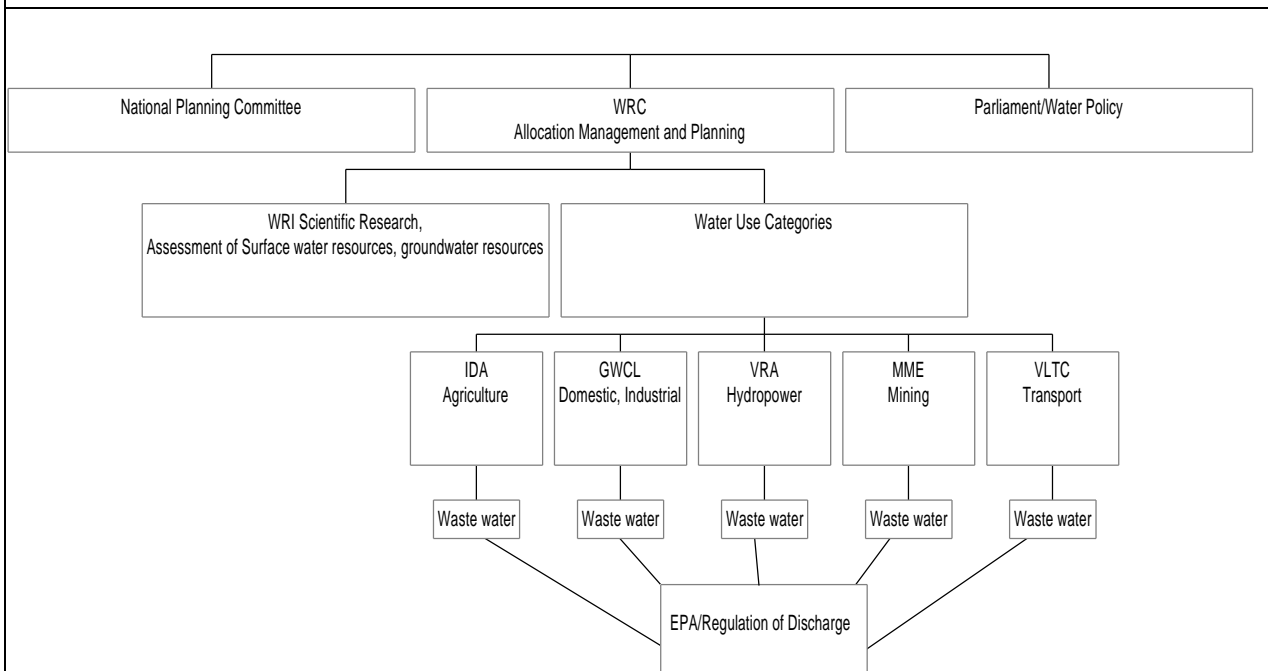
Government agencies formerly responsible for water use in their sector (irrigation, mining, hydropower generation, etc.) will now have to apply for a license from the WRC to use water. They will have to specify the amount of water to be used and apply for pollution licenses from the Environmental Protection Agency, which is now responsible for water discharges. This reorganization of institutions and the allocation of water use rights is not an easy task

to get the acceptance of every downstream riparian before financing a dam on an international watercourse.

12 Cf. Ministry of Works and Housing (1998b) p. 6.

13 Cf. Water Resources Commission Secretariat (2000), p. 11.

14 Cf. *ibid.*, p. 14.

Figure 3: Water institutions in Ghana

as it implies reducing the power of other ministries and agencies that formerly managed water use in their sector on an autonomous basis.

The draft water policy contains all the principles identified at recent international conferences on water. Although the policy is meant to serve as a guideline and has yet to be implemented through institutional measures and laws, it remains broad and vague, setting out global objectives, such as good governance, establishment of a stable macro-economic environment, democratization of civil society and the rule of law. These are without a doubt important objectives, but it remains to be seen if they will in fact precede concrete actions and in what way they will be implemented in the water sector. One major institutional problem of government water institutions at the national level as well as at regional and local levels is capacity-building. Once trained, staff members often move into the private sector or to international NGOs. Attempts are therefore being made to develop a system of incentives to keep professionals in public service.

Apart from water policy, the WRC has drafted a water-use regulation according to which water use

permits are given to different water users. It is a detailed regulation involving investigations and public hearings on the licenses applied for, on registration procedures, and so forth. These regulations will be used by the WRC as the basis for the allocation of water-use rights to institutions and users, and because of it the WRC may encounter difficulties with other administrative levels over issues of water rights and water allocation.

It is clear that the WRC is unable to address all the different actors in the sectors using water. International donors as well as NGOs play an important role in reaching these actors, but they often follow their own rules and not the government's water policy. On the other hand, water users associations, initiated by international donors, are often not given the district level backing they need, for example in the form of by-laws. This has caused problems in irrigation programs. The same holds true for the integration of traditional authorities in projects and government programs.

5 Interlocking the International and the National Level

Now that we have presented the challenges facing the management of water at the international level and the relevance of the case study of Ghana for national level water institutions, the question that remains is: How do the international and national levels intertwine and what constraints or chances of cooperation between riparian countries can the international and national institutional setting reveal?

At the international level, the main task of cooperation and institution-building still remains to be tackled, beginning with informal cooperation and extending to the legal framework and the institutional set-up of international institutions. What preconditions have to be present at the national level of the riparian countries for international cooperation to take place?

If we compare Ghanaian national water management and the national water management of other riparian countries, we can observe that their set-up varies considerably. Ghana is in a favorable position as donors are heavily involved in its water sector reform. This has had a positive effect on water management and the implementation of reforms. In other countries, like Burkina Faso, water institutions operate in a somewhat uncoordinated manner, at least at the different administrative levels.¹⁵ In Mali, a colonial decree from 1928 concerning water resources is still in force. These varying stages of management and institution-building are an *obstacle to international cooperation*. Efficient national institutions are essential to implement the obligations agreed upon in international accords. For if international agreements and agreed water policy measures are to be implemented and institutional cooperation is to function, national institutions must have *counterparts in other riparian countries*, for example in the field of pollution prevention. Donors should not neglect this aspect and should also invest in institutional reforms in the other riparian countries.

