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Poverty Oriented Irrigation Policy in Kenya

Empirical Results and Suggestions for Reform

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Preface

"Re-engagement in irrigation" and "Re-engagement in infrastructure" were core messages of the World Bank's 2003 and 2004 Water Weeks. Thus the World Bank gave the signal for a new engagement of development partners in the field of irrigation, a field for which the International and Bilateral Development Co-operation (DC) had only given little attention some ten years ago.

However, do the development partners have really learned enough from the mistakes they made in the past to justify a re-engagement? Are the conditions in partner countries today really more favorable for successful irrigation than they were in the 1980s and 1990s, when most of such projects failed in many African countries? Can irrigation today help to mitigate poverty, even though irrigation projects have up to now benefited primarily farmers who were in any case better off? And can irrigation be sustainable in the first place, even in view of the fact that irrigation is one of the major causes of water scarcity?

The report is based on a study that focused on the above questions. It was prepared at a time when Kenya was already implementing its water sector reform under the Water Act 2002 while reform on irrigation policy was still underway. The report is expected to provide contributions towards the preparation of the anticipated irrigation policy especially on the aspects of poverty orientation and environmental sustainability. Against the background of a growing population and increasingly scarce water resources in Kenya, it is essential that both goals be reached if irrigated agriculture is, in the future, to be able to further contribute to the country's economic development and the wellbeing of its population.

The present report is a joint product of the German Development Institute (DIE), Egerton University (EgU, Njoro), and the Kenyan Ministry of Water and Irrigation, Irrigation and Drainage Department (MWI / IDD, Nairobi). The recommendations made here are based on the results of an empirical study conducted by a DIE Country Working Group (CWG) 2005-2006. The members of this interdisciplinary research group were Valeska Hesse (political scientist), Simone Iltgen (economist), Valérie Peters (sociologist), Antti Seelaff (agricultural economist), and Daniel Taras (economist). The CWG was headed by Dr.-agr. Susanne Neubert (DIE) and coordinated and supervised by Prof. Dr.-Ing. Japheth Onyando (Egerton University) and Eng. Wilfred Onchoke (MWI / IDD Nairobi).

The report is organized in two parts: The first part begins by focusing on the findings of the CWG study most relevant for the political sphere; and the second part then goes further to translate these findings into policy recommendations. The complete CWG study on irrigation in Kenya, which includes a conceptual section, background information, and the body of results and conclusions is set to be published in late 2007.

Dr. Susanne Neubert, May 2007

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Abbreviations

ASALs	Arid and Semi-Arid Lands
BCM	Billion Cubicmetres
BMZ	(German) Federal Ministry for Economic Cooperation and Development
BRWUA	Burguret River Water Users Association
CAAC	Catchment Area Advisory Committee
CAP	Center for Applied Policy Research
CGIAR	Consultative Group on International Agricultural Research
DANIDA	Danish International Development Agency
DC	Development Cooperation
DIE	Deutsches Institut für Entwicklungspolitik (German Development Institute)
DIO	District Irrigation Officer
EurepGAP	Euro-Retailer-Produce Working Group for Good Agricultural Practices
FC	Financial Cooperation
GDP	Gross Domestic Product
GNF	Global Nature Fund
GoK	Government of Kenya
GTZ	Gesellschaft für Technische Zusammenarbeit
ha	hectare
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
IDB	Irrigation and Drainage Branch
IDD	Irrigation and Drainage Department
IDPs	International Development Partners
IFAD	International Fund for Agricultural Development
ILECF	International Lake Environment Committee Foundation
IIMI	International Irrigation Management Institute
IPIA	Improving the performance of irrigation in Africa
IISD	International Institute for Sustainable Development
IWRM	Integrated Water Resources Management
IWUA	Irrigation Water User Association
JICA	Japanese International Cooperation Agency
KARI	Kenya Agricultural Research Institute
KFC	Kenya Flower Council
KfW	Kreditanstalt für Wiederaufbau
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KSh.	Kenyan Shilling
KWS	Kenya Wildlife Service
LNGG	Lake Naivasha Growers Group
MoA	Ministry of Agriculture
MWI	Ministry of Water and Irrigation
NEMA	National Environmental Management Authority
NETWAS	Network for Water and Sanitation
NGO	Nongovernmental Organization
NIB	National Irrigation Board
O&M	Operation and Maintenance

PIO	Provincial Irrigation Officer
PPP	Purchasing Power Parity
PRSP	Poverty Reduction Strategy Paper
RDA	Regional Development Authorities
RWUA	River Water User Association
SIDA	Swedish International Development Cooperation Agency
SSIU	Small Scale Irrigation Unit
TC	Technical Cooperation
UN	United Nations
UNEP	United Nations Development Program
WBIFP	World Bank Group – Finance and Private Sector Division
WCD	World Commission on Dams
WRM	Water Resource Management
WRMA	Water Resources Management Authority
WRUA	Water Resources User Association
WSS	Water Supply and Sanitation
WSTF	Water Services Trust Fund
WUA	Water User Association

Acknowledgement

The authors wish to take this opportunity to extend their heartfelt thanks to all those involved in the project. We owe particular thanks to Wilfred Onchoke and Japheth Onyando for their excellent consultation work and coordination, but also to Roland Werchota (Deutsche Gesellschaft für Technische Zusammenarbeit – GTZ) and other experts from DC organizations in Kenya for their substantive and organizational support. We further thank all of our interview partners, i. e. the staff members of the Ministry of Water and Irrigation and Ministry of Agriculture at the National, province and district levels together with the provincial administrations. Last but not least we are grateful to representatives of governmental and nongovernmental organizations as well as the water users for the support they offered to us.

Summary

The empirical findings of this report show that in Kenya irrigation decisively improves the life quality of the people concerned, in smallholder farms and governmental scheme households as well as in households of persons employed on commercial farms. As far as this overall assessment is concerned, differences between the different organizational types of irrigation are existent but they turn out to be smaller than expected. This also applies to the differences between population groups and provinces.

Today the most significant impact of irrigation in Kenya is a decisive raise in food security, followed by a raise in income and empowerment. The raise for the latter was most distinct for governmental schemes, because here the change from having almost no rights at all to having the opportunity for considerable participation in almost all management and marketing questions was anticipated as very pronounced by farmers. While food security is seen as the most important impact of irrigation in remote areas the income raise is the most important aspect on schemes in high potential areas. However, the raise in income is accompanied by high marketing risks for the agricultural products, and this is true for all sites and scheme types visited. Other poverty dimensions such as gender equality and health aspects are influenced in a two-edged way. While the women's workload grows significantly with the introduction of irrigation, their capability to contribute to the household income raises and thus also their status and say in the families. However modernization of irrigation systems lighten the workload again, from which women benefit most as they state.

Beside these positive effects of irrigation, the study shows that irrigation is more and more threatened by serious environmental problems. Some of these environmental problems are caused by irrigation itself, e. g. high water extractions and unsustainable agricultural practices on the schemes. Other problems are caused by general mismanagement such as deforestation and land overuse outside of schemes and also by external factors such as climate change. These factors impact together in a growing uneven water supply and in a dramatic increase of siltation of rivers, reservoirs and scheme canals. While these effects make irrigation less and less profitable at many sites the same factors cause, that irrigation becomes more and more necessary in order to achieve more yield security.

The competition on water resources is, along the results of our study, most serious around commercial schemes at Lake Naivasha but it exists also in other regions (e. g. around Mt. Kenya) along small water courses. There exist already many examples in which this competition results in more or less violent conflicts over water among commercial farms and the riparian population, upstream and downstream-users, and also farmers and wild animals. To resolve these increasing problems, it is essential — among others — to form new and to strengthen existing bottom up institutions such as River Water User Associations with a mandate for conflict resolution and prevention. Some very good examples already exist at several water courses around Mt. Kenya, which could serve as a model for new foundations of such Associations.

Summing up the study shows that irrigation has in fact a big poverty reduction potential but at the same time entails large environmental and social risks concerning the depletion of scarce water resources. Against the background that Kenya is struggling against both, a

deepening poverty problem and an increasing environmental problem, the results of the study lead to the conclusion, that on the one hand irrigation should be enhanced in this country to make use of its potential, but that on the other hand this must go together with a sound water demand and land management policy, which leads to a saving and efficient use of the scarce water and soil resources.

The legislative framework of such a new irrigation policy must therefore also take social and environmental issues into consideration. It can only be effective when water extractions will be systematically coordinated and water and land rights will be granted in a fair, efficient and saving manner. In addition it is necessary that the legislative framework will enforce the implementation of good agricultural practices and land conserving methods including afforestation. However, it is not possible anymore to separate the management of irrigation schemes from land use methods outside of schemes, in contrary, the efficiency of irrigation schemes depends strongly on land use practices in the whole country.

To achieve a sustainable water use in irrigation, it is not only necessary to enforce regulatory measures but also to give incentives so that farmers favor an economic way to deal with water. While in Kenya the Water Resources Management Authority (WRMA) and the Irrigation Department Division (IDD) are the most important entities for establishing such suitable regulatory framework, the creation of bottom up institutions is crucial for the practical implementation, in particular coordination of water uses, conflict management and local water extractions.

The policy analysis of this paper shows that in the last five years Kenya has made big progress not only in the institutional set-up but also in some conceptual ideas especially concerning the rewarding of water permits, the implementation of participatory approaches and the support of smallholder irrigation activities. In addition, the large governmental schemes under the National Irrigation Board (NIB) are currently under extensive reform, for which — at the end — full participation of farmers is envisaged.

Besides these promising changes, the success of the coming irrigation reform depends on the financial and personal capability as well as on the enforcement capacity of the new administrative bodies. In addition it depends also on the will of farmers to contribute to a sustainable use of water resources. While the analysis shows that the willingness to pay for water permits is given among most farmers, the readiness to pay for water as such (water charges) has still to be developed among most smallholders. Concerning commercial farms at Naivasha Lake the managers pretend their willingness to pay for water, even for water as such, as long as the government uses this money for environmental protection and supports them in keeping and/or creating a more suitable environment for investment and infrastructure.

But these encouraging results are counteracted by the financial situation of the WRMA, which must be seen as very difficult, particularly in 4–5 years from now, when the governmental subsidies will run out. Then the WRMA has to entirely finance itself through the receipts coming from the awarding of water permits etc. In this paper it is argued that this financial burden will hamper the necessary investments in environmental protection measures for most of which they are also responsible. Because of these

financial constraints the WRMA will not be able to realize these tasks and will also not have the capacity to employ and to train enough staff for enforcing the regulatory framework. If farmers will have to pay for water permits but won't see any progress in environmental protection measures, this will lead very quickly to a reliability loss of farmers vis-à-vis the administrative bodies. Since the commitment of farmers is one essential success factor for the reform, it is necessary to avoid this situation. This means at the end of the day, that much more money is needed and more financial sources are to be identified to ensure that WRMA can work effectively and can also implement its tasks defined by the government.

In addition, another issue is crucial for the success of the irrigation reform and this is the right combination of regulatory tools to achieve a good and saving water management at the river and lake basins. Increasing the efficiency of water use is usually extolled as the key to any sustainable irrigated agriculture. But it must be seen that as an isolated measure, efficient water use on farm level even increases the inequality of water distribution, because the raise in efficiency means that plants consume water more completely and that the drainage water which serves the downstream user will then be reduced. Thus increased use efficiency can lead to positive impacts for downstream users or for the waterbody concerned only if the absolute amount of water extracted is reduced considerably at the same time. Only in this way it is possible to reallocate the farm-level benefits to downstream users or to the waterbody itself.

To implement any sort of integrated water resources management, it is essential that at least part of the gains generated by increased water use efficiency of e. g. large commercial farms be made available to other water users as well as to the waterbody concerned. This can be effected using the following additional regulatory measures:

1. coupling efficiency increases with rules requiring a reduction of the absolute quantity of water extracted or limitation on the area of the land under cultivation;
2. support for the efforts of river and lake institutions to coordinate individual users;
3. enforce 90 days-storage, install water meters or gauges and apply other regulatory tools to achieve good water management.

In the last chapter of this paper recommendations are formulated in order to give the new irrigation policy a poverty and environment oriented shape, while – at the same time – making full use of the safe yield of water resources. A number of action-oriented suggestions concerning the most suitable regions for irrigation development, better access for poor farmers to credit and land rights etc. are given as well as recommendations concerning environmental protection measures, e. g. afforestation and the construction of water storage facilities as well as rainwater harvesting measures. It is hoped that some of the recommendations will find their way into the anticipated irrigation reform, in which also the German DC should become engaged. Some suggestions for how and in which fields this engagement could be useful are also given at the very last section of this paper.

PART I: Impacts of Irrigation on Poverty and the Environment in Kenya

1 Introduction

1.1 Objectives of the study

The objective of the study was to determine to what extent irrigation measures in Kenya presently contribute to poverty reduction and whether irrigation can be ecologically sustainable against the background of increasingly scarce water resources.

Kenya was selected because it is water-scarce and irrigation plays a relatively important role for national economic development. Kenya, like many African countries, has a complex irrigation history, which has to be reformed fundamentally in order to be successful in the future.

Due to the fact that poverty in Kenya is deepening in many places while at the same time the Gross Domestic Product (GDP) is growing (by 4,7 percent in 2006), Kenya obviously calls for a more poverty-oriented irrigation policy that enables the whole population to benefit from this technology.

