Briefing Note

Effective Agricultural Water Management

Background

In many countries the shortage of freshwater resources is becoming a critical obstacle to economic development. An important aspect of this is the very high water consumption in agriculture compared to other sectors. The Briefing Note 'Water Scarcity and Agriculture' explores this in more detail. A consequence of this situation is the need to discuss and improve the **effectiveness** and **efficiency** of agricultural water management in the light of resource scarcity.

The **effectiveness** of water management – i.e. the extent to which targets are met – has in the past been measured mainly by the increase in agricultural yields. The main criterion of **efficiency** – i.e. the extent to which targets are met per unit of inputs applied – has therefore been land productivity. This productivity rose considerably in the wake of the **'green revolution'**. Irrigation, used in combination with high-yielding cereal varieties and increased application of fertiliser, has caused cereal yields in developing countries to double from an average of 1.5 tons per hectare to more than 3 tons per hectare. Because of irrigation, 20 per cent of the land under cereal production now yields 40 per cent of the global cereal harvest.

Under conditions of water scarcity, an increasingly important **efficiency criterion** is that of **water productivity** - i.e. the level of agricultural yields or value added per unit of water used.

Food crises and climate change have drawn international attention to the issue of water management in agriculture and rural development. There has been a significant increase in investment in these areas. Moreover, the rapid rise in foreign direct investment in Africa mainly involves irrigable land.

At the same time many irrigation schemes – especially large-scale projects in Africa – have attracted criticism. They are often regarded as too expensive, ecologically and socially questionable and inefficiently managed. On the other hand, appropriate agricultural water management schemes – irrigation projects among them – have proved highly effective in **increasing food security** and **reducing poverty**. In future the effectiveness of agricultural water management will in many countries have to be gauged also by the extent to which it helps to **limit water scarcity**.

One must ask how this challenge can be met and how the lessons of the past can be applied.

GIZ's position

In the light of these considerations GIZ's position is as follows:

1. **Substantive reorientation** of the approaches taken to promote agricultural water management in developing countries is essential. The latent conflicts of objectives between sustainable manage-

ment of scarce water resources, increasing national food production and reducing poverty in rural areas must be brought more clearly into focus. The effectiveness of water management in farming must in future be measured not just in terms of production increases but in the light of the specific objective priorities.

2. It must also be borne in mind that the allocation of scarce resources brings with it growing potential for conflict. In the context of effectiveness, therefore, it is important to aim for **equity** in the allocation of water both within agriculture and between agriculture and other sectors, such as the environment. The process must take account of existing foci of power and interest and of smallholder water users' needs.

3. The extensive experience of German and international development cooperation in the area of agricultural water management must be combined with information on important **trends and developments in rural areas**. These developments include the growing impact of the world food market on small-scale producers as a result of increasing globalisation, and shifts in demand towards higher-value products. Other trends include the wide diversification of farming methods practised by small farmers, migration to the cities and, linked to this, the feminisation of small-scale farming. In addition, the need for adaptation as a consequence of **climate change** must be considered.

4. It is important to consider the effectiveness of agricultural water management not only in terms of crop production but also livestock keeping and aquaculture.

5. A reorientation of perspectives is also called for in relation to the **technical and technological options** for effective and efficient water management in agriculture. The opportunities for technical modernisation and deployment of new technologies need to be considered in relation to the associated economic and regulatory requirements relating to the exploitation, conservation and allocation of scarce water resources. If this is not done, even the deployment of 'water-saving' technologies can have counterproductive effects and increase water consumption instead of reducing it (see Briefing Note 'Water-Saving Irrigation').

Action required

Substantive reorientation of water management in agriculture will be required in a number of ways. In addition, care must be taken to ensure that the design of interventions is context-specific. Action is also required in adapting measures to existing capacities in the area of water governance.