When it comes to institution-building at the international level, it would be advisable to choose a step-by-step approach. National institutions or departments in the riparian countries could be identified for cooperation. They could then exchange information not only on management of international watercourses but also on institutional experience, in this way speeding up capacity-building. Once such cooperation is established, additional institutions could follow the example, so that the preconditions for efficient transboundary institutions will eventually be met. As personal contacts and information exchange intensify, trust between countries increases. This could help the parties involved to overcome narrow national thinking and to recognize that, in order to profit from the benefits of cooperation, it may be worthwhile and necessary to limit rights that are generally considered to be part of national sovereignty. At the moment, a wide gap exists between the ideal and the existing situation: the national management structures of the countries involved are in no way harmonized, and institutions do not even have counterparts to cooperate with. While the national WRC in Ghana is busy with its own national management tasks, international cooperation is undertaken – if at all – mainly with Burkina Faso. No international integration of water management is foreseeable. The same holds true for the national and the regional levels: the tendency at the moment is to overload regional districts with work related to water management. Employees at this level do not have the necessary skills and the Commissions lack the financial resources needed to carry out all of the monitoring work they are entrusted with.

6 From National to Local: Interlocking Water Resource Commission, River Basin Commissions and Local Actors in Ghanaian Water Reform

Thus far we have presented Ghana's water reform process at the national level and discussed what reforms are planned to help it address questions regarding internationally shared bodies of water and water distribution issues at the regional and local

15 Cf. Ministry of Works and Housing (1998b), p. 9.

levels. The following chapter, using examples from the irrigation sector, discusses how the different levels are to interlock and what difficulties the projected new water management is likely to encounter with its current design.

Current Developments within the Ghanaian Irrigation Sector

Since many changes are underway in Ghana's irrigation sector, it is one of the main focuses of the present paper. To date, irrigation has been of minor importance in the Ghanaian agricultural sector. Officially, only 10.000 ha of land are irrigated, which account for 1 % of Ghana's arable land and only about 1 % of its agricultural output. Nevertheless, this figure is incomplete, since it only accounts for areas irrigated under the irrigation schemes established by government bodies, such as the Irrigation Development Authority (IDA). There is no essential data available on small-scale private irrigation, and areas irrigated with run-off water, such as inland valleys and wetland rice production areas are not accounted for.

Due to concerns about high population growth rates (2.6 % annually) and the prospects of world climate change, which could make rain-fed agriculture, especially in Northern Ghana, even more insecure than it already is, the Ghanaian government has embarked on an ambitious policy of irrigation development. Based on Vision 2020, the government plans to put 136,000 ha of land under irrigation by 2020. For the Volta River Basin alone, this implies a six-fold increase in annual demand for irrigation water, from 0.565 km³ in 2000 to 3.605 km³ in 2020.¹⁶

To achieve this ambitious goal, some older and large irrigation schemes are to be rehabilitated and expanded, but the goal will mainly be achieved by the expansion of medium- and small-scale irrigation schemes. Several irrigation programs funded by

various international and bilateral donors exist and more are planned for in the near future.¹⁷

Expansion of irrigated farmland is not only promoted by the government and development agencies: in many villages, farmers, driven by the prospect of additional income during the dry season and of safer food supplies, are irrigating more and more. These efforts are necessarily small in scale, since farmers lack the capital to make major investments. Irrigation in these cases is most often done by bucket and involves high labor inputs (family or paid laborers). This development is only found along perennial rivers or where water is available from dams, dugouts or water holes in the riverbed during the dry season. Where water is available in larger amounts, it is possible to find commercial farmers who water their fields through pump irrigation and operate substantially bigger farms. Small-scale irrigators and commercial farmers are placing an increasing amount of land under irrigation and therefore need additional water. Basic data on this