Kenya is also known for its growing environmental problems due to overexploitation of lands and increasingly also due to effects of climate change. The task is therefore to formulate the new irrigation policy in such a way as to ensure that it has both a positive impact on reducing poverty and on ecological sustainability. The aim of the study is to provide a contribution to these ends.

Apart from these objectives, the study also had the aim of taking a closer look at, and possibly encouraging, the change of mindsets that has come about in DC organizations as regards irrigation. Depending on the results, further work bearing on the formulation of a new irrigation policy in general and support from German partners in particular can be initiated.

1.2 Background

In Kenya irrigation may be seen as both a major cause of and an important solution to the country's increasing water scarcity and water insecurity. On the one hand, irrigated agriculture in Kenya accounts for 76 percent of the water resources used (WRI 2003), and thus irrigation itself is aggravating water scarcity. On the other hand, expanding irrigation is one of the most important ways out of this situation, because in many locations rain-fed agriculture is no longer able to generate adequate yields.

1.2.1 Kenyan history of irrigation

Apart from the traditional small scale irrigation practices that have been ongoing in some areas in Kenya for the past 400 years, large scale irrigation schemes have also been in existence from the time of the colonial era. Farmers were forced to work in these large irrigation schemes, first as slaves in the 19th century and then as unpaid laborers during World War II. Well into the 1990s then, they worked as "free" but still dependent workers

on the large-scale irrigation schemes. Neither under colonial rule nor under government ownership did farmers have a say on management of the schemes or benefit from the produce.

Since 1966 these large-scale irrigation schemes have been managed by the National Irrigation Board (NIB), a government parastatal of the Ministry of Water and Irrigation (MWI). It is semi-autonomous and operates relatively independent of the Ministry. Up to the end of the 1990s the NIB schemes were centrally managed with farmers getting very little profits.

The end of the 1990s saw the collapse of all but one of the NIB irrigation schemes, some of which were even taken over and operated by the farmers. Partly because these schemes were already as good as unviable under NIB management, but also due to the limited managerial skills possessed by the farmers themselves, this attempt of individual management proved unsuccessful. By the year 2000 nearly all of these irrigation schemes were operating under capacity, or not operating at all. This raised a lot of concern and NIB, with the consent of the farmers, took over some management functions of the schemes based on an understanding with the farmers. While the NIB manages the irrigation structures, the farmers are responsible for land management and marketing. This restructuring process, which has yet to be completed, was coupled with a dramatic process of reorientation and reform which has changed the mindset of the farmers (see Ngigi 2003; NIB 2003). This modernization process is clearly noticeable in the NIB management system and there is hope of coexistence and sharing of responsibilities in the management of the schemes.

In 1977 the Small Scale Irrigation Unit (SSIU) was set up within the Ministry of Agriculture (MoA) to supplement the NIB. The task of the SSIU, which later became the Irrigation and Drainage Branch (IDB) in 1978, was to support the development of smallholder irrigation schemes. When this unit was transferred to the MWI, it continued to have the task of promoting smallholder schemes. Today the unit has the following two major responsibilities:

1. Water allocation systems regulated by big water contractors.
2. Irrigation schemes fully and independently managed by water user associations.

Furthermore, the so-called Regional Development Authorities (RDAs) were set up from the 1970s. The RDAs were given a far-reaching mandate for the development of their respective regions, including the development of irrigated agriculture. These authorities initially developed large, so-called public commercial schemes, and later went on to develop community-based irrigation systems, some of which are still in operation today.

The first purely commercial flower and vegetable farms, also based on irrigation systems, were set up in the late 1980s, mostly in the areas around Naivasha, Eldoret, Nanyuki, and Nairobi.

Keeping in mind what was mentioned in the previous section,[1] the irrigation schemes in Kenya can be categorized into three organizational types as follows, although clear distinction is difficult to discern:

a) Smallholder schemes. These are schemes of variable farm sizes, which are operated by water user groups or by farmers' organizations within the scheme. The produce from these schemes are used to meet subsistence demands as well as for domestic and export markets. At present there are approximately 2,500 such irrigation schemes covering an area of about 47,000 hectares, a figure that accounts for 46 percent of the total area under irrigation in Kenya (GoK s. a., 17). Approximately 47 percent of the active population in irrigated agriculture works in these schemes. The overall development of these schemes is undertaken by the Ministry of Water and Irrigation (Irrigation and Drainage Department – IDD of the Ministry of Water and Irrigation – MWI).[2]

b) NIB-managed large-scale schemes (NIB schemes). These schemes range from several hundred to several thousand hectares in size that produce for domestic and export markets. The National Irrigation Board (NIB) is responsible for their management and further development. About 90 percent of Kenya's rice is produced from NIB schemes. Today there are a total of seven such schemes covering an area of some 13,000 hectares. These schemes account for some 12 percent of Kenya's irrigated land, and about 12 percent of the farmers active in irrigated agriculture work there (Ngigi 1999, 42; GoK 2005, 58).

c) Commercial flower and vegetable farms. These are schemes with modernized irrigation facilities having a workforce of roughly 70,000 persons. They produce almost exclusively for export markets, and in the 1990s they earned large and growing profits. In all, the total area irrigated in this way amounts to some 42,800 hectares, roughly 42 percent of the land under irrigation in Kenya. These farms offer employment for about 41 percent of the population active in irrigated agriculture.

1.2.2 Today's challenges faced by the different types of irrigation

The interviews conducted showed that the challenges vary along the different types of irrigation. The core concerns of smallholder schemes are marketing problems and poor access to credits. What would be called for here are special lines of credit and creation of marketing cooperatives in order to enable farmers to achieve more market power and reduce marketing costs.

The crucial factors for NIB managed schemes comprise the consistent implementation of the present reform plans and effective cooperation between NIB management and farmers. Two key needs here are assigning to farmers' provisional land-use rights and building their capacity as well. Furthermore, one bottleneck for pump-supplied NIB managed schemes is the financial sustainability of the schemes.

1 See also Blank / Mutero / Murray-Rust (2002).

2 In addition to these figures there are also individual irrigation farmers who are not organized (in user associations) and were not included in this study.

Commercial schemes are mostly concerned with maintaining their international competitiveness. Commercial operators see effective transportation infrastructure, a reliable power supply, and an investment-friendly tax policy as the most important preconditions they need to be able to continue producing successfully. Particular attention needs to be paid to developing the national market, which, as the findings of our study indicate, has a larger future growth potential for vegetable crops than the export market.[3]

Moreover, representatives of all irrigation types attach great importance to secure access to water. Serious bottlenecks on several river courses and lakes are already causing problems for all forms of irrigation.[4] In particular, the declining water level of Lake Naivasha constitutes a problem of existential proportions for commercial farms and other water users near by.

The present study was conducted with immediate reference to the different organizational types of irrigation which exist in Kenya and the findings of the study have been analyzed accordingly.

1.2.3 The study's area (map)

The study was conducted in four different Provinces of Kenya: Nyanza, Rift Valley, Central and Eastern Provinces. The map showing the general location of the schemes is shown in Figure 1.[5] The criteria for selection of the sites were the following: water availability, poverty depth, current and planned future importance of irrigation, population groups (farmers – non farmers) and conflicts over water. Accordingly, the team has identified different characteristics for each of the criteria, e. g. very poor (Nyanza), and very rich (central) regions, very degraded areas (Rift Valley), very water scarce areas and has met population groups with different socio-cultural backgrounds (farmers, fishermen and herders). Hence, nearly the whole range of problems/successes could be observed.

1.2.4 Previous development cooperation engagement in the irrigation sector

Against the background of the successful history of irrigation in many Asian countries, many development experts may see the poverty-reduction impact of irrigation as self-evident for engagement in irrigation. However, "poverty reduction through irrigation" is in no way self-evident for African countries. In the past irrigation in Africa was frequently not sustainable, neither financially nor in social and ecological terms. Irrigation schemes also led to significantly smaller yields than expected in most locations and the overall technology was often not broadly and effectively adopted by the farming population. Moreover, the majority of irrigation projects supported by DC in African countries over the past decades operated poorly and quite often collapsed soon after handing over the projects.[6]

3 See Neubert et al. (forthcoming) for more information.

4 See the idem for more information.

5 All schemes visited are noted in table 5 in the appendix.

6 The history of irrigation in Kenya is described in further detail in Neubert et al. (forthcoming).

Figure 1: Map of Kenya and visited areas

Source: MWI (2004): The National Water Resources Management Strategy (NWRMS) 2005–2007, 3

These experiences led to a very dismissive mindset towards irrigated agriculture in Africa on the part of development partners, and in the 1990s DC withdrew almost completely from the irrigation sector in Africa. Since then, irrigation in Africa has been regarded as neither poverty-oriented nor socially or culturally viable, and in addition it was seen as financially and environmentally unsustainable. Therefore, in the last decade German DC rarely supported any schemes designed to expand irrigation.

However, this negative mindset has led to neglect the huge economic potentials offered in principle by irrigation, and it dismisses the fact that there are, beside irrigation if any then only very few other opportunities to raise incomes in rural areas. In addition, such an attitude fails to see that, far from being static, culture and society are dynamic elements that continue to develop, i. e. what is not compatible today can become compatible tomorrow.

What was really missing, when irrigated agriculture was abandoned by many development partners, was an analysis of the problems that led to the many failures of irrigation in Africa as opposed to Asia.[7] Otherwise, more emphasis would have been placed on the fact that the different ways in which irrigation is organized can have considerable influence on the development of irrigation. Whereas in Asia it is mainly smallholders who engage in irrigation, in Africa irrigation has largely been defined by large-scale structures. In fact, it was the large-scale schemes in Kenya that failed, and they are currently being reconstituted under different conditions and with a much more participatory focus. On closer examination we find that smallholder irrigation schemes have in fact not failed; indeed one can find both cases of successes and failures while the purely commercial irrigated farms in Kenya have even posted major economic gains over the past decade.

When the pro-poor growth debate was revived at the beginning of the 2000s, DC again started placing more emphasis on the need for economic growth to effectively reduce poverty in rural areas. The discussion focused in particular on the economic growth potential of irrigation and its great poverty reducing potential. Some development experts simply ignored the fact that many of these irrigation schemes had failed in the past. This they appear to have forgotten or never to have known. One reason for that appears to be that most of the experts involved in this pro-poor growth-discussion were development experts without agricultural background.

In parallel to this development, both partner countries and DC organizations had gone through learning processes concerning participatory irrigation management, and it came to be recognized that bottom-up institutions are of central importance for management and sustainability of the irrigation schemes.

It is thus not surprising that another reversal in the trend of development partners thinking has taken place in recent years, and that there is now again talk of re-engagement in irrigation (to cite the motto of the World Bank's Water Week 2004). Development partners are now again in a position to support rural water infrastructure projects, and now that the World Commission on Dams (WCD) has defined clear-cut criteria for such schemes, DC organizations are once again willing to venture also into this area.

This change of development partners' thinking coincides with an enormous increase in the need for irrigation in Kenya. We can cite the following reasons for this:

— In many regions water insecurity has risen sharply in recent years, and this means that rain-fed agriculture is forced to contend with incessantly growing production risks. In many locations agriculture is no longer possible without irrigation.

7 In the meantime, analyses of the of NIB scheme failures in Kenya have become available (see PMU-Kenya 2004; Blank / Mutero / Murray-Rust 2002), although they make no comparison with Asia.

– Climate change is leading to rising variability of precipitation events, and both droughts and floods are occurring more frequently. In addition, the advanced state of deforestation of catchment areas as well as unsustainable land-use methods compound the effects of climate change by impairing the buffering capacity of vegetation, i. e. its ability to absorb precipitation. In addition to efforts to combat the causes, the only way to come to effective grips with these impacts is to implement both water infrastructure measures such as rainwater harvesting measures and construction of water reservoirs and irrigation measures. Only in this way will it be possible to restabilize water supply.
– Population growth and increasing pressure on the land call for an increasingly intensive cultivation. One key productivity factor here is a stable water supply, not only in regions with high agricultural potential but also in arid and semi-arid lands (ASALs), which need to feed a steadily increasing population.

The learning processes in partner countries and development partner organizations mentioned above may be summarized as follows:

1. It has been recognized that expanding irrigated agriculture often represents the only possibility of achieving broadly effective economic development in rural regions. In other words, irrigation can both generate sustainable livelihoods and boost economic growth (pro-poor growth).
2. Irrigation can be socially and culturally compatible if it is adapted to the locality and given a participatory orientation.
3. A new irrigation policy must be environmentally sustainable, otherwise it has no future. A sustainable irrigation policy must therefore be based on an integrated water resources management policy and good water governance if it is to achieve the aims mentioned above.

The implementation of the water sector reform in Kenya with its new perspective and shift in priorities has sparked a renewed interest on the part of international development partners in promoting irrigated agriculture. The role that development partner organizations envisage to play in this sector is yet to be clearly defined.

2 Methodology

2.1 Conceptual framework of the study

The study was conceptualized on a multidimensional understanding of poverty and the selected dimensions were “life quality, gender equality, health effects, work burden, empowerment, income, food security and conflicts”. Environmental indicators were also selected from which the indicators “soil quality” and “changes in biodiversity” were surveyed together with the poverty indicators on farm level.[8] The results displayed in Figure 2 (section 3) show the levels of the different indicators, broken down into the different forms in which irrigation is organized. Each curve depicts the changes that the interviewees see as having occurred since the introduction of irrigation. The rating values

8 For methodological details see Neubert et al. (forthcoming).

range from –2 (very negative change) and 0 (no change) to +2 (very positive change); these must thus be seen as relative values over time.