1. **Substantive reorientation of water management in farming**

In view of the increasing scarcity of land and water resources and the growing divide between agricultural and ecological water requirements, a system of **integrated land and water resource management (ILWRM)** will be needed. Such a system is based on a detailed survey and analysis of the existing land and water resources and their current and predicted use. With regard to water management, ILWRM takes account of the requirements of different sectors (water for agriculture, households, industry and ecosystems) in the **catchment areas and river basins** under consideration and attempts to strike a balance between them. The aim of ILWRM is to link the requirements of land and water management and to bring them together at local, regional and national level. An important aspect of this is the coherence of the provisions of land- and water-related law. Integrated approaches pose a particular challenge in that considerations of the effectiveness of the agricultural water management system no longer relate only to an individual farm or business or to an individual irrigation system; instead they must be assessed in the light of overarching regional planning objectives and the objectives of resource management in the catchment area.

A further change of emphasis involves utilising the entire range of options in the field of agricultural water management and not automatically equating agricultural water management with irrigation. In this context it is especially important to consider **rain-fed agriculture,** including in particular water-saving farming methods involving direct sowing, as well as opportunities for water-saving irrigation. The various methods of water harvesting and the use of flood recession farming also deserve greater attention, especially in Africa. Opportunities for **irrigated contract farming or outgrower schemes** will also need to be explored in more depth, especially in the environments of cities. Water use for **livestock keeping** and **aquaculture** also needs to be included, and integrated as appropriate, in measures to increase the effectiveness of agricultural water management.

In general, marketing and issues of **cost-effectiveness on farm and household levels** play an important part. In considering these aspects, the risk-avoidance strategies of small farmers must be taken into account, as must possible **opportunity costs** in comparison with other activities within and outside farming. External costs that could be incurred as a result of excessive resource use or soil- and water-related damage must be identified. In line with this, payments for environmental services in catchment areas are becoming increasingly important.

2. Context-specific design of interventions in agricultural water management

An increase in the effectiveness of water management in agriculture will need to be achieved primarily by paying particular attention to the **wide range of different contexts** in rural areas. The requirements of location-adapted agriculture are especially important in this respect. National strategies and advisory approaches must take account of sub-regional features of land and water resources, market proximity, local capacities for collective action and institutional conditions (zoning). In particular, participatory measures must be designed and adjusted to the local organisational capacities of water users. **Water user organisations** that are capable of functioning independently are very important in this context. Measures also need to be adapted in line with the trends and changes in rural areas outlined above. These measures impact on different regions in different ways. To deal with this diversity, various objectives and measures of effectiveness must be formulated and context-specific approaches must be adopted. As part of this variety, the role and organisation of agricultural water use in **fragile states** is set to become an important issue.

3. Adapting measures to existing capacities in the area of water governance

A viable strategy for agricultural water use must take account of the institutional capacities available for water governance – that is, for the exploitation, conservation and allocation of scarce water resources. These capacities include all the requisite political directives, laws, standards and rules and the necessary implementation bodies and mechanisms. It is important to challenge the mode of thinking that propagates technical or management-related approaches without reference to the associated need for institutional governance. Different options for agricultural water use make different demands on water governance. For example, rain-fed farming practised by individual farmers requires little institutional control of the water resources involved (apart from restrictions on the polluting of groundwater).

Individual small, decentralised systems for harvesting and storing water require only limited governance to regulate distribution between users. But extended schemes of such small storage systems entail a considerably increased need for regulation if adverse impacts on the catchment area are to be prevented. Large-scale irrigation systems or a multiplicity of small systems in one catchment further amplify the governance requirements. With regard to the allocation of water between different users, such large-scale or complex settings call for regulation within the systems, between different systems, between irrigation and other types of use and potentially between the usage requirements of different administrative districts.

Different approaches to the management of scarce water resources also entail different governance requirements. For example, establishing and enforcing water prices that are linked to the volume of water used, or rationing the allocation of water, require significantly greater governance capacities in terms of legal regulations and implementation mechanisms than tariffs that are simply based on area. Moreover, the governance requirements for the effective use of water pricing in irrigation are usually considerably underestimated.