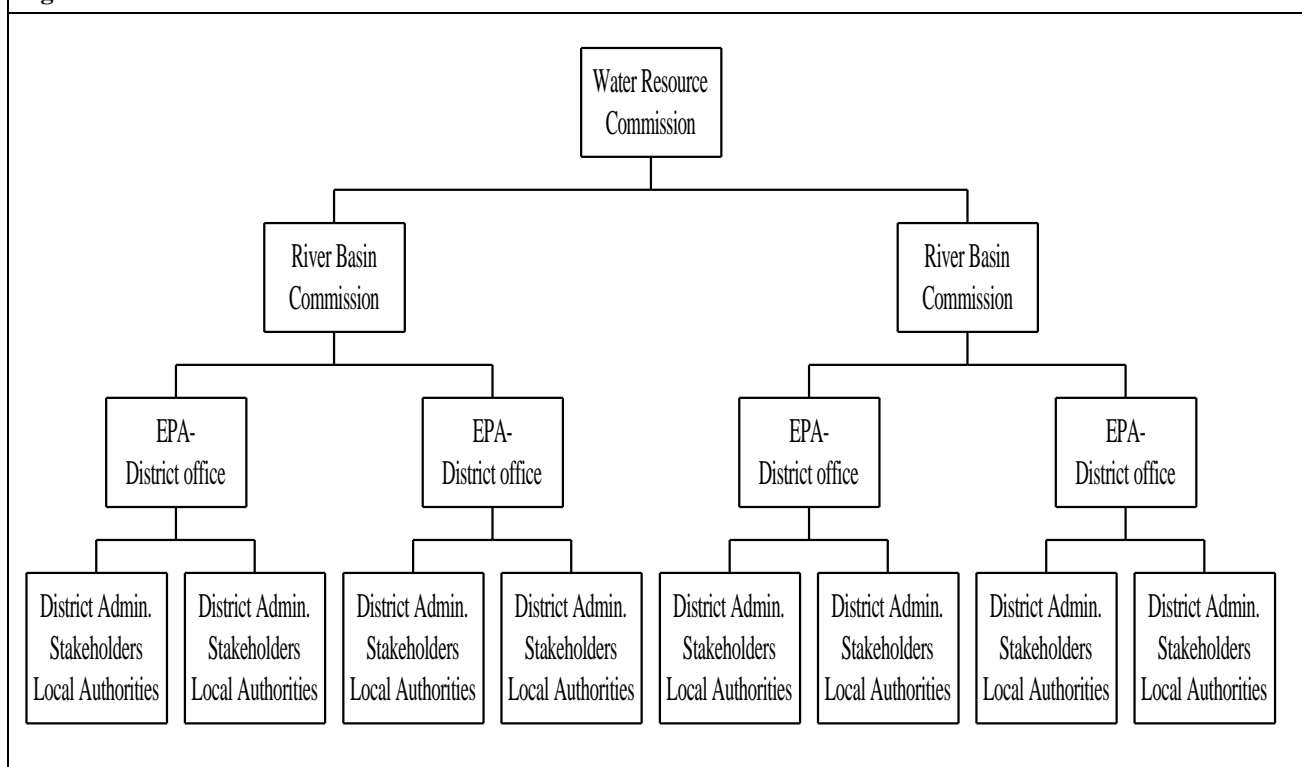
development are lacking, but remote sensing pictures have revealed changes in land use. This runs counter to experience of experts in development policy, who have attributed the failures of many irrigation projects in African countries to an underdeveloped culture of irrigation in this region. Currently, a shift in the habits of farmers can be observed, with farmers increasingly engaging in irrigated agriculture.

Interlocking the National, Regional and Local Levels

Now that the WRC has been successfully established, has formulated a new Ghanaian water policy, and has made efforts to harmonize the country's previously fragmented water laws, its next task will be to efficiently administer water use. To achieve this objective, it will be necessary to implement its regulations at the river basins level and at the ad-

16 Cf. Ministry of Works and Housing (1998a), p. 8.

17 Cf. Ministry of Works and Housing (1998b), p. 13.

Figure 4: Institutions at the national and district level

ministrative and political levels in the country's 110 districts.

In coping with this task, the WRC faces a dilemma: on the one hand, its duties and powers are far-reaching; on the other hand, its financial and human resources are limited. Its rights and responsibilities include the following:

- to formulate comprehensive plans for the utilization, conservation, development and management of water resources;
- to initiate, control and coordinate activities connected with the development and utilization of water resources, including those shared with other countries;
- to grant water rights;
- to collect, collate, store and disseminate data or information on water resources in Ghana;
- to require water user agencies to undertake scientific investigations, experiments or research into water resources in Ghana;
- to monitor and evaluate programs for the operation and maintenance of water resources in Ghana;

- to advise pollution control agencies in Ghana on matters concerning the management and control of pollution of water resources.¹⁸

Since the WRC has very limited human and financial resources, and is funded solely by the Ghanaian government – which is chronically short of money and has just signed a debt reduction agreement under the HIPC program¹⁹ – it is unlikely that the WRC will be able to fulfill all of the above-mentioned tasks. Currently the WRC only aims to establish River Basin Commissions (RBC), in accordance with internationally accepted water management principles (see Figure 4).²⁰ However, RBCs also lack the resources necessary to administer water resource planning and management and to decide on allocation of water resources through a participatory approach in which the *participation of communities, local and traditional authorities, District Assemblies, the private sector and NGOs* is an

18 Cf. Ministry of Works and Housing (2001), p. 2.

19 Cf. IFAD (1999); IHP (2000).

20 Cf. World Bank (1993).

important factor.²¹ This is especially true for the Volta River Basin, which is extremely large and covers about 70 % of Ghana's landmass.²²

The WRC therefore plans to establish partnerships with organizations and authorities operating at the district level to achieve its objectives. To date, the WRC plans to establish close cooperation with the District Offices (DO) of the Environmental Protection Agency (EPA)²³. The WRC is also cooperating with the EPA on water body protection and the issuing of EPA fluid waste discharge permits.

Cooperation between Formal and Informal Institutions at the Local Level

Cooperation between the WRC and the EPA at the district level has some obvious drawbacks: the EPA does not function effectively, and its DOs even less so. The lack of resources, environmental standards and, most importantly, power to enforce its regulations are preventing the EPA from realizing its objectives.²⁴

Since the EPA and especially its district-level branches are already performing poorly, if at all, it is questionable whether this organization is equipped to additionally monitor local water use and enforce the new water policy at the local level.

To assess the local water situation within the Volta Basin, a survey was conducted in 24 villages across seven regions. Twenty of these villages had surface water resources, and in 19 of these the local chiefs and politicians interviewed stated that surface water pollution was being controlled. Only once was the

EPA's District Office mentioned in connection with water pollution control. In fact, it was the traditional institutions: chiefs, religious leaders or lords of the land, who controlled the physical and spiritual protection of water bodies, often in cooperation with unit committees and assemblymen. Measures against physical pollution of bodies of water include controlling waste disposal, animal watering upstream of fetching points, washing of cars, defecation close to water bodies and fishing practices. The aim of these control measures is mainly to protect bodies of water used for human consumption. This demonstrates that traditional leaders and local politicians, often acting together, do control water pollution and enforce the regulations they put in place.