While the quantitative data analysis was conducted using EXCEL, the qualitative analysis was performed with help of Atlas.ti. In the framework of two workshops the results were then discussed with experts from Egerton University, and with key stakeholders of Kenyan Ministries, administrations, and development partners. The comments from these workshops were incorporated in the final report. In addition, information from relevant literature was included in the analysis.

2.2 Empirical basis of the study

The study was based on intense cooperation between the six members of the DIE team and their Kenyan partners from the Ministry of Water and Irrigation and Egerton University. In the course of the three-months research sojourn in Kenya, a total of 107 interviews were conducted, 32 of them were focused group discussions and 75 were either one-to-one or small-group interviews.

Group discussions were conducted with Water User Associations (WUAs) and farmer committees on the irrigation schemes, with 15 to 70 farmers participating in each session. Between 600-700 farmers were sampled with this tool. With a view to giving due consideration to the situation of downstream riparians and other water users beyond those involved in irrigation, a systematic study (transect) was conducted along two water courses in the Ewaso Ng'iro catchment. Here the team interviewed various water users as well as the members of a river water user association (RWUA) that focuses on the entire course of the river and the uses to which it is put (roughly 12 interviews).

In addition, the team conducted around 35 background interviews at the district, provincial, and national levels, including interviews with decision-makers from the relevant institutions at the national level (MWI, NIB, MoA, NEMA, KWS, among others) as well as with experts from research institutes and nongovernmental organizations (Tegemeo, KARI, KIPPRA, Egerton University, Kickstart, NETWAS, among others). Representatives of DC organizations were also among the interview partners (GTZ, KfW, JICA, Danida, SIDA, Dutch Embassy). Interviews were also conducted at the regional level with the expert staff responsible for irrigation at the different provincial, catchment, and district levels (provincial and district irrigation officers, regional development authorities / CAACs, WRMAs).

The research team visited a total of 32 irrigation schemes. Both management boards and farmers were interviewed on each scheme. On the commercial flower and vegetable farms, interviews with management as well as with workers and their representatives were conducted. Of the 32 schemes visited, 23 were organized by smallholders, 4 were NIB schemes, and 5 were commercial flower and/or vegetable farms. Overall, the schemes visited varied substantially in size (from less than 10 to several thousand hectares).[9]

9 See the list of visited schemes in the appendix.

The group discussions on the irrigation schemes were typically divided into two phases. The first phase served to examine poverty indicators on the basis of a largely standardized method. The second phase was used to collect qualitative information on the organization and functional capacity as well as the modernization and side-effects of the schemes concerned. Semi-structured interview guidelines were used for this purpose.

3 Results of the study

3.1 Poverty-reduction impacts of irrigation in Kenya

3.1.1 Overview

According to the empirical data, irrigation decisively improves the life situations of the people concerned, both in smallholder households and in the households of persons employed on commercial farms (see Figure 2).[10] As far as this overall assessment is concerned, the differences found between the organizational types of irrigation turned out to be smaller than expected. This also applies to the differences noted between population groups and provinces. Traditionally nomadic populations (here Massai and Pokot) have also adopted a very positive view of irrigation; no pronounced cultural barriers were noted.

3.1.2 Impact of irrigation on food security

According to water users, the most positive impact of irrigation compared to rain-fed agriculture is the improved food security. The interviewees indicated that to realize this, there is need for reliable water supply which also serves to lengthen the growing season. However, since many rivers have very low water levels during the dry season irrigation at that time is only possible in cases where there is sufficient water i. e., in areas served by perennial rivers (many rivers e. g., in the area around Mt. Kenya have sufficient water only during the rainy season).[11] All interviewees noted that the diversification of farming that accompanies irrigation (cultivation of more vegetables) leads to qualitative improvements in household nutrition. The aspect of food security is particularly important for poor and rural-based population, especially pastoralists in remote areas who are exposed to high risk of drought.

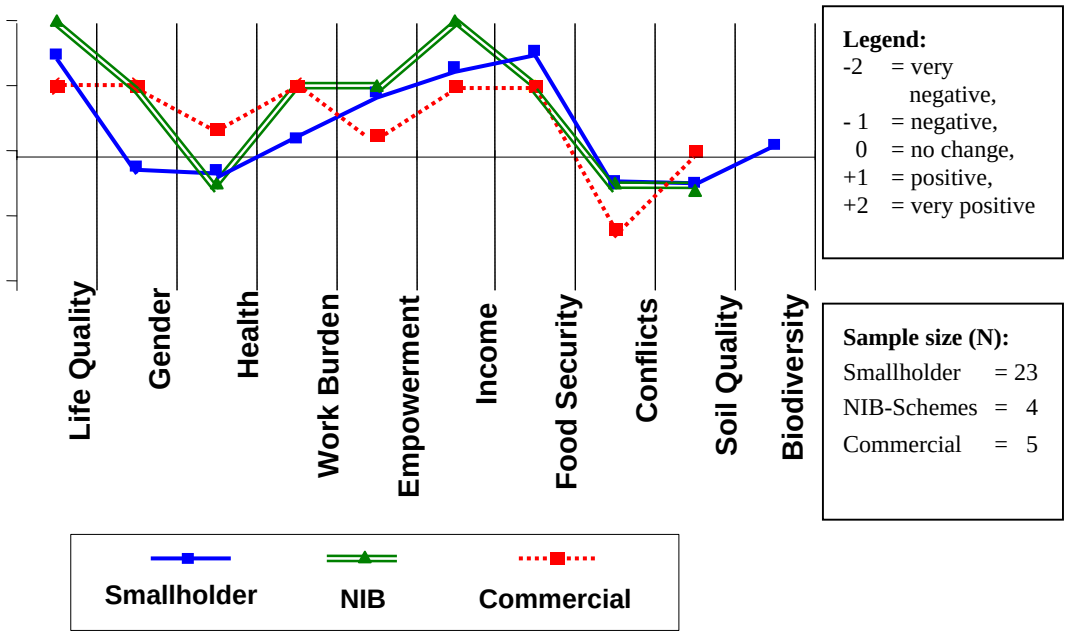
3.1.3 Impact of irrigation on income generation

Irrigation is also rated positively by water users with regard to income generation, well-being, and empowerment. Farmers indicate that in most cases household incomes have doubled, and in some cases even trebled, thanks to irrigation. Moreover, the introduction

10 The empirical variance of statements and more pronounced distinctions are discussed in Neubert et al. (forthcoming).

11 The risks associated with this situation are discussed further below.

Figure 2: Poverty-reduction impacts of irrigation, broken down by organizational type



of irrigation is frequently reported to entail other positive secondary impacts (better access to both drinking water and to watering points).[12]Workers in larger commercial farms may further benefit from the additional non-monetary services such as schools and health facilities made available to them.

The greatest income risk noted by interviewees found and in all irrigation types is associated with the marketing of their products.[13] Smallholders in particular are affected by these marketing problems; indeed, poor infrastructure and transportation conditions often make it very difficult for them to gain access to markets at all. Intermediaries (middlemen) also pay farmers very low — or as farmers themselves put it — unfair prices. It is also very difficult for smallholders to gain access to market information, or the information they receive are unreliable and prices tend to change very quickly. The NIB schemes and big commercial farms furthermore see themselves increasingly confronted with marketing problems. The cheap rice on the world market depresses domestic prices and poor infrastructure makes it difficult for flower and vegetable producers to get their products to airports in time, a factor that undercuts their international competitiveness (see also Muendo / Tschirley 2004 and Muendo / Weber 2004).

On the other hand, for many of the interview partners, the other poverty indicators, “health, gender, soil quality and conflicts,” have tended to be negatively impacted on by irrigation. While the positive and negative impacts on the indicators health and gender

12 This may, however, pose health risks because of the poor quality of irrigation water.

13 The details of marketing problems will be discussed further in the CWG study.

nearly neutralize each other, the impacts on soil quality are more often negative than positive while the effects on conflict are even more negative.[14]

3.1.4 Impact of irrigation on health

Negative effects of irrigation on health result from the increased use of pesticides, a practice usually associated with the cultivation of irrigated crops (vegetables). Since the most smallholders, but also the farmers on NIB schemes, have little know-how concerning the use of pesticides and almost never wear protective clothing, they are far more exposed to such health risks than workers on commercial farms. The increased health risks associated with irrigation are, however, compensated in part by other positive health effects. These are due to the more diversified and healthier food typically available when more vegetables are grown and consumed, thanks to irrigation. Many smallholders, but also farmers in NIB schemes, reported that the higher incomes they have earned since the introduction of irrigation have improved their access to health services and made it possible for them to get medication.

3.1.5 Impact of irrigation on Gender equality

The intensification of agricultural production, that goes hand in hand with irrigation, results in considerably more work for smallholder households. As reported by our interviewees, the greater share of this extra work is done by women. This increases their day-to-day workload and is, accordingly, reflected in a slightly negative trend on the gender indicator. On the other hand, the introduction of irrigation often facilitates access to drinking water, and this in turn reduces women's workload with regard to fetching water. If women also organize the marketing of products, this factor of course differed from one population group to another, then irrigation in effect ends up encouraging women to gain more independence from men, a development that was rated positively.

Women benefit disproportionately from the modernization of irrigation systems because this as a rule eases their workloads compared to conventional irrigation schemes.

Women were consistently underrepresented in water user groups. In certain cases, e. g. on a Massai irrigation project, the World Bank has introduced a system of quotas designed to increase women's participation. For the Massai, adhering to these rules and giving women a greater say in decision-making no longer appeared to constitute a problem.

3.1.6 Social conflicts associated with irrigation

Conflict types, causes, and differences between irrigation types

Conflicts over water in Kenya have already had significant social and economic effects on the population along the water sources prone to conflicts (Kiteme / Gikonyo 2002, 334;

14 The effects on conflict and soil quality will be treated in a later section.

interview: BRWUA, Central Province). In our study, the main focus was on conflicts over water in which irrigating farmers are involved. There is no doubt that the absence of conflicts is a vital prerequisite for any positive effect of a development initiative, on the welfare situation of farmers in irrigation agriculture as well as on other water users.

In the interviews conducted by the study team, farmers in irrigation agriculture experienced the negative effects of water-related conflicts in several ways – be it verbal or physical conflicts. These conflicts have severe effects on the every day life of the people concerned, both because of the fear of the conflicts (social burden of conflict) and because of physical threat and the consequences thereof (physical burden of conflict).

Water-related conflicts tend to increase appreciably as more use is made of irrigation; this goes for conflicts between upstream and downstream users, between socio-professional groups, between groups and individuals within irrigation schemes, and between irrigation water users and non-users. Conflicts tend to develop in particular during the dry season, when rivers have low flows. Any additional abstraction of water for irrigation purposes then tends to lead directly to water shortages downstream (see e. g. NETWAS, 2005, 8). Conflicts may emerge in particular if farmers ignore upstream rules – e. g. rules banning daytime irrigation in order to ensure that downstream users have enough water for their basic needs – or if there are no rules at all in place designed to equitably allocate water in times of scarcity (PMU–Kenya, 2004).

As a general rule, pastoralists tend to be found on the lower reaches of rivers, while settled farmers tend to be located on the upper reaches. Apart from the political discrimination that pastoralists tend to experience in Kenya, they are also in most cases disadvantaged in terms of access to resources. If water becomes scarce on the lower reaches of a river, pastoralists tend to migrate upstream in search of food and water. If they encounter the farming population settled there, and if the latter is unwilling to reduce the amounts of water it is abstracting, pastoralists may respond by destroying feeder canals, as recently happened on the Tambuzi Farm, Central Province. Their cattle may destroy farmers' crops or cropland through trampling, especially in cases where no corridors have been left to enable cattle access the river.

Similar conflicts over water occur in all types of irrigation schemes, although the present study indicates that they occur most frequently between commercial farms and the sedentary farming population. In such circumstances conflicts tend to be less open and less violent, which doesn't mean that they are also less serious. The likelihood for open conflicts over water with private commercial schemes is relatively low due to their high political leverage and lobby in comparison to other water users. Private commercial farms can exert more influence on governmental organisations both at local and national levels in comparison to individual water users or smallholder farmers. This is due to their significant role in the local and national economy (employment, export earnings, tax revenues). In addition, they have high security arrangements within and around their schemes that enable them to reduce possibilities of confrontation.

The most common and immediate causes of violent conflicts as revealed by the study are illegal and excessive water abstraction practices, especially during dry seasons, ineffective or lack of regulations on water abstraction, inefficient irrigation techniques, and inadequate communication channels between upstream and downstream users. Here

ethnicity plays at best a subordinate role, even though differences in language, lifestyle, and group affiliation[15] may well increase the potential for violent conflict.

Water conflicts may emerge not only between different water users but also between different irrigation schemes (e. g. Gem Rae and Awach irrigation schemes), or indeed even within irrigation schemes themselves (West Kano irrigation scheme). The most frequent cause is unequal water allocation within and between irrigation schemes. This may be due to technical problems (e. g. declining water pressure), or it may result from social causes (e. g. if an irrigation system is used by more people than it was originally planned for – a case given in most irrigation schemes).[16]

Water scarcity has also been seen as responsible for the frequent and increasing immigration of wild animals and humans into irrigation areas (Central Provinces, Nyanza). Wild animals likewise tend to migrate upstream when looking for water in cases where the river dries downstream, and in the process they may destroy irrigation infrastructure together with crops.