In the light of all this there is a fundamental need for an **adaptive water management system** in agriculture that can align technical, technological and management-related approaches with the institutional capacities available in a specific situation.

Note: The Briefing Notes on water in agriculture form a set of three. The first deals with the issue of water scarcity in agriculture, providing a general view of agriculture as one of the principal water-using sectors. The second is concerned with effective water management in agriculture and the third explores aspects of water-saving irrigation in more detail.

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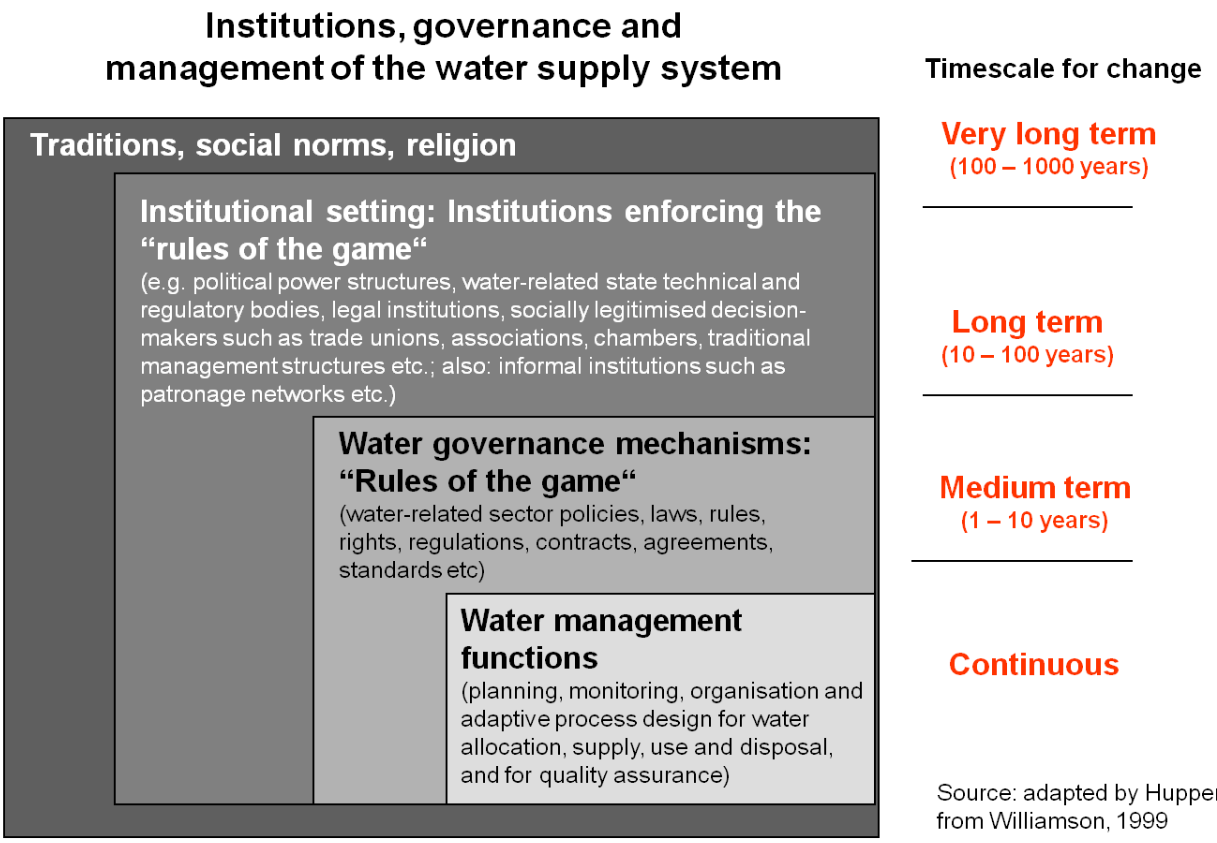
Illustration: Summary of the key aspects of water governance and the timescale for modifying them.



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