The role of traditional authorities is even more important in the domain of water rights. In twelve villages, the chiefs or lords of the land were said to own the water as custodians for the people; in six others, it was perceived that the community, or everybody, owned the water. The ownership of water resources was attributed to the government in only two villages. In four villages where conflicts over water resources were encountered, it was always the chiefs who solved the quarrels in cooperation with the unit committee. Varying from the south to the north of the Basin, it is mainly chiefs or lords of the land who directly or indirectly administer water user rights:²⁵ directly, by allocating water withdrawal or fishing rights, and indirectly, by allocating rights to land which lies adjacent to water. In the latter case, water withdrawal rights are implicitly included, since riparian water rights are commonly acknowledged in Ghana.

In the area under study here, irrigation systems existed in 10 of the villages surveyed. In four of the villages, officially organized irrigation schemes existed; in seven, irrigation was privately organized by local farmers, while one village had both types of irrigation schemes. In 5 of the 7 villages with privately owned irrigation systems, farmers indicated that the irrigated area was increasing. In the remaining villages where no irrigation was in use,

21 Cf. Ministry of Works and Housing (2001).

22 One example for participative water management on local level is the communally or privately organized and financed program IMT (irrigation management transfer), which will be introduced below in Section 7.

23 Information as presented at the National Water Policy Forum (Northern Sector) of the WRC at Kumasi, 11 June, 2001.

24 Cf. Ayee (1998); Ministry of Works and Housing (1998a).

25 Cf. Mensah (1999).

seven indicated that water for irrigation was unavailable, three lacked irrigation equipment such as pumps or found irrigation too expensive. Nine of these villages stated that they would engage in irrigation if they had the possibility.

In all villages with private irrigation, i.e. irrigation organized by farmers and without intervention from government, development agencies or NGOs, the land rights and implicitly the water rights were transferred through traditional institutions such as chiefs, lords of the land or clans. Sometimes farmers paid rent for irrigated land. The same phenomena can be found in a few cases of commercial private irrigation, where investors obtain land and water rights through traditional authorities, set-up irrigation schemes and in turn collect funds by renting the irrigated land to farmers.

There is no official land registration in Ghana, and patterns of land allocation and tenure vary from region to region, according to local custom. While chiefs are custodians of the land in the southern and northern regions, lords of the land assume this position in the upper regions. These traditional institutions perform rituals to ensure the fertility of the land, allocate unclaimed land and settle land conflicts.²⁶

The central position of traditional authorities in the allocation of water rights and the protection of water bodies has to be taken into account. The WRC is aware of this, but has adopted a dual policy on this issue. On the one hand, the WRC acknowledges that *customary law and practices in Ghana have existed over the years and cover the areas of water conservation, pollution control, protection of catchments and protection of fisheries*²⁷, and it attaches great importance to the accomplishments traditional authorities have made in these areas and wishes to make use of their enforcement power and local legitimacy as far as possible. On the other hand, the WRC plans to seize the water rights from these traditional authorities, without consultation them or compensation them for potential revenue losses.

In the absence of efficient state monitoring and local enforcement agencies, the WRC is counting on the work and cooperation of traditional authorities, while simultaneously weakening their position and powers. It is clear that the allocation of water rights through local institutions does not fit into the projected new water management, where the main objectives of integrated river basin management are the consideration of the overall economic benefits of competing water uses and the mediation of stakeholder interests. Nevertheless, given the current realities, the dual policy of the WRC towards traditional authorities seems risky, since it is their cooperation, and not resistance, that is needed. Instead of providing incentives for traditional institutions to cooperate, the WRC's policy of neglecting traditional practices of water rights allocation, which is backed by the current rule of law,²⁸ provides disincentives for cooperation by diminishing the chiefs' responsibilities and ability to collect funds. For beneficial outcomes, the integration of traditional chiefs in projects funded by international donors it is equally important (see Section 7).

However, care must be taken to not paint a romantic picture of traditional institutions, and to take into account the fact that chiefs sometimes behave to the detriment of society and the environment, granting excessive water rights, especially to the mining sector and to commercially irrigating farmers. In addition, the democratic legitimacy of informal institutions and the way disadvantaged or underprivileged social groups such as women, the poor, ethnic minorities or youths are represented and treated by traditional authorities poses an important problem. Furthermore, there is some hesitation in strengthening the position of traditional institutions, especially in view of their role within the system of indirect rule established by the British during colonial times.²⁹ Nevertheless, they occupy a constitutionally defined space in the Ghanaian political system and could be important partners of the WRC at the local level.

26 Cf. Dittoh, (1998); and Kasanga / Kotey (2001).

27 Ministry of Works and Housing (2001).

28 Cf. Water Resources Commission Act, Act 552 (1996).

29 Cf. Rathbone (2000).

The question of whether the centralized planning approach of the WRC fits into the decentralized political landscape of Ghana remains open. In 1989 Ghana embarked on a decentralization policy which has put many rights and responsibilities regarding administration and development in the hands of district administration and district assemblies. However imperfect this policy may be with regard to grass-roots participation, district financing and staff capabilities, the fact remains that many development and infrastructure projects are planned and implemented at the local level. Many of these projects have an impact on water resources and would therefore have to be approved by the WRC. How much of their decision-making power the 110 Ghanaian Districts are prepared to concede to the WRC's water plans in the absence of efficient monitoring bodies remains to be seen, especially when conflicting interests are involved. In this context, the issue of waste disposal in Ghana is of some significance. It is the district assemblies (DAs) that are responsible for the safe, hygienic and ecologically sound disposal of human waste. However, their performance remains very poor, and due to lack of efficient waste disposal controls, DAs actually jeopardize the quality of the soil as well as that of ground and surface water. Because both the WRC and the DAs have a vested interest in distributing water rights, their cooperation may be difficult. Not to mention the widespread phenomenon of rent-seeking and corruption in public administration, which adds to doubts about the viability of cooperation between the WRC and the DAs.