Conflict-resolution mechanisms

Most of the conflicts reported were resolved through negotiations between the parties at the local level and by agreeing to adopt and enforce rules, e. g. on certain irrigation times. Ground-up institutions play a central role in coming up with such arrangements. Institutions of this kind would include Irrigation Water User Associations (IWUAs), which focus on water allocation within irrigation schemes, Water Resources User Associations (WRUAs), which ensure that water allocation and abstractions are done according to regulations, and River Water User Associations (RWUAs), which monitor abstractions along a river course to ensure that water users adhere to permit conditions (see also GoK 2005, 45).[17] In certain cases, provincial administration at local level together with interest groups, individuals and representatives of different water user groups have collectively formed a front to address specific conflict cases. Such an arrangement can be very effective as it comprises a number of stakeholders. They in fact succeeded in settling several conflicts and disputes.

Aeschebacher (2003), however, sees only RWUAs as having the potential to resolve more deep-seated water-use conflicts, e. g. in the Ewaso Ng'iro Basin (Naro Moru). RWUAs have both an overview of water abstraction along river courses and the mandate to enforce rules and regulations. This often enables them to observe and control new abstractions and violations of rules at an earlier stage than official government institutions (see Thomas, 2001).

In the meantime, though, individual water users in possession of portable, diesel-driven pumps have aggravated water abstraction problems. In many rivers the amounts of water they abstract are a major contribution to or the main factor responsible for the depletion of

15 Or language; ethnic divisions tend to be defined along language lines.

16 See Neubert et al. (forthcoming) for further information.

17 *"The [Water] Act provides a role for community groups, organized as water resources users associations, in the management of water resources. Section 15(5) states that these associations will act as fora for conflict resolution and cooperative management of water resources."* (Mumma 2005, 5-4).

water resources on small rivers, e. g. the Naro Moro River in Central province, where abstraction of this kind accounts for over 80 percent of all water abstracted from such rivers (Aeschenbacher 2003, 2). In the future, RWUAs will have the task of registering individual users and setting limits on the amounts of water they are allowed to abstract.

Even though the establishment of such bottom-up institutions has served to satisfactorily resolve a good number of conflicts, more equitable allocation and more efficient use of water resources will, in the future, although certainly be able to fully compensate for steadily increasing abstractions. What is really needed here are efforts to appreciably reduce water extraction in a number of waterbodies. For example, discussions are underway in Lake Naivasha on case-by-case restrictions on irrigation, including farm relocations.

3.1.7 Differences in poverty-reduction impacts for individual types of irrigation

Commercial schemes

While the commercial schemes on one hand, score higher than the other irrigation types in the indicators gender, health, and workload, they do have lower scores in the indicators food security, quality of life, income, and empowerment on the other hand. These differences are considered in greater detail below.

All certified farms have relatively high labor and production standards that guarantee relatively safe and good working conditions, regular incomes, and a workforce say in company management. Although incomes are low in relation to the needs of the workers, they are however in line with the minimum wage of 100 KSh/day (or sometimes slightly higher). Regularity of wage payments and – in most cases – job security are factors that need to be clearly addressed.

Unlike the case of smallholder schemes, which are intended to address food requirements as well, workers on commercial farms must use their incomes to secure their food needs. Because incomes on commercial farms are low and not enough to meet the food requirements of a given household, it is difficult or even impossible to base food security on such income alone. Assuming that harvests are good and products properly marketed, incomes (after food costs) from smallholder schemes must be estimated to be far higher than those available to the household of a commercial farm worker. The commercial farm worker's advantage over the smallholder farmer must be seen in greater income security as well as in somewhat better access to nonmonetary services (health services, schools, etc.).[18]

As already mentioned, commercial farms scored higher on the indicators health, gender, and workload than the other irrigation types. Commercial farms typically use modern

18 Even though workers on commercial farms do have a say in farm management, the dependent labor performed by these workers is far less self-determined than the work performed by farmers on smallholder irrigation schemes. The interviewees were aware of this difference, and it is reflected in lower values on this indicator.

production and management methods with a view to bolstering their competitiveness and complying with export standards patterned by the Euro-Retailer-Produce Working Group for Good Agricultural Practices (EurepGap). Certified farms are obliged to meet certain working and production conditions in order to qualify for membership in their business association (Kenyan Flower Council, KFC) or, beyond membership, to qualify for certain awards.[19] In all, the commercial farms that were visited generally adhered to relatively high standards.

Most commercial farms engage in integrated plant protection in order to meet the strict regulations on residues. This means that fewer toxic pesticides are used and that pest control is geared to specific damage thresholds. Furthermore, workers are required to wear protective clothing and workers who apply pesticides are given periodic medical checkups. Workers are therefore not overly concerned about possible effects on their health. The situation is different with smallholders. According to their own reports, they know little about pesticides and normally wear no protective clothing.

In the past, commercial flower and vegetable farms were known as places where female workers were often victims of sexual harassment by superiors (foremen). But according to reports of works councils, this situation has improved significantly in recent years. Commercial farms have set up complaints units, hired more female supervisory personnel, and conducted in-company awareness campaigns. Reports indicate that while this problem has yet to be solved completely, it plays a far smaller role today than it did in the past. In addition, commercial farms have maternity protection arrangements in place and women are not required to apply pesticides. Commercial farms have also adopted regulations on maximum working times.

NIB schemes

In view of the fact that NIB is undergoing a reform process that will take some time to complete, it is not yet possible to make any final assessment regarding the future viability of NIB schemes. However, the approach adopted for rehabilitating the schemes, the division of responsibilities between management and farmers, and the openness and resolution usually noted among both management and farmers when they discuss the reforms must be seen as reasons for cautious optimism.[20]

In recent years the reform process has given farmers considerably more responsibility, and opportunities to share in profits. This has meant that in most schemes farmers and/or farmer committees are themselves responsible for the organization of land management and, in part, for marketing as well. Only the large components of irrigation infrastructure (pump systems and primary structures) continue to be managed by the NIB. This positive development is clearly reflected by the empowerment indicator, as shown in Figure 1. The overall curve shows that in the eyes of farmers the poverty-reduction impacts of the NIB schemes are in no way inferior to those of the smallholder schemes. In connection with the

19 All of the schemes we visited were certified farms; 80 percent of the cut-flower farms in Kenya are certified. There are certainly also poorly managed commercial farms in Kenya; these are for the most part not association members. However, this also includes farms that meet standards, even though their products are marketed under other labels.

20 See the extensive report for more information.

reform process, the life situations of farmers on NIB schemes are increasingly converging with the situations of smallholders.

However, there are still several differences that place farmers in NIB schemes in a disadvantaged position as compared to smallholders:

1. To date farmers in NIB schemes have neither secured land nor land-use titles of their own. This makes it more difficult for them to invest in land and it places them in a generally more insecure situation. Also, without land rights farmers have no access to credit. If, as on the NIB scheme in West Kano, land is merely leased to farmers as "trust land," these farmers are not creditworthy, even if one and the same family has cultivated the land for several generations. Even though the NIB has no mandate to assign land titles, the institution is giving some thought to the possibility of assigning provisional land-use titles: *"…to improve this situation, NIB soon will come up with some kind of entitlement to the farmers…"* (interview: NIB Management, West Kano, 2006).
2. It is noted that farmers on NIB schemes still have retained some dependence on the NIB management. This is because of the sheer size of the NIB schemes as well as the fact that farmers – many of whom were resettled to NIB schemes – often lack sufficient management skills and know-how. The NIB structure still continue in part to be responsible for many segments of the work on these schemes (e. g. contracted machine land tilling) as well as for marketing, even though farmers in fact have the right to conduct these activities on their own.[21] Individual farmers have considerably less market power and higher marketing costs than the NIB schemes, which, using contracted services, are able to calculate on the basis of secure prices. Here too, smallholders still lack the marketing cooperatives and access to market information they would need to achieve good prices.[22]

One problem that can be approached only together with NIB management and investors – and not by smallholders themselves – is the lack of financial sustainability of pump-driven systems, some of which are in urgent need for technical modernization (renewal of pump systems). Pumping operations are highly energy-intensive and costly, and they can only prove viable if crop yield levels (especially of rice) are significantly increased. In addition, the water-use efficiency of these systems is very low. What is needed to raise the profitability of these schemes is suitable water and land management. This means that the farmers are in need of improved technical extension services. NIB management would at the same time need to improve the maintenance of its schemes and increase the charges for O&M, some of which are very low (in Mwea e. g. they amount to about 2 percent of farmer incomes). Another possibility would be to enable farmers to take over an additional share of these maintenance tasks themselves.

Furthermore, marketing must be improved to increase the viability of the schemes. Farmers would need to form marketing cooperatives and to organize them in such a way as to preclude embezzlement of scheme funds.[23] At the same time, the NIB would need to

21 The reform process has made more headway on some projects than others; see Neubert et al. (forthcoming).

22 See Neubert et al. (forthcoming) for more information.

23 The farmers (also at the smallholder level) have had bad experiences with marketing cooperatives, and embezzlement of cooperative funds etc. was widespread. Farmers are for this reason very wary and discouraged when it comes to forming new cooperatives. Since there are no serious alternatives to

provide farmers with better access to market information. Last but not least, the sustainability of NIB schemes will depend to a large extent on how rice prices develop in the world market. At present only basmati rice appears to be achieving good prices in Kenya, and cheap imported rice is flooding into the country.

Smallholder schemes

The main impact of smallholder schemes must be seen in the improvement in overall quality of life and food security which they entail. However, income increases due to irrigation differ quite substantially from scheme to scheme;[24] basically this is closely coupled with the marketing options open to specific schemes. Smallholders often complain of lack of infrastructure and bargaining power when it comes to dealing with intermediaries (middlemen). Smallholders lack the organizational capacity they need to set up functioning marketing cooperatives.

The health-related effects of irrigation have two different aspects. These are on one hand the negative effects generated by the uncontrolled use of pesticides, and on the other hand the positive effects comprising mainly improved nutrition for children. Those responsible for handling pesticides (men)[25] feel neglected. Most of them have no knowledge regarding good plant protection practice, i. e. they are often unaware of the types of diseases they are dealing with, which pesticides they need to apply in what doses, when and how applications are indicated, and what other options are available. For example, farmers are unaware that fungal diseases, which frequently occur with irrigation, are best addressed by preventive means and that fungicides are quite ineffective through curative measures. Instead of applying less water or changing rotation patterns, farmers often spray fungicides, which then prove ineffective. This leads to high costs and crop losses. Biological methods of plant protection and soil-conserving cropping methods are largely unknown to them.

The fact that irrigation is a community task that requires the establishment of WUAs serves to raise farmers' degree of organization, organizational capacity, and feeling of togetherness. To some extent, this improvement in organizational capacity entails spillover effects with positive impacts on other areas of life (especially for women). If cooperation with the authorities functions smoothly, farmers will have more trust in institutions. In all of the smallholder schemes visited seemed to exist a good and trusting relationship between farmers and district irrigation officers (DIOs).

Irrigation on smallholder schemes inevitably entails increases in working hours. However, our interviewees typically did not perceive this to be an increased workload in the sense of a heavier burden. All interviewees stated that the benefits achieved through irrigation are so manifold (i. e. their opportunity costs are so low) that they are perfectly willing to accept the additional work, which they see as wholly worthwhile. Furthermore, increased revenues often even permit small farms to hire wage laborers to do the extra work that

marketing on the basis of cooperatives, it is imperative that mechanisms be found to increase their workability and integrity.

24 For further details regarding the empirical variance of results see Neubert et al. (forthcoming).

25 All smallholders interviewed indicated that on all projects women are exempted from the task of applying pesticides due to the possible health risks.

accrues. Here irrigation may be seen as generating an employment effect that serves to reduce the poverty of the landless population (pro-poor growth).

3.1.8 Effects of the modernization of Kenya's irrigation systems

On smallholder schemes, modernization of irrigation systems usually means lining and cementing the irrigation canals and installing mechanical or electrical water abstraction facilities from intake points to fields.

Farmers regard modernization measures as positive in every respect. They put particular emphasis on how these measures ease workloads, an effect from which mainly women benefit. Modernization measures serve to significantly reduce both the number of working hours and the physical burden of the work itself. Following modernization, irrigation water is increasingly used as drinking water. This eliminates the need to carry water over great distances. In addition, conveying water through closed pipes or cemented canals improves water quality. Nevertheless, modernization measures do not eliminate the possibility of water contamination, and this makes the use of irrigation water as drinking water problematic.

Modernization of irrigation systems as a rule reduces water losses on the scheme level. The interviewees stated that in this case individual schemes have more water available for irrigation. This water is then used to expand the land under irrigation and thus to significantly raise both production and the incomes of farming households on the scheme level. However, these efficiency-boosting measures do little to increase water savings — which may benefit downstream water users or the environment. This would call for additional regulatory measures (see Section 4.6 for more information).

3.1.9 Irrigation by pastoralists

The study shows that even pastoralists, namely the Massais and the Pokots may be successful irrigation users and that, under the pressure of the last droughts in Kenya, pastoralists are increasingly getting interested in adopting irrigation. All of the interview partners saw increased food security and more balanced nutrition (especially for children) as the greatest benefits of irrigation.[26] Irrigation may be life-saving for pastoralists, and it may also serve to prevent migration into urban centers.

Irrigation improves both the role and the status of women in pastoralist societies. For women, irrigation means a chance to contribute productively to family incomes, also in the absence of the men. This gives them more freedom and self-confidence. According to water users, including the men, this effect saved the lives of many people – and especially children – during the 2006 drought period. Moreover, inclusion of women in water user

26 Nomads reported that children in particular suffer from the traditional diet, which in times of need consists primarily of blood.

groups, which was noted in Narok,[27] generates emancipation and modernization impulses in other spheres of life. Pastoralists indicate that they find change in this direction acceptable. Pressure on resources is so great that the changes made – even if this implies the progressive emancipation of women – is accepted by the men. In the long run this offers an opportunity to escape the poverty spiral, as noted by the irrigation officer responsible for the district.

Irrigation not only increases the options open to societies to improve their food security and, possibly, larger incomes, it also makes such societies more open and flexible in regard to certain traditions that are no longer suited to given conditions. For instance, the goal of possessing the largest possible cattle herd – even if this means jeopardizing the overall survival chances of the total cattle population in times of drought – is gradually being questioned by pastoralists themselves. Following the 2006 drought shock in Massai Mara, some pastoralist groups have indicated that they are prepared to reduce the size of their cattle herds to be able to benefit from the newly created food potentials offered by vegetable cultivation. If for example supportive incentives are used to encourage this willingness, then the indirect effect of irrigation would be to counteract overgrazing and contribute to environmentally adapted land use.

Irrigation requires pastoralists to engage in types of work wholly new to them, including e. g. digging canals and cultivating crops. Furthermore, many pastoralists are unaccustomed to regular work in the framework of an 8- to 10-hour workday. Consequently, pastoralists first have to learn both these activities and how they are best organized. The World Bank has achieved some successes here with its so-called Rapid Results Approach; the approach is geared to formulating, in stages, clear-cut objectives and strictly translating them into practice in the course of 100 days.[28] Furthermore, pastoralists are in need of comprehensive technical extension services and training to help them on their way as successful irrigators.

Due to the scarcity of surface water[29] and its unequal distribution in the areas inhabited by pastoralists, irrigation schemes will have to be restricted to a limited number of locations, and this means that in the short run irrigation will be a realistic alternative only for some pastoralists with a view to expansion with improvement in water resources through creation of storages. In times of drought and hunger, pastoralists from other areas tend to besiege irrigation schemes, demanding their share of the resources there. Since even today the sense of group affiliation among the Massai is still quite strong, the operators of irrigation schemes often share their produce with them, even though this means that they themselves will not have enough to survive on. In other words, there is good reason to assess the present situation of pastoralists, both with and without irrigation, as quite precarious.[30] In the medium term, the question is how best to strike a balance between beneficiaries and nonbeneficiaries and how this balance might best be formalized. In the

27 The nomads on the irrigation project in Narok (Narosua, see appendix) received technical advice from World Bank staff. Among other things, the package of advisory measures required compliance with quotas for women in WUAs.

28 See http://info.worldbank.org/etools/bSPAN/Presentation.

29 Even today groundwater reserves have not yet been accurately mapped; in some regions they could contribute alleviating the severity of the situation.

30 A study should be conducted to determine the potential for expanding irrigation.

long run, otherwise, conflicts between individual pastoralist groups are as good as inevitable.

3.2 Environmental problems caused by irrigation

The empirical data show that the positive poverty-reduction impacts of irrigation measures are increasingly counteracted by environmental problems. In many places the growing pressure on water resources generated by excessive use of water has already led to conflicts between upstream and downstream users as well as between users on lake water, some of which have taken a violent dimension in Kenya.

3.2.1 Growing water scarcity

While growing water scarcity, increasing population pressure, and rising fluctuations in precipitation rates have served to increase the need for irrigation, irrigation is at the same time a crucial factor contributing to this same water scarcity. It is essential to look at this phenomenon on the basis of individual waterbodies. While some waterbodies still have a great future potential for irrigation, some waterbodies have already been overexploited by irrigation, indeed in some cases their existence may even be threatened already.

Even today many small rivers in the Ewaso Ng'iro Basin are threatened by drought or start to dry up at the onset of drought and then completely as drought advances. Also the situation in Kenya's lakes is becoming increasingly worrying. The very existence of smaller bodies like Lake Nakuru, Lake Naivasha, and Lake Baringo is already under threat. The causes are multifactoral in nature. In the case of Lake Nakuru the most important causes are seen in declining inflow volumes partly due to irrigation from its tributaries and partly to low rainfall levels. In the case of Lake Baringo, the problem is sedimentation due to deforestation of the catchment (Odada / Onyando s. a., 35). Regarding Lake Naivasha, the causes are mainly from water abstraction for commercial agriculture (see ILECF 2005, 16), which removes large amounts of water from both the groundwater reserves[31] in the area and the lake itself.

Another factor, which may not be a consequence of irrigation but nevertheless relevant to irrigation is that the water level of Lake Victoria has declined significantly in recent years. The reasons for this include both lower precipitation levels and inflows, and degradation of the lake basin and the dams for hydropower plants in Kiira and Nalubaale in Uganda (see http://de.wikipedia.org).[32] The Global Nature Fund (GNF) for this reason named Lake Victoria "the threatened lake 2005."

31 25 percent of the inflows to Lake Naivasha run underground via aquifer systems The communicating system connecting aquifers is complex, and it can be depicted only on the basis of scientific models (see ILECF 2005, 23). Our interviews with project managers indicate that even today people fail to properly understand – or choose simply to ignore – the connection between groundwater extraction and declines in the lake's water levels.

32 A newly built dam is in full operation and a second hydropower plant connected to it was put into operation in 2006 (See http://de.wikipedia.org/wiki/Owen-Falls-Damm).

The local population is for this reason faced with major difficulties in farming their small irrigated plots, and people are now forced to walk longer distances to reach the lake's waters.

3.2.2 Decline in water quality

Irrigation contributes both directly and indirectly to water pollution. The indirect impact must be seen in the decline of water (flow) volumes; this is as a rule also associated with a decline in water quality since there is no change in the pollutant loads discharged into waterbodies in the form of wastewater (household sewage and agricultural drainage water). This means that the waterbodies affected are no longer able to adequately dilute these discharges.

But even apart from these considerations, water quality is negatively affected by irrigation because irrigation usually goes along with the use of more pesticides and fertilizers that directly pollute waterbodies. In the past, for instance, Lake Naivasha was polluted by discharges of highly toxic methyl bromide, a component of pesticides used in the flower industry (at the international level suggestions are rife for a possible ban of the substance because of its negative effects on the ozone layer). On the other hand, the use of fertilizers involves discharges of nutrients that lead to eutrophication of lakes, which is a major problem in Kenya.

If production in commercial farms is to be made more environmentally compatible, it is therefore very important to define strict regulations of the kind that have been set by EurepGAP for pesticides. The high standards that have been set by EurepGAP and Fair Trade serve to force producers to implement "good" agricultural practices. Ecological or biological measures designed to conserve soil fertility and control pests are more likely to be used in large commercial farms than on average small farms. There have also been reports on some successes in dealing with nutrient discharges from fertilizers. Public pressure intensified by Nongovernmental Organizations (NGOs) has made large flower- and vegetable-growing farms to treat their wastewater, which had been a major factor contributing to the pollution of Lake Naivasha (ILECF 2005, 63).

Inducing small farms to engage in learning processes and to adhere to ecologically sustainable farming principles is a more difficult challenge and needs a long term approach. Today, the many small farms in Kenya continue to discharge a major share of the pollutants found in waterbodies. Most farmers in Kenya in general and on the country's NIB schemes are as good as unfamiliar with the principles of ecofarming, and hardly any of them engage in it. A good agricultural and irrigation policy should be used to make up for these deficits.

But good agricultural practices are in fact scattered in the area around Mt. Kenya, where farming continues to have traditional roots and some small farmers even produce for the export market. Soil-conserving land management is a familiar practice here.

Even though EurepGAP may at first sight seem to constitute a trade impediment for farmers on smallholder-schemes, the rules do have highly positive environmental effects that are conducive to the sustainability of irrigation, and they should for this reason not be

relaxed. Instead, farmers should be better supported in their efforts to convert to more sustainable methods, and training measures should be provided for the purpose.

In Nyanza, many farmers pointed out that the quality of the water in Lake Victoria has seriously deteriorated in recent years. The main problem facing the lake is eutrophication. However, irrigation and/or discharges of agrochemicals are unlikely to be a major factor responsible for this phenomenon. By comparison, the most important source of pollution here is likely to be sewage discharged e. g. from Kisumu (GNF 2006).

3.2.3 Soil fertility and soil erosion[33]

Farmers in Lake Victoria region also indicated that the yield capacity of their soils is on the decline and that pest problems are on the rise. During the interviews, farmers stated that the decline in yields began about eight years after irrigation was introduced there. The Luo population who are originally fishermen, have no conventional knowledge concerning land-use management, and they indicated that they have limited knowledge about crop rotation, adapted fertilizer use, organic fertilization, and soil-protection measures. It is therefore not surprising that soil fertility is on the decline in this area. Another problem faced by irrigation farmers in the Lake region is microlevel soil erosion due to irrigation. The furrow irrigation and bucket irrigation used in this area is washing the soil away. Here too, what is needed is suitable irrigation techniques.

3.2.4 Decline in biodiversity

Kenya is blessed with an extremely rich biodiversity, and many of the species found here are rare and in need of protection. Despite the fact that Kenya has set aside numerous protected areas (3.2 percent of the country's land surface), Kenya's wildlife population has, according to the Kenyan Wildlife Service, declined by some 60 percent, and at present some 50 animal and plant species are seen as endangered; these include several species of birds and fish, some of which play an important nutritional role also for the population (UNEP / IISD 2005, 12).

More intensive land use, expansion of areas under irrigation, drainage of wetlands, and introduction of new crops inevitably entail a decline in biodiversity or a shift in the interrelationship between species as well as the loss of many species. This goes in particular for cases in which ecofarming methods are not used. As in many other countries, the most important reasons for the loss of biodiversity in Kenya must be sought in the expansion and intensification of agriculture (including irrigated farming) as well as in deforestation and overexploitation of water resources.

The interviews conducted in connection with our study indicated that farmers view the development of wildlife stocks from a purely agricultural angle. Wildlife is seen in terms of competition for crops and, at least in part, for water, and farmers seem uninterested in

33 In all of the regions visited water logging and salinization problems were either of secondary importance or played no role at all.

observing any other plant or insect species. Farmers tend mainly to keep close track of changes in the population density of dangerous wild animals, although some countertrends can also be observed. While protection goals for snakes, certain bird species, and some other more shy species of wild animals have been ignored in favour of more intensive land use and irrigation (a positive development in the eyes of farmers), big animals (e. g. hippopotamuses and elephants) are attracted to farms by the abundant "food supply" they offer. In the areas around Lake Victoria and Mt. Kenya in particular, the threat posed by hippopotamuses, elephants, buffaloes, etc. is a real problem for the rural population. These animals not only eat or trample crops, they also pose danger to humans when confrontations occur. Since hippopotamuses and elephants are protected species, hunting them is a punishable offense, and farmers regard this situation as unjust and unreasonable.

The Kenyan Wildlife Service (KWS) is tasked with enforcing the ban on farming activities along the banks of lakes, setting up protected zones and breeding grounds and feeding areas, and defining protected corridors to enable wild animals to reach sources of water. Considering this, it would be important for the competent authorities to engage in a moderate regulation of these animal populations; this would allow the farmers concerned to develop a better understanding of such protective measures and perhaps even encourage them to contribute to the protection of these animal species.[34]

3.2.5 Land degradation and climate change with negative impacts on irrigation

Serious signs of soil degradation have been noted for all Kenyan catchment areas, including the Lake Victoria, Rift Valley, and Ewaso Ng'iro basins (with extreme forms of degradation being observed in West Pokot). The most obvious signs are soil erosion and siltation of rivers, processes which cost Kenya some 26 million tons of soil per year (see Breburda, 1993). The problem is found throughout Kenya, and it affects nearly all of the country's rivers and lakes. Today rivers are carrying more and more silt into Kenya's lakes, and this in turn has negative impacts on the overall quality of these lakes (Kull 2006; Njuguna 2002; interview: PIO Nyanza Province). Both the official "Kenya Water Report" and publications of the World Bank view the growing degradation of the country's catchment areas as a serious ecological problem (GoK 2003b, 4; World Bank, 2004 and 2006).

This degradation is mainly caused by deforestation and unsustainable land-use practices along river courses (see Thomas 2001); thus far practically no headway has been made in halting the deforestation process, and today forest areas account for no more than 2.8 percent of the country land surface (GoK 2002a). The causes for deforestation must in turn be sought in an inadequate reforestation policy in combination with growing land scarcity and unbroken population growth. Another aggravating factor is uncontrolled cutting of trees for charcoal burning as a source of income. Charcoal is used for heating and cooking

34 If we consider for a moment the fuss sparked by the appearance of one single wild bear in Germany in 2006 – which did no more than kill a couple of goats and was finally shot down in a large-scale community-style action – we become again aware of the whole set of double standards that induce us to call for absolute protection for elephants, no matter where they are and how densely populated the region may be.

especially in the urban centres. To control this source of income therefore poses a major challenge (interview: Nyanza Province).

Unsustainable land-use methods cause particularly heavy damage, especially if the so-called riparian gap is not respected. According to this rule, no farming is allowed in the immediate vicinity of riverbanks. Yet nowhere in Kenya is this rule observed by farmers, and government institutions have not made any serious attempts to enforce it. In view of the fact that farm plots are small and the strips along riverbanks are very fertile, farmers can often not resist the temptation to disregard the riparian-gap rule. Furthermore, it is relatively difficult to appraise the degree of gap, because it differs from river to river depending on its width. In some cases the population is wholly unaware of how broad the prescribed gap actually could be.