7 Management of Irrigation Schemes at the Community Level: What Determines the Results of Participatory Management?

Given the importance of local informal institutions and the role of local authorities as outlined above, this section looks at decision-making at the level of irrigation schemes (denoted below as the *community level*). The focus is on Ghana's Upper East Region, where irrigation is most prevalent. The considerations presented in this section are based on a

research project different from the one on which the previous sections are based. The links between the community-level analysis and the higher levels are two-fold: first, local-level decisions determine actual water use and pollution. If these are to be influenced in coordination with higher level objectives, it is crucial to understand the determinants of local-level decisions and the extent to which higher-level institutions and policies can affect these decisions. Second, sustainable use of irrigation schemes at the community level requires cooperation between water users or a strong hierarchical structure that acts in the interest of the community. In a sense, this is a microcosm with many parallels to institutional issues at higher levels. Thus, an analysis of the determinants of local-level outcomes may provide useful insights for decision-making and outcome forecasting at the regional, national and international levels. For example, Section 6 discusses the planned role of the RBCs in managing water allocation at the river basin level. However, little knowledge is available on how best to set up these committees with a view to assuring an efficient and equitable allocation. The experiences made with water users associations, discussed below, could be useful in setting up these committees. Similarly, as explained subsequently, participatory irrigation management at the community level requires the cooperation of different groups of water users. The same is true, in principle, at the international level. The only difference lies in the degree to which a higher-level authority may enforce overall objectives. While no such authority exists at the international level, district authorities may play such an enforcement role at the community-level. However, as discussed in the previous section and below, this enforcement potential has not necessarily been realized.

The Move towards Devolution and Participatory Management of Irrigation Schemes

In many countries, the past top-down administration of irrigation programs led to problems of rent-seeking and corruption, and to the rapid deterioration and declining productivity of irrigation systems due to poor maintenance. In Ghana, 37 % of the public investment funds not invested in cocoa pro-

duction were invested in irrigation development between 1984 and 1986, with little to show for it.³⁰ Institutional weaknesses led to high costs of irrigation development and inefficient operation of existing irrigation schemes. Moreover, farming in and poor maintenance of catchment areas led to deposition of sediments (siltation), erosion of embankments and spillways, and blockage of outlet valves, often resulting in a complete breakdown of the irrigation system.

Due to poor results of government management, together with reduced national budgets and a general move towards decentralization promoted by international donor agencies, many countries switched to participatory approaches for irrigation management and irrigation management transfer (IMT) programs starting in the 1980s. In these programs, the responsibility and authority for irrigation system management are transferred in varying degrees to water users associations or private-sector entities. Moreover, a certain preference for small-scale irrigation schemes rather than larger structures has emerged. The underlying idea is that, by increasing the involvement of local communities and water users in the construction and management of irrigation schemes, a sense of ownership can be created, making it possible to improve maintenance and rule enforcement, increase the availability of funds for operation and maintenance (O&M), and empower local farmers empowered. However, it is naïve to think of local communities as a homogeneous unit which – once given rights to a resource (i.e. irrigation scheme, water, land, etc.) – will automatically act to maximize the benefits of the group as a whole. In reality, effective irrigation management by local communities requires the cooperation of many different community members or subgroups. Such cooperation, in the interest of the whole, can be hampered by local hierarchies, different ethnic groups, or simply differences in interests and negotiating power between groups of users. Devolution may thus lead to rent-seeking activities by the more powerful and prevent the state from exercising an important role in assuring the inclusion of marginalized groups.

30 Cf. Sarris and Shams, cited in Dittoh (1998).

The tendency to increase farmer involvement in the O&M of irrigation schemes can also be observed in Ghana, where local farmers were completely ignored in the planning, construction, and even implementation of irrigation schemes until quite recently.³¹ In a 1996 interview with the International Food Policy Research Institute (IFPRI), the Minister of Food and Agriculture said that the government *will invest more in small- and medium-scale irrigation projects that will be owned or managed by their users – the farmers.*³² In the Upper East Region (UER), where irrigation is most prevalent, almost all irrigation schemes now have varying components of farmer involvement in O&M. The following section focuses on this region, which also has the highest rate of population growth and population densities and the lowest living standards in Ghana.³³

Participatory Irrigation Management in Ghana's Upper East Region

Large-scale Schemes

Ghana's two largest irrigation schemes, the Tono and Veia Irrigation Projects, are located in the UER. Both projects are managed by the Irrigation Company of the Upper Region (ICOUR), a semi-autonomous government agency, which is expected to increasingly commercialize its operations and become self-financing.³⁴ The irrigation management transfer (IMT) adopted by ICOUR aims at increasing the role of participating farmers in the operation of the projects. Village Committees (VCs) – composed of small-scale farmers – have been formed in all villages belonging to the two large-scale irrigation schemes. As of 1998, VCs were actively involved in land allocation and control and distribution of irrigation water. Training to actively participate in record-keeping, committee administration, debt recovery, literacy programs, tractor / power

31 Cf. Dittoh (1998).

32 Cf. Laube (2001).

33 Cf. IFAD (1999).

34 Cf. Dittoh (1998).

tiller-hire programs, and threshing floor construction was still deficient at the time. VCs decide on the allocation of irrigable land as well as on the quantity and timing of water releases into the sub-laterals. ICOUR only provides guidance to encourage equity and fairness, and allocates excess land to contract farmers. VCs are also responsible for cleaning sub-laterals, field drains and field bunds, while ICOUR is in charge of cleaning, maintenance and repair of the main canals. Since 1998, the United Nations Development Programme (UNDP) has supported an environmental rehabilitation program to improve catchment area protection. It consists of the development of tree nurseries, community tree-planting projects, and the planting of trees, shrubs and grasses in a 100 meter protected belt around dams.