Both deforestation and degradation of riverbanks may thus be seen (at least in part) as consequences of poverty, and these effects clearly indicate the negative interaction between rural poverty and environmentally destructive behaviors. To cite an example, one farmer engaged in working a riverbank noted, aptly: “We know it’s a problem, but we only have ¼ acre to irrigate, so we have no choice.” (Interview, Kiamariga Scheme, Central Province). This poverty spiral must be halted, for it in turn has extremely dire consequences, e. g. for the economic development capacity of irrigation schemes.

Deforestation and clearance of the vegetation cover first lead to erosion, then to river siltation and uncontrolled runoffs of large quantities of water downstream. For one thing, this leads to increasingly frequent flooding and for another it causes rivers to dry up more rapidly, the reason being that the water deficits in riverbeds reach dramatic levels following flood events (see World Bank 2004). This process is in turn intensified by the effects of climate change. Global warming is accelerating the hydrological cycle, and this in turn is further increasing the risk of drought and flooding. Quite apart from the fact that the longer-term impacts of these processes appear disastrous, even today the consequences for Kenya are very severe (see World Bank 2006).

Very little awareness of the consequences of climate change was found either among the general population or among the national or provincial institutions. In Kenya climate change is associated with the melting of the ice caps on Mt. Kilimanjaro and Mt. Kenya; and even though it is thus widely familiar as a phenomenon, there isn’t much discussion in the country about its far-reaching consequences for water management and agriculture apart from when related disasters occur.

Soil erosion is one of the major environmental problems in Kenya which also threatens the success of irrigation activities. In the first case, it leads to sedimentation in lakes and retention basins, which significantly reduces their storage capacity. It furthermore clogs up irrigation systems. Siltation was addressed as a major problem in all of the irrigation schemes that were visited, and it has critically undercut the viability of irrigation in several regions seriously affected by the problem (Rift Valley, West Pokot, and others). The management of NIB irrigation schemes reported that it has today become necessary to desilt some irrigation systems twice a week instead of in the two-year cycle originally provided for. Siltation has now come to be recognized as the most important factor leading to the collapse of irrigation systems (e. g. Gam Rae).

As a rule, neither farmers themselves nor the operators of irrigation systems have actively addressed the more general environmental problems that form the background of the siltation problem. Nor was it observed that any visible initiatives by farmers – e. g. reforestation actions – aimed at combating these problems have been undertaken. The environmental measures that have been taken so far are not sufficient, and relevant capacity-building measures are urgently called for. *"Few decision-makers understand how catchment degradation and deforestation […] alter hydrology, increase runoff rates (flash floods), and cause extended dry periods (droughts)"* (World Bank 2004, 26).

What is needed to counteract the degradation of Kenya's catchment areas is an integrated approach that pays due attention to social factors, i. e. an approach that points out viable alternatives for farmers who have been cultivating the strips along riverbanks. Furthermore, on top of the need for technical measures like reforestation, efforts must be undertaken above all to mobilize political will at the highest levels, to raise awareness, and to stimulate common action. On the other hand, large sums of money are needed to build water infrastructure such as storage reservoirs for rainwater harvesting, retention basins, etc., all of which must be seen as measures essential to coming to terms with the problem.

Compared with other countries, Kenya's water infrastructure is very underdeveloped (see Table 1). In this regard the country would be able to absorb large sums of financial aid made available to realize such measures.

Table 1: Water storage capacity per capita (not including water power uses) in Kenya and other selected countries	
Kenya	4.3 m^3 per capita
Africa, on average	70 m^3 per capita
South Africa	740 m^3 per capita
Zimbabwe	750 m^3 per capita
Thailand	1287 m^3 per capita
North America	6150 m^3 per capita
Source: World Bank (2004, 17, 18).	

Part II: New Irrigation Policy in Kenya

4 Irrigation policy analysis

4.1 Legislative framework

Kenya, at the moment, does not have a new national irrigation strategy in place, and for that reason the 1966 Irrigation Act (CAP 347) is still in force. However, in May 2005 the MWI formulated a first draft for a reformulation of the act, and a revised version of the draft was set to be submitted to Parliament for approval in the course of 2006. A new irrigation strategy keyed to the concept of integrated water resources management will have to be built on the Water Act 2002. What this means concretely is that the new strategy will have to be compatible with the water resources policy which was laid down in the Water Act 2002 and is being implemented by the Water Resources Management Authority (WRMA), a new government institution.

Before offering any practical policy proposals, the authors wish to start by commenting on a few underlying issues, and above all by taking a closer look at the tasks of and the possibilities open to the WRMA. This will mainly mean discussing some questions bearing on the financial capacity the Authority needs in order to carry out its duties. Thereafter the discussion will focus on two fundamental questions linked to demand management, viz. water policy and the need to increase water-use efficiency. Last but not least some possible elements of an ecologically sustainable and poverty-oriented irrigation policy will be presented and discussed.

4.2 Institutional arrangements

4.2.1 General changes within the sector

One important institutional change brought about during reforms in the water sector is that responsibility for irrigation has been transferred from the Ministry of Agriculture (MoA) to the Ministry of Water and Irrigation (MWI / IDD). This shift has served to appreciably upgrade the irrigation sector. First, irrigation has, since then, no longer been merely one field of agricultural action among others, as it was under the responsibility of the MoA. It has now become the second pillar of water policy and management, alongside the drinking-water sector. Second, transferring the irrigation sector to the MWI has altered the ways in which irrigation problems are perceived. Irrigation is now not only viewed as an economic activity, which has more or less nothing to do with environmental sustainability, but the focus has shifted to water as a resource and its sustainable management. Third, the Kenyan government has appreciably raised the irrigation-sector budget. Even though there are no exact data available, several district-level administrative officials indicated a 15-fold rise in the 2006 budget as compared with the preceding years. And tight as this budget may still be in view of the growing number of tasks that need to be addressed, the enhanced budget is already making itself felt in improved resources and operational capacities at the medium administrative level. It must be noted here, though, that this relatively good situation is not found in all districts.

Our observations also indicated that the staffing levels, competence, and commitment of and the cooperation with administration appear to have developed very positively, especially at the province and district levels, as has the interaction between officials and the smallholding population. Without exception, the WUAs stated that their relationship with government organizations was good. All the administration officials interviewed were open and highly familiar with the idea of participation. Here and there the research team even gained the impression that there was good progress (in part even within the NIB structures), and this must be seen as favorable preconditions for an effective institutional modernization of the sector.

4.2.2 Tasks of the Water Resources Management Authority

The WRMA's tasks include planning, regulation, and management of water resources; the most important aims relevant to irrigation may be listed as follows:[35]

- support for the establishment of bottom-up institutions, like water resources user associations (WRUAs), which deal, at the local level, with both water-use and water-resources issues;
- creation of a hydrological database for Kenya (including the task of mapping groundwater resources) and monitoring of water quality and the uses to which wastewater is put;
- the task of issuing, on a region-wide basis, so-called water permits, i. e. licenses to extract water, which are designed to register, in the future, all water users and water uses and to set the stage for improved water regulation;
- introduction of quantitative, i. e. volume-related, water-use charges, on which work is set to start as soon as water permits have been issued;
- establishment and implementation of management strategies designed to protect and conserve catchment basins (in cooperation with the Water Services Trust Fund WSTF).

Above and beyond this list of tasks, which must be seen as ambitious in view of the faulty developments in the years preceding the present reform, the WRMA has also been tasked with gradually funding its own operations through the revenues generated from its various activities. The WRMA is expected to be able to stand on its own financial feet within a period of five years (MWI / WRMA 2005).

4.2.3 The WRMA's priorities and capacity

The goal of having an Authority which funds itself through the fees it receives is a controversial and ambitious one that is, furthermore, very difficult to meet anywhere in the world, not only in Kenya.

35 For more information on division of responsibilities and implementation plans, see MWI / WRMA (2005).

The WRMA indicates that its personnel and nonpersonnel costs amount to roughly KSh 500-620 million per year. Its current revenues are generated mainly from fees for water permits, which have amounted to only some KSh 30 million in 2006, and this means cost recovery of no more than 5 percent (MWI / WRMA 2005, 59). Since the large majority of water users are still without water permits, there is reason to expect that these revenues will rise in the course of the coming years, although it would be illusory to assume water-permit fees will ever be able to wholly cover the WRMA's costs.

The WRMA will for this reason have to develop other sources of revenue to fund its own operation; these sources could include (see also WRMA 2005, 52 ff.):

- fees from schemes designed to utilize water power;
- collection of volume-related use charges for drinking and irrigation water;
- charges for groundwater use (wells);
- charges for water used by refugee camps;
- fees for wastewater-discharge permits;
- fees for contracted services (e. g. data collection / surveys / reports);
- fees for the renewal of water permits once they have expired.

In order not to induce water users to draw water illegally, the WRMA proposes starting out by charging very low water tariffs, roughly 50 cents/m^3 for small users and 100 cents/m^3 for big users (WRMA 2006, 68).[36]

With a view to estimating its revenue potential on this basis, the WRMA is conducting model calculations for individual subsectors; it comes to the following estimates:

- potential revenues from hydro-power projects: roughly KSh 163 million/year;
- potential revenues from groundwater uses: roughly KSh 50 million/year;
- potential revenues from water supplied to refugee camps: roughly KSh 720,000/year;
- potential revenues from all water uses in the Lake Naivasha Basin: roughly KSh 40 million/year (KSh 20 million of this from the irrigation activities of large commercial farms);
- potential revenues from groundwater supplied to municipalities: roughly KSh 30 million.

Apart from the potential revenues for irrigation water – which, due to lack of sufficient data, can be calculated for Lake Naivasha, but not for the national level – the revenues indicated for hydro- power, groundwater uses, and refugees camps are estimated for the national level. However, the fact that water abstraction for industrial irrigation schemes on Lake Naivasha alone could bring in KSh 20 million/year shows that there is a large untapped potential in the collection of water use charges for irrigation water.

To assess its overall revenue potential, the WRMA makes use of a different approach based on an estimate of the total annual quantity of surface and groundwater used in

36 Large water users = over 500 m^3 / day, small users = under 500 m^3 /day .

Kenya. This quantity is estimated to be roughly 1.58 BCM/year. Assuming that use charges could be collected for 50 percent of this water (at an average price of 50 cents/m3), the WRMA would be able to take in a total of KSh 400 million/year, a figure that comes close to the sum the authority would require only to cover its own needs.

For the irrigation sector, though, which would account for a large share of these revenues, this scenario presupposes that all users have been issued water permits, water meters have been installed everywhere, and users are willing to accept water use charges and/or enforcement of these charges.

Yet it will take a few years even to issue water permits, because this presupposes that the WRMA is able to monitor and control water uses and meet certain other conditions. Installation of water meters must likewise be seen as a measure that will not be easy to realize, because the measure needs a minimum level of acceptance on the part of water users; otherwise water meters may simply be destroyed, a practice that has been observed in other countries (e. g. in Jordan). And last but not least, monitoring, fees collection, and proper and correct country-wide invoicing pose a logistical challenge for the WRMA and its staff that should not be underestimated (interview: Kenya Institute for Public Policy Research and Analysis – KIPPRA).

4.3 Financial and economic sustainability

4.3.1 Acceptance of water use charges

In 1995 the Kenyan government launched an effort to collect water use charges for raw water, an attempt that failed due to the refusal of large water users to pay the charge and was abandoned within three months. But now, 10 years later, the WRMA reports that it sees indications that this attitude has changed. The authority notes e. g. that the Lake Naivasha Growers Group (LNGG), which represents the region's 20-30 large irrigated farms, has signaled its willingness to pay for raw water – under the condition that visible resource management measures are conducted in return (MWI / WRMA 2005, 61).[37]

In its interviews the study team also asked smallholder water users and the operators of commercial irrigation schemes about their willingness to pay different water tariffs; in this way the team came up with the following picture:

- On the other hand the majority of interview partners accept the fees for water permits and tariffs for water services (water services and O&M) as justified measures.
- On the other hand, the majority of respondents regard water use charges as illegitimate; but this attitude varies for farmers and operators using different types of irrigation systems, with operators from the flower industry being far more open to water use charges than smallholders. The first group regards water use charges as a more rational policy approach and as a possibility to achieve saving effects as far as overall water consumption is concerned. However, the large-scale operators also expected something in return from the government. This might be a better

37 Although willingness-to-pay studies indicated that this willingness is often retracted when the day finally comes on which the charges are to be collected.

maintenance of the road network, other infrastructure measures, or environmental protection measures. According to our interview partners, therefore, it would not be legitimate to use the revenues from charges and fees only to maintain the WRMA.

In other words, the findings underline a growing willingness to pay on the part of the large commercial farms on Lake Naivasha. But it would appear also important that part of the funds collected be used for visible water resources management measures, and not merely to pay the salaries of WRMA staff.

4.3.2 Financing water infrastructure and environmental protection measures

As the previous section shows, the WRMA neither has nor will have the funds it needs to cover its own costs and to finance water infrastructure measures or measures designed to protect water catchment areas. In fact, a report by the authority itself comes to this conclusion: *"The fees and water user charges are NOT seen as a mechanism to finance water resource infrastructure development or necessarily catchment conservation activities."* (MWI / WRMA 2005, 53).