According to an analysis by Dittoh³⁵, the Veia irrigation project has suffered from problems of poor leadership and mistrust between farmers and their leaders. As a consequence, many farmers have refused to pay fees for water and other services, and irrigation has been reduced. The Tono project does not seem to be affected by such problems. Little is known about the success of the environmental rehabilitation program. The tree survival rate is thought to be around 70 %, and soil degradation, water pollution due to sanitation problems, and high incidences of water-borne diseases remain prevalent in both project areas.

Small-scale Schemes

Many small-scale irrigation schemes based on earthen dams and dugouts also exist in the UER. Many were funded by a World Bank project, the Upper Region Agricultural Development Project (URADEP), which started out in the 1970s. While it appears that the majority of small-scale structures have broken down over time due to poor maintenance and resulting siltation problems, several donor agencies and government organizations are involved in the rehabilitation of these schemes and

in the construction of new ones. There is a clear trend towards the construction of small structures and the use of participatory approaches for management. According to Dittoh³⁶, about 75 - 90 % of rehabilitated small schemes are controlled by farmers. A major rehabilitation scheme in the UER is the IFAD-funded Land Conservation and Smallholder Rehabilitation Project (LACOSREP). In its first phase, LACOSREP rehabilitated a total of 44 dams and dugouts.³⁷ The program has recently started out on its second, so-called consolidation phase.

Currently, the WRC does not require small-scale schemes to apply for water-use licenses, as it is perceived that the total volume of water used by such schemes is small. However, if the plans to promote irrigation in Ghana and the trend towards small structures continue, it may become necessary to require licenses for such schemes.

The local-level unit of organization under participatory schemes is the water users association (WUA). WUAs are responsible for operation and maintenance of dams, allocation of land to WUA members and collection of water fees as well as for providing agricultural services on the sites. The Government of Ghana, through the Ghana Irrigation Development Authority, often provides supervision and takes care of the maintenance of head works, pumps, primary canals and other major structures. The executive body of the WUA, the Damsite Management Committee (DMC), ensures that these functions are carried out. The DMC is also responsible for conflict resolution and ensuring protection of the dam's catchment area. Figure 5 shows the structure and responsibilities of a typical water users association under the LACOSREP program.

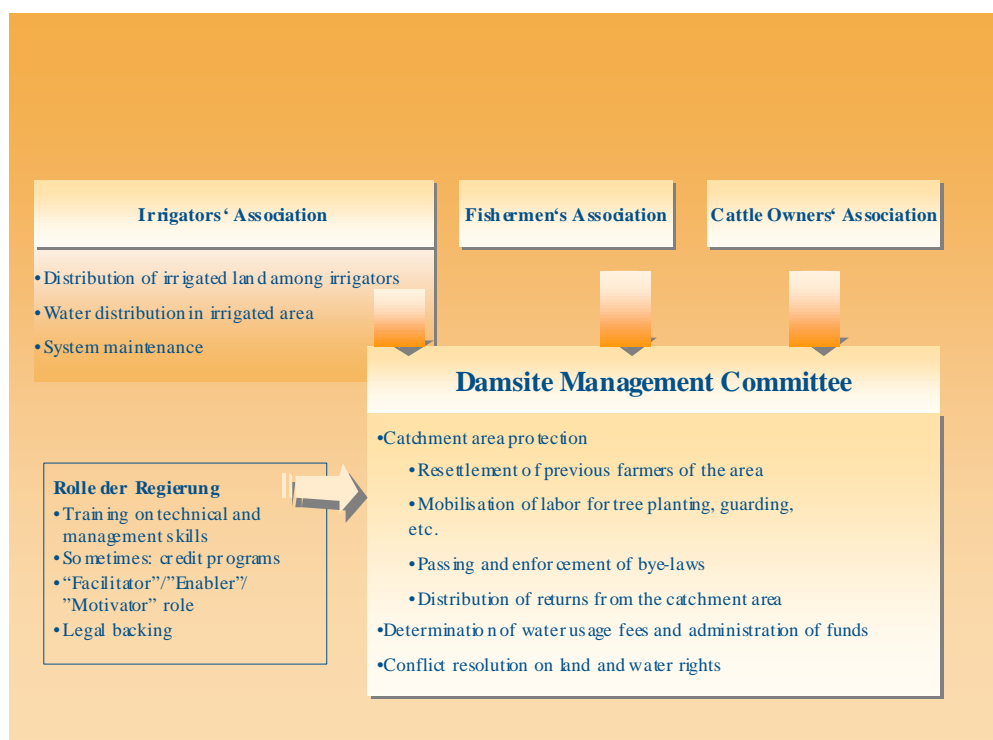
With assistance from the Ministry of Food and Agriculture and IDA, farmers have been involved in the planting of grasses on embankments and in protected belts. Attempts to prevent farming in the catchment areas have been made. However, due to land scarcity, population pressure, and poor definition of catchment areas, implementation of restric-

35 Cf. *ibid.*

36 Cf. *ibid.*

37 Cf. IFAD, 1999.

Figure 5: Structure and responsibilities of a water users association (using the example of the LACOSREP program)^a



Source: Engel, based on Ayariga (1993)

tions on farming in catchment areas has been difficult. Of the five schemes studied by Dittoh,³⁸ only one had an uncultivated catchment area. Soil degradation and water pollution caused by poor sanitation are also problems, but to a lesser degree than in larger schemes.³⁹

Determinants of Success of Participatory Approaches

The empirical evidence from Ghana's UER clearly shows that participatory approaches do not automatically lead to improved O&M of irrigation schemes. It is important to realize that participatory approaches imply significantly higher contributions of time and finances from farmers than more centralized approaches. Many aspects of participatory irrigation management require collective action on

the part of the members of local user groups. Examples include the distribution and financing of maintenance activities and the afforestation and protection of the catchment area. The fact that, in practice, differences can be observed in the degree to which communities succeed in these tasks leads to the following research question: What explains the different outcomes of participatory management across local user groups, and what policies can be used to improve these outcomes?