This fact must not only be seen as critical against the background of the acceptance problems outlined above, it could also turn out to be a fundamental legitimacy problem for the WRMA over the longer run. Viewed soberly, the WRMA could, even if it did its best, not come anywhere near mobilizing, on its own, i. e. from the charges and fees it collects, the funds it needs to protect catchment areas and to build infrastructure. The estimated costs would amount to some KSh 2–5 billion/year (MWI / WRMA 2005, 53); indeed, at best the Authority's own revenues from charges and fees would suffice to cover only 10 percent of the sum required.

The funds needed for these measures will therefore have to be generated by other potential sources. MWI/WRMA has therefore proposed the following measures:

- project investments by the private sector (Purchasing Power Parity projects);
- funds from CO_2 credits (e. g., emission trade with Costa Rica);
- revenues from environmental taxes on gasoline;
- government funds;
- funds from credits (grants and loans) provided by DC partners.

Against this background, that most of these sources are weak or unsure, it can be assumed that the share covered by development partner credits would have to be very high.

It is recommended here that as soon as the WRMA starts collecting water use charges, it should, in parallel, undertake measures geared to sustainable water resources management. The fact that this would have to be financed again with other sources of funding is – for the water user – of secondary importance. Since 70 percent of Kenya's flower industry is located in Lake Naivasha area, and the actors concerned must be assumed to be able and, possibly, willing to pay, no time should be lost in embarking on these measures – in particular in view of the increasing nature of the problems.

4.3.3 Water use charges and their demand-management potential

The last section suggests that while water use charges will be introduced in the near future, these charges will have to be so low that they will have no major impact as a demand-management tool, i. e. they will have no major impact on water saving.

If water use charges are to serve to manage water-use efficiency, the charges would have to a) reflect water scarcity and b) constitute a relevant cost factor in profit margin calculations. Only in this way can water use charges develop an influence on choices of crop type or production method relevant to water-consumption aspects.

Should this be the case then, why do larger private operators have nevertheless invested in recent years in boosting their water use efficiency? Several factors may be seen as responsible for these investments. First, efficient water use can serve to reduce relevant abstraction costs, i. e. energy costs; second, this in turn makes it possible to raise yields, because it serves to minimize water logging, fungal diseases, etc. Third, farms add liquid fertilizer to their irrigation water, and this increases the value of the water and lowers losses; and fourth, another relevant reason to invest may be image-building and/or simply the survival instinct. For water scarcity in Lake Naivasha has already reached dimensions that pose an immediate threat to the existence of some farms in the region.

It can be said by way of summary that water use charges lead to increased water-use efficiency on individual farms only when these charges represent relevant costs in relation to other operating costs. That is, they must be high enough. However, the political water use charges currently envisioned appear to be too low to provide the impulse needed for more efficient water use. Water use charges are, though, NOT the only instrument available to bring about efficient water use at the farm level. Other approaches to reaching this goal include high extraction costs, cultivation of high-value crops, labeling, legal provisions on maximum water consumption per unit of land, bans on the cultivation of certain water-intensive crops, or certain binding standards for irrigation systems.

4.3.4 Impacts of increased water use efficiency on downstream users

Everyone is talking about efficient water use, and hardly anyone in water policy disputes that the need to boost water-use efficiency is a high-priority goal. However, efficient water use at the scheme level by no means automatically leads to a more equitable allocation to different users of the water resources on a river or lake. Nor does efficient water use automatically lead to water savings that benefit a waterbody. Assuming that individual farms have succeeded in making more efficient use of water – regardless of how this has been achieved – this will usually lead to an expansion of the land under irrigation on these same farms. This automatic response can be observed everywhere in Kenya and elsewhere, if there are no extra added regulations in place to avoid it.

This situation is even exacerbated by another problem, which may be referred to as the micro-macro paradox (Keller / Keller / Seckler, 1996). According to this paradox, a more efficient use of water at the farm level, e. g. on the upper course of a river, may even reduce the amount of water available downstream. The reason for this is that irrigation systems on scheme level are open systems, and the water, which is removed by the farmer

from the waterbody for irrigation needs, partly flows back into it in the form of drainage water. This drainage water is then – depending on location – available for reuse (wholly or in part) by downstream users.

We speak of an increase in efficiency when the share of water absorbed and productively used by a plant rises. This, however, means plainly and simply a reduction in the quantity of water that would otherwise flow back into the system in the form of unused drainage water. This is why an increase in efficiency benefits the individual farmer, who can subsequently use the same amount of water to produce more ("more crop per drop"), while for the downstream user this effect is a negative one: less backflow water becomes available for use there. In other words, the gap between upstream and downstream users is widened by uncoordinated efficiency increases on individual irrigation schemes – if no additional rules or regulations are adopted, to reduce at the same time the withdrawals.

There are e. g. cases, notably on the Egyptian Nile, where the reason for an equitable allocation of water between upstream and downstream users may be traced back to the fact that the water use efficiency on individual farms or schemes is low and for this reason more or less large drainage rates are passed on from one user to the next. (see Wolff / Stein, 1999).[38] However, the negative effect of inefficient uses must be seen in terms of water pollution, which increases the more often water is reused (see Keller / Keller / Seckler, 1996).

Increased water use efficiency can thus lead to positive impacts for downstream users or for the waterbody concerned only if the absolute amount of water extracted is reduced considerably at the same time.[39] Only in this way it is possible to reallocate the farm-level benefits to downstream users or to the waterbody itself. This likewise applies to lakes involving roughly the same context, even though in this case it is somewhat more difficult to illustrate. Thus regarding lakes, the more efficient the irrigation systems are, the more completely will the water abstracted from there be consumed productively by plants. This is visible when a lake's water level recedes despite the efficient production facilities used by all the operators.

Increasing the efficiency of water use, usually extolled as the key to any sustainable irrigated agriculture, is for this reason only one component of sustainable irrigation, and one that is by no means sufficient on its own. As isolated measure, efficient water use on farm levels even increases the inequality of water distribution. To implement any sort of integrated water resources management, it is therefore essential that at least part of the gains generated by increased water use efficiency of e. g. large commercials be made available to smaller farms or other water users as well as to the waterbody concerned. This effect can be achieved by using the following additional regulatory measures:

1. coupling efficiency increases with rules requiring reduction of the absolute quantity of water abstraction or limitation on the area of the land under cultivation;

38 This is, though, not the case everywhere. In some locations backflow water disappears in one reservoir or another, where it is difficult to retrieve.

39 The needed reduction of water withdrawals on farm level has to exceed the reduced drainage water, which – as effect of increased water-use efficiency – no longer flows back to the river. Only then, the water body – and thus the downstream user – can benefit from the rise in water-use efficiency of upstream users.

2. support for the efforts of river and lake institutions to coordinate individual users;
3. taking into account the quantity of drainage water at specific locations, which really flows back to the river after its use.[40] To boost an efficient water use at the farm level will accordingly be less important, if all the drainage water flows back to the river.

5 Conclusions

The findings of our study and the policy analysis show, that also in Kenya irrigation is a very suitable and effective instrument to fight poverty and that this African country – after a troublesome irrigation history – is now ready to formulate a new pro-active and modern irrigation policy, building on the water sector reform. The farmers are willing to participate through forming bottom-up institutions and also take responsibility in maintaining the structures among others while the governmental institutions would coordinate good water governance. The first conclusion of the last chapter of this study is therefore, that the very common prejudice, that irrigation in Africa cannot be successful and poverty reducing as e. g. in Asia, is not reflecting reality.

All existing organizational types of irrigation investigated are contributing to poverty reduction or can in principle be poverty reducing in the future as the schemes under NIB. In future, special challenges for each scheme type are to be considered to ensure their success also in the long run. While the major concerns of smallholder schemes are the improvement of marketing conditions and a better access to credits, which calls for special lines of credit and the creation of marketing cooperatives, the crucial factors for NIB schemes would include the consistent implementation of the present reform plans and the effective and fair cooperation with farmers. Two key needs here are assigning (provisional) land-use rights and training for farmers. Commercial schemes, on the other hand, are mostly concerned with maintaining their international competitiveness. Commercial operators see effective transportation infrastructure and a reliable power supply as the most important preconditions they need to be able to continue producing successfully. Particular attention needs to be paid to developing the national market, which, as the findings of our study indicate, has a larger future growth potential for vegetable crops than the export market.[41]

Besides the positive effects of irrigation, the study shows that irrigation is more and more threatened by serious environmental problems. Some of these are caused by irrigation itself, e. g. high water abstractions and unsustainable agricultural practices. Other problems are caused by mismanagement in general such as deforestation and inappropriate land use practices. These factors together with the effects of climate change, unreliable rainfall and irrigation water supply result in conflicts among water users and in a dramatic increase of siltation of rivers and scheme canals. On one hand these effects make irrigation less and less profitable while on the other hand they also cause irrigation to become more and more necessary to ensure better yields. Therefore it is urgently necessary to find a

40 This proportion differs along locations, which differ themselves in geological and other site specific conditions.

41 See Neubert et al. (forthcoming) for more information.

solution for this negative cycle as fast as possible. To tackle this big challenge, more resources, capacity building and commitment from all sides are necessary.

The overall conclusion is that due to its high poverty reducing potential, irrigation should be enhanced in Kenya, but this must urgently go hand in hand with a sound water demand and land management policy, which leads to a fair, saving and efficient use of water and land resources.

The policy analysis in chapter 5 shows that in the last five years Kenya has made big progress not only in the institutional set-up but also in some conceptual ideas especially concerning demand management and participatory approaches and the support of smallholder irrigation activities. In addition the large governmental schemes under the National Irrigation Board (NIB) are currently under extensive reform, for which – at the end – full participation of farmers is envisaged.

This encouraging institutional development is counteracted by the difficult financial situation of the WRMA. Since the institution has to finance itself through income it generates, such as payments for water permits, investments in environmental protection, measures will be almost impossible for the near future as revealed in this document. Therefore it is urgently needed to bridge this financial deficit by either support from development partners or other sources, if the whole issue of good water governance will not be put entirely in question in the long run.

In addition decisions have to be made, on which combination of tools such as the water demand management policy should be based. Increasing the efficiency of water use is usually extolled as the key to any sustainable irrigated agriculture. But it must not be looked at in isolation since efficient water use on farm levels even increases the inequality of water distribution as explained earlier. Thus increased use efficiency can lead to positive impacts for downstream users or for the waterbody concerned only if the absolute amount of water extracted is reduced considerablly at the same time. To realize this, the installation of water meters or gauges is essential and a strong commitment of farmers to coordinate the water uses in a fair way. Therefore awareness raising among farmers and the population must be seen as just as important as the pursuing of a reliable and consequent water saving policy.

To make irrigation more poverty oriented and environmentally sustainable, the new irrigation act has to entail specific elements which set the course for this direction in practice. In the next chapter some recommendations for a focused orientation on poverty and sustainability are formulated.

6 Recommendations for a new irrigation policy in Kenya

6.1 Recommendations concerning environmental sustainability

Bearing in mind existing strategies and legislation (including the Water Act 2002, the Strategy for Wealth and Employment Creation 2003–2007, the National Development Plan 2002–2008), the Strategy for Revitalizing Agriculture) as well as the priorities that have been defined and the deficits and challenges that have been identified, we will now

outline a number of key elements needed for a new irrigation policy. The integrated water resources management (IWRM) approach will serve here as a normative basis; both the UN and other international institutions have committed themselves to the strategy since the 1992 Dublin conference.

a) Aligning irrigation policy to the principles of IWRM

If it is to be consistent with the principles of IWRM, a new irrigation policy must contain certain elements. The most important elements that need to be given consideration are:

- participation of all relevant stakeholder groups in both policy formulation and implementation of the individual measures adopted;
- ecological sustainability, i. e. the water consumed on a waterbody must not be allowed to exceed the safe yield;
- a poverty orientation mindful of the need to equitably allocate water both within and outside irrigation schemes;
- adequate consideration of other water uses that may be in competition with irrigation schemes (drinking water, water for cattle and wildlife, water for ecosystems);
- equal consideration for water-quality issues;
- equal consideration for land-use issues, land-rights issues, and the land-management issues bound up with a country-wide introduction of good agricultural practices.

b) Expansion of areas under irrigation, institutional coordination and modernization

It is generally still possible to expand irrigation in Kenya; for even though Kenya is a country with scarce water resources, experts are of the opinion that no more than 20 percent of the safe yield of the country's water resources has been tapped (see MWI 2004; World Bank 2004). The stated objectives of the Kenyan government, viz. to expand irrigated areas by 5000 hectares per year and to drain an additional 4000 ha of seasonal waterlogged agricultural land per year, is therefore understandable. However, it is essential that these objectives be coupled with a number of compensatory conditions for nature conservation. They should also combined with the goals of a) reaching a more equitable allocation of the water resources on the waterbodies concerned and b) using improved coordination of individual uses to appreciably reduce the periods in which waterbodies have little or no water. Only if these principles are given due consideration it will be possible to expand irrigation in such a way that it remains ecologically sustainable.