38 Cf. Dittoh (1998).

39 Cf. *ibid.*

Many aspects of participatory irrigation management exhibit characteristics of common pool resources.⁴⁰ The success of participatory approaches depends on whether the user group is able to *agree* on a set of *socially desirable* rules, and to *enforce* them. There are two potential ways to achieve this. First, in a hierarchical system, local leaders could take a decision. In this case, success will depend on whether these leaders act in the interest of the group and whether they have the institutional capacity (formal or informal) to enforce the decision. Potential problems arise in the form of political and economic considerations as well as corruption. Second, in a more democratic system agreement on a set of rules can be achieved through cooperation among user group members. These rules may either be self-enforcing or enforced by local leaders if – once again – they have the necessary backing in the form of formal legal or informal institutions. Free-riding and externalities are potential hurdles in the way of achieving such cooperation. Whether the problem takes on more of the first (hierarchical) or the second (democratic) form will depend on local conditions but also on the way in which the participatory scheme is set up by funding agencies. Most programs appear to aim at a democratic structure by including representatives from all potential stakeholder groups (farmers, women, landowners, livestock owners, etc.) in the formation of water users associations and by giving them equal weight in the decision-making process. However, little is known about the degree to which these externally imposed democratic structures will in fact endure in the long run, given the context of traditional hierarchical structures in Ghana.

Theoretical considerations and case studies in the field of the New Institutional Economics have led to a number of hypotheses about the conditions under which cooperation and collective action in the man-

agement of common-pool resources are more or less likely to emerge. Table 1 provides a classification of these determinants for the outcomes of participatory irrigation management. Potential policies and components of participatory programs that may influence these determinants are also shown. A few of these hypotheses will be discussed in more detail below.

A first class of determinants of the outcome of participatory irrigation management are those which relate to the community's awareness of the potential overuse and mismanagement of common-pool resources. In the case of small-scale irrigation schemes, the most problematic management aspect is the protection of the dam's catchment area. For this reason, most current programs aim to afforest the catchment area and prohibit agricultural activities in it. To achieve this, participatory programs like the LACOSREP emphasize education programs that aim to increase community awareness of the importance of protecting the catchment area for the sustainability of the irrigation system. However, it is important to point out that this approach is only likely to be successful where a lack of awareness is at the heart of the community's past failure to protect the catchment area. If, by contrast, other factors – i.e. the ones discussed below – are more important, education programs may not have much of an impact on the community's behavior.

A second class of determinants are those which determine the incentives and capacity for cooperation of individual water users within the community. One determinant which has attracted considerable attention in the literature is the number and the social homogeneity of resource users. It is generally hypothesized that cooperation is more likely to be achieved in smaller and more socially homogeneous groups. This could explain the trend towards smaller irrigation schemes in Ghana. Another factor in this class of determinants is the social capital of the community. The hypothesis is that communities where trust, leadership and altruism prevail are more successful at managing irrigation schemes than others. Participatory programs like LACOSREP are based on the idea that external actors like the government, NGOs or international donors can play a role in building social capital, i.e. by transfer-

40 Cf. Ostrom (1998). They define common-pool resources (CPRs) as systems that generate finite quantities of resource units, so that one person's use subtracts from the quantity of resource units available to others. Other authors use the term *local commons* instead (Baland / Platteau, 1996). Characteristics of CPRs are that they are typically large enough to allow for use by multiple actors and that efforts to exclude potential beneficiaries are costly.

ring partial responsibilities to local users, e.g. in the construction or rehabilitation stage, via workshops on leadership and cooperation.⁴¹ However, little is known about the success of these activities. Participatory programs like LACOSREP are centered on the idea of water users associations, which are in fact artificially created democratic structures. This raises the question of whether it is indeed possible to build democratic structures from the outside, in a context of strong traditional hierarchies.

A third class of potential factors determining the success of participatory irrigation management is related to the distribution of costs and benefits. The best democratic structures will not lead to cooperation if they are hampered by an unequal distribution of costs and benefits among different water users and between users and non-users of the resource. It is therefore important to understand the economic

41 Cf. Ayariga (1993).

Table 1: Hypothesized determinants of the outcomes of participatory irrigation management schemes and corresponding policy / program approaches

Hypothesized determinants	Program approaches
<p>Awareness of/ interest in resource within community</p> <ul style="list-style-type: none"> • Scarcity of resource • Visibility of resource and degradation • Importance of the resource conservation to people's livelihood • Existence of alternatives 	<p>Education / Awareness building "</p>
<p>Incentives and capacity for cooperation</p> <ul style="list-style-type: none"> • Number of resource users • Number of conflicting uses • Distribution of benefits and costs (see below) • Wealth endowments • Rate of time preference • Social capital • Leadership • Social heterogeneity • Prevailing norms • Past experiences with collective action • Past experiences with government programs policies • Formal and informal property rights (definition, security) 	<p>Location and size of schemes " Credit schemes Poverty alleviation, tenure reforms Participatory planning/construction? Location and size of schemes Involvement of NGOs, consistent Clear definition of rights, balance of rights and responsibilities</p>
<p>Distribution of benefits and costs of resource use and protection</p> <ul style="list-style-type: none"> • Level of investment required to make resource productive • Exit opportunities (alternative income, etc.) • Income inequality • Inequality in land holdings • Allocation rules chosen (endogenous) • Prices 	<p>Cost-sharing / technology transfer Market integration Tax policies, credit programs Land reforms, proposal of rules Proposal of rules Price policies, marketing</p>
<p>Potential for enforcement</p> <ul style="list-style-type: none"> • Size of resource • Clarity of definition of boundaries • Formal and informal property rights (definition, security) • Legal backing from higher-level agencies • Potential to exclude others • Community acceptance of executive body <ul style="list-style-type: none"> – Participation of community groups – Local hierarchies / power relationships – Leadership • Monitoring capacity 	<p>Scheme size Definition of catchment area Full transfer, adjustment Strong legal status of WUA, involvement of assemblymen, mediation Definition of property rights Involvement of all affected groups Involvement of traditional authorities Facilitation/ motivation/ training? External audits, technology transfer</p>
<p>Power structures / Information asymmetries</p>	
<p>Source: Engel, building on Rasmussen and Meinzen-Dick (1995), Knox and Meinzen-Dick (2001), Baland and Platteau (1996), Ostrom (1990), Vedeld (2000)</p>	

incentives for cooperation that prevail in a community. In the case of LACOSREP, it was found that protection of the catchment area from agricultural activities proved difficult if the farmers who had previously cultivated the area were not sufficiently compensated.⁴² As a consequence, the program recommends that these "displaced farmers" be given special consideration in the distribution of irrigated land. Similarly, the distribution of returns from the sale of goods extracted from the catchment area (i.e. fruits and grasses) is important for achieving cooperation. However, the water users associations themselves choose the rules governing distribution. Participatory programs can only provide advice on those rules that are most likely to achieve cooperation. Other options available to influence the distribution of costs and benefits from irrigation management include price policies, marketing programs and credit programs which are linked to legal and institutional reforms on the national level. If the rules are not enforced, cooperation on management and operation rules will not be sufficient to ensure the sustainability of irrigation schemes. A fifth class of potential determinants is therefore composed of the determinants related to the potential for enforcement. For example, one would expect better results where district assemblies formally support by-laws established by local water users associations. A lesson learned from LACOSREP's experience is that it is important to include local assemblymen early on in the decision process.⁴³ Similarly, experience shows that it is important to involve traditional authorities, like chiefs and lords of the land, since they have traditional authority over common-pool resources in the community (see Section 6). However, more research is needed on how programs can benefit from the structure of traditional authorities, without compromising the aim of a fair distribution of the costs and benefits of irrigation.

A final class of factors, which has received less attention in the past and is related to the issue of enforcement, is that of power structures and information asymmetries. If strong power imbalances

prevail at the community level, more decentralized approaches to irrigation management may lead to rent-seeking and corruption and may not achieve socially desirable results. Of course, similar problems exist in more centralized societies. Power imbalances are often enhanced by information asymmetries and vice versa. This leads us back to our earlier remarks on problems of corruption and distribution issues linked to the district and community levels. The article by Huppert and Renger in this volume presents interesting examples of how institutional design can help resolve these issues.

The discussion above illustrates that there are many factors that potentially influence the actual outcomes of participatory irrigation management schemes. While participatory programs have adopted design principles that appear to address these factors, little is known about their success. An improved understanding of the empirical importance of the various factors is required to improve program design and to concentrate public funds on those aspects that are most important. Moreover, the effect of many of the hypothesized factors on irrigation management appears ambiguous. In these cases, only rigorous empirical analysis can determine the actual effect of the various factors on irrigation management in the specific case of Ghana.⁴⁴

8 Conclusions and Issues for Future Research

This article is a first attempt at combining existing research projects at ZEF to describe the significant changes in water-related institutions currently taking place in Ghana and to analyze their potentials and difficulties. On the one hand, increasing water scarcity and conflicting water uses, both in Ghana and in its neighboring countries, have led to the establishment of a centralized national water management agency, the Water Resources Commission

42 Cf. Ayariga (1995).

43 Cf. *Ibid.*

44 The new project at ZEF mentioned earlier, which is funded by the Robert-Bosch Foundation, will conduct such an analysis based on econometrics and simulation models.

(WRC), with a mandate to distribute water use rights and pollution licenses among the country's water use sectors. On the other hand, Ghana has been pursuing a general policy of decentralization, including a devolution of authority to district and local level authorities, as well as a trend towards participatory approaches. Both types of reform have their advantages. Centralization of water allocation authority has the potential of providing an efficient and equitable allocation of water across sectors and to resolve externality problems associated with pollution and water scarcity. Devolution and participatory approaches potentially lead to improved water management at the local level. However, one of the major issues arising from the analysis is the way in which centralized and decentralized approaches can be coordinated to harness both these potentials. It is currently unclear how the new institutional set-up will ensure local-level compliance with sector-level water and pollution licenses. To address this issue, attempts are being made to involve district environmental committees and to build water management committees at the river basin level, though they are likely to be hampered by several factors.

First, environmental committees themselves function poorly. Second, little is known about how to set up River Basin Commissions to achieve an efficient water management and a fair distribution of water and pollution rights among different stakeholder groups. Third, the role and the sustainability of these new, externally imposed democratic structures in the context of strong informal rights held by traditional authorities remain unclear.

At the international level things become even more difficult. While the WRC has a mandate for international negotiations on water, there is a complete lack of comparable counterpart institutions in the other riparian countries. As water scarcity and the corresponding potential for international conflict grow, it is important that donor agencies facilitate comparable reforms in the riparian countries of the Volta Basin.

Analysis of participatory approaches for irrigation management at the community level has shown many parallels to the above issues. The perform-

ance of water users associations has been quite diverse, and the way in which these institutions can benefit from the enforcement powers of local authorities while ensuring a fair distribution of costs and benefits from water management remains unclear. An improved understanding of the factors that lead to different success levels would be useful to improve current programs. Moreover, the lessons learned from community level action can potentially provide useful insights for higher-level water policy issues (i.e. for the set-up of river basin management committees) and international cooperation. On the other hand, it would be important to gain a better understanding of *macro*- and *meso*-level water institutions in Ghana and their impact on local level decisions. The two ongoing research projects at ZEF will continue to analyze these issues.

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