In Kenya, though, one difficulty involved in selecting suitable locations to expand irrigation is that the places where the greatest water-resource development potentials have been identified are often sparsely populated; one needs to think here only of the land along the Tana River. If the errors of the past are to be avoided (e. g. resettlement, as in the past, of people to such locations or construction of financially unsustainable irrigation facilities), it would be recommendable to expand irrigation only in places with a higher population density. Smaller structures should in any case be given precedence over large-scale structures, because the former are much easier for farmers to manage. Furthermore, in selecting locations, efforts should be made to keep the investment risk as low as possible, i. e. it is important not to opt for locations at which e. g. the river changes its

course or the soil is not really suited for irrigation – as is the case along several segments of the Tana River.[42]

Before starting out with concrete planning or support of measures designed to expand irrigation on a waterbody, it is essential to have an overview of existing uses and to have data on the waterbody's safe yield. As provided under current legislation, it is important always to have the National Environmental Management Authority (NEMA) conduct an environmental assessment before any concrete plans are drawn up to expand irrigation. Before irrigation expansion takes place, all the water users at the river should be registered and all the water permits should be issued. If possible, water meters should be installed for every irrigator – or at least water-level measuring equipment should be in place. It is furthermore important to set up an irrigation drainage water monitoring system on every waterbody on which there are plans to expand irrigation. This makes it possible to subsequently adjust the extraction quantities allowed under water permits so that use efficiency is raised, and it is also a good means to better ensure that the water is allocated as equitably as possible to the different users.

Before starting out with an expansion of irrigation, it is also important to ensure that – apart from IWUAs – a relevant WRUA or RWUA is in position to observe and coordinate all water-related activities involved within the area. There should be no incongruities in the ways in which these bottom-up institutions share their tasks with the government authorities specifically responsible at their level (e. g. District Irrigation Office / Provincial Irrigation Office) and coordinate them with the WRMA's competent organs. On the other hand it is important to consider that the formation and operationalization of WRUAs and RWUAs is a role under WRMA while the IWUAs exist under the umbrella of IDD. In order to avoid that irrigation expansion will be hampered it is therefore essential that WRMA will quickly come up with WRUAs and RWUAs where there are proposals for irrigation development.

Until now, the relationship of WRMA and IDD is not clear apart from the fact that IDD supports a sector which is a consumer of water. Therefore forums should be established to better integrate the departments and thus the productive and reproductive sides of water uses. In the sense of an integrated approach the objective should be to develop a common understanding of optimizing water uses including irrigation and protecting the resource at the same time.

c) Improvements in irrigation management

Under existing legislation it is already possible to require water users to build 90-day reservoirs on waterbodies that periodically face the threat of desiccation. This is normally stipulated in connection with a water permit. 90-day reservoirs are in fact an effective means of preventing or compensating for periodic low-water levels on a waterbody. Such reservoirs fill up during the rainy season and are then available for use in irrigation during the dry season – without constituting a burden on the river in question. The research team noted, however, that at present this condition has nowhere been met by the water users in

42 The Kenyan government sees the greatest social economic potentials for an expansion of irrigation in coastal strips (the lower courses of many rivers and streams) as well as on Lake Victoria, both of which are locations inhabited, at least in part, by many people.

question. The reason is that construction of such water reservoirs requires funds and know-how that are simply not available to farmers. They are therefore in urgent need of financial and technical support in building such facilities.[43] Probably it would make sense, that the farmers initiate the building up of storage facilities and give their share for the construction (by work or by money) to the WRMA. The WRMA should then be responsible for the implementation and technical correctness of the construction. Adequate water charges will then be also inevitable for farmers.

Complementary powerful strategies to optimize water uses in the short term perspective lie in the right timing of irrigation activities. Besides training and awareness raising this can be regulated through irrigation bans at particular times or by imposing night irrigation. Both possibilities are painful for farmers, but at certain seasons they are the only possibility to conserve water resources for the downstream user.

Modernizing and raising the water-use efficiency of individual schemes are likewise important means of making more productive use of water and increasing the profitability of schemes. This furthermore has a positive impact on other poverty-related indicators, as the study has shown. Water-use efficiency is still very low precisely within the large-scale NIB schemes (e. g. in Ahereo), and it could be improved enormously by better management, technical and hydraulic rehabilitation of the equipment in use, and good agricultural practice. As discussed above, it is important to link these endeavors with other regulatory measures, e. g. such as adoptions in water rights, to ensure equitability for the small water users near by. The most important modernization measure for most small-scale schemes would be to line the irrigation canals, a step that would serve to sharply minimize water losses in feeder channels. Furthermore, there is often a need for improved regulation at water standpipes, i. e. for technical measures that would cost very little money. But more know-how is also needed to optimize irrigation timing, levels of water doses, and overall management. Efforts to properly level irrigation systems, to exactly calculate water inflows, and to prepare land-use plans can serve to improve the manageability of the systems and to reach higher levels of equitability in the allocation of water within irrigation schemes.

d) Increasing the environmental sustainability of irrigation

The constantly growing degradation of water catchment areas and increasing erosion damage pose a fundamental challenge to the environmental sustainability of irrigation in Kenya. For this reason efforts to expand and intensify irrigation only make sense if the general sustainability of land use is increased at the same time. Apart from systematic rainwater-harvesting measures based on specifically adapted methods, there is an urgent need for afforestation measures as well as for construction of water reservoirs, rainwater retention basins, and similar structures designed to halt the process of degradation.

Flanking these measures, farmers should respect the riparian gap as a means of preventing rivers from silting up, in this way e. g. minimizing the clogging of irrigation systems. It is essential here that a closed vegetation cover extend down to the riverbank. Thought should

43 Today WRMA looks the other way when no reservoirs are built despite the legal requirement to do so. The aim of using water permits to register water users continues to be regarded as a priority goal.

be given to whether and how farmers could reclaim bank zones and at the same time preserve the closed vegetation cover in these zones. A second possibility would be to point out to farmers alternative means of income generation. In any case, though, it is essential that the riparian gap be respected as a means of erosion protection. Means must therefore be sought to better enforce existing rules and regulations.

Irrigated agriculture affects both the quantity and the quality of available water resources. In order to reduce the negative effects on water quality, it is important to use more sustainable land-management methods or – wherever possible – to convert to ecofarming. Since ecofarming is more labor-intensive and requires fewer and lower inputs in terms of pesticides and fertilizers, it could prove to be a real alternative for many farmers and NIB schemes. It may well be just as attractive in economic terms, provided eco-labeling and (external) marketing is possible. Here farmers are in need of thorough technical advice and support, i. e. extension services.

Shifting the responsibility for irrigation development from the MoA to the MWI has – as side effect – led to a disconnection of water management services from the supplementary services related to land management, which before had been provided by the MoA as a package. This shift has given rise to a gap that must be closed by undertaking greater efforts to coordinate the responsible ministries and relevant research institutions. During its field phase, the research team observed different levels of intensity in this cooperation, mainly between MoA and MWI, but also between other institutions. There appears to be a need to improve the liaison between agricultural extension offices and irrigation officers at the district level. It must be pointed out that the agricultural extension concept of both the MWI and the MoA is predicated on the assumption that smallholders will develop a strong initiative on their own, i. e. as a rule they will themselves request visits and support by extension officers, and that they may have to pay for such support. It would therefore appear highly recommendable to intensify extension services, even by using more assertive means.

e) Support provided by conflict-resolution institutions

RWUAs and WRUAs can play a key role in moderating and settling conflicts between water users. There exist already some positive examples, where these new institutions take their responsibility in conflict resolution and prevention. But many more of such institutions have to be established and the existing institutions have to gather still some experiences, before their significance for the whole country will be proven. The government side should step up its efforts to strengthen these organizations and promote their institutionalization.

If they are able to play a greater role in conflict prevention, RWUAs should not, as is presently the case, be created only when conflicts have already occurred, they should be established with a view to their preventive potential. Their preliminary function is to ensure that water resources are allocated equitably, and here it would be important to think through and to improve or supplement communication processes and possible measures designed to achieve these aims. At the moment, the pressing challenges would include efforts to further integrate individual water users to use portable pumps (e. g. Kickstart

MoneyMaker Pumps©) and to gain the participation of nomads as members of these institutions.[44]

f) Continuous collection and processing of hydrological data

One precondition of central importance to implementing sustainable water resources management is a reliable database on available and utilizable water resources. Data collection and monitoring should be expanded and accelerated for this reason. It is important here to make sure that the relevant data are collected and prepared in such a way that they suit the needs of – i. e. can be used by – the responsible authorities and institutions. Information flows should be fast and as transparent as possible. It is in particular important to improve, as quickly as possible, the data situation concerning available groundwater resources.

g) Observation of the climate regime and adaptation mechanisms

In the future all questions bound up with water management will have to be looked at in connection with the effects of climate change. Here in particular, Kenya will have to be prepared to come to terms with major and growing uncertainties regarding precipitation regimes. It will for this reason be necessary to base the dimensions of all technical measures designed to provide buffers against floods and droughts (e. g. water reservoirs) on future-oriented models that include the effects of climate change. Since the industrialized countries (and increasingly China and India) are mainly responsible for climate change – while Kenya can in no way be seen as responsible for the phenomenon – the question of how these measures are to be funded is a political issue, one that Kenya might use to good effect in relevant negotiations.

h) Funding of irrigation systems and access to credit

Large-scale irrigation structures will always have to be funded by the state, the private sector, or development partners; nowhere in the world are smallholders themselves generally able to build such structures. But at the individual level or in small-scale irrigation schemes, farmers are able to contribute to the investment costs by providing their own labor to build irrigation structures or by gradually paying a share of the costs once an irrigation scheme has gone into operation. This, however, presupposes that smallholders have better access to credit, a state of affairs that is more the exception in Kenya (e. g. in IFAD and KfW schemes). More favorable credit arrangements would in all likelihood go some way toward dynamizing irrigated agriculture in Kenya. In planning and designing an irrigation scheme, it is essential to ensure that the scheme will, in principle, be financially sustainable. One of the determinating factors here is the manner in which water is delivered to the irrigation system (gravity versus pump systems). Gravity-based systems are, in this regard, far preferable to pump-driven systems.

At present the income share of the charges paid by Kenyan farmers for irrigation O&M is lower than it is in other (developing) countries. The study comes to the conclusion that it would be possible to increase this share for certain farmer groups, e. g. those who live and

44 See Neubert et al. (forthcoming) for more in-depth information on conflict prevention.

work in the high-potential regions. It would as a rule be advisable to continue to aim for 100 percent O&M cost recovery based on farmer contributions – indeed, even to insist on this point, because it appears to be quite practicable in many cases. However, contributions should be reduced especially for vulnerable population groups that farm on a subsistence basis.[45]

i) Support for marketing associations and cooperatives

In Kenya marketing organizations for farmers have a very poor image, and in the past numerous cases of corruption have been uncovered. This is one important reason why farmers have become highly wary and are now reluctant to organize in cooperatives. Still, cooperatives are the only possibility available for smallholders to gain more market power, to reduce their marketing costs, and to achieve higher prices. Thought should therefore be given to how cooperatives can be made less susceptible to corruption. Efforts to raise awareness, to introduce reciprocal control mechanisms, and to enforce sanctions against individual wrongdoers must be counted among the approaches suited to reaching this end. Such measures should be well conceived and coordinated before they are put in place. It would also be recommendable to document and disseminate positive examples of successful "cooperative governance."

6.2 Recommendations concerning poverty orientation[46]

There are several possible ways – some complementary, some competing – to impart a poverty orientation to a country's irrigated agriculture. In what follows these possible approaches are listed and described as options. What approach, in the end, is embarked upon by decision-makers is a matter that can only be determined through the process of social and political give-and-take.

a) Development of irrigation in fertile pockets of ASALs and in particularly poor provinces

Growing pressure on land in high-potential areas, particularly in the Mt. Kenya region, is increasingly inducing people to migrate to the ASALs; while these lands lack water, their soils are, in part, highly fertile.[47] It would therefore be entirely possible to achieve high yields in the so-called fertile pockets, if they were irrigated. Development of irrigated agriculture in these regions would thus be a good option for a poverty-oriented approach – where "blue" water resources are available (see also the Poverty Reduction Strategy Paper (PRSP) of Kenya, MWI 2000).

45 See Neubert et al. (forthcoming) for more information.

46 The recommendations on poverty orientation that follow were developed on two different bases: 1. policy, country-, and sector-related documents from the Kenyan government and from international development partners; 2. findings of our field research.

47 This was stated by experts from MoA and KARI; see also Sanchez (2001) and the soil map of Kenya (1980).

b) Irrigation and a focus on especially vulnerable population groups as a means of creating food security

As the findings of our study indicate, irrigation can be used to sharply improve the food security of especially poor population groups, in both quantitative and qualitative terms, even though the incomes generated in this connection play less of a role due to marketing problems, which are to be expected in all these areas, where vulnerable population groups live. Besides very poor population groups, like e. g. the people living around Lake Victoria (Nyanza), nomads could also benefit from an approach to irrigation geared to creating food security. An approach of this kind could possibly also make good economic sense, namely in the case that we compare the food security gained with the costs that would otherwise be required to provide food aid for these population groups.

It should furthermore be pointed out that efforts to promote irrigation activities among nomads have positive impacts on both food security and other social indicators that tend more to be negatively impacted by the instrument of food aid.[48] Irrigation has positive impacts on the following factors: empowerment, specifically of women; people's ability to provide their own food; and possible spillover impacts working in the direction of a more sustainable land use (reduction of livestock levels). Taken together, these impacts could in several cases very well compensate for the low financial sustainability of such irrigation schemes. In other words, in all locations where river or groundwater resources are available in sufficient quantities and the soil is generally suitable, irrigation could prove to be a reasonable option, and it could even generate further development impulses. The advisory component could fall back on the World Bank's Rapid-Results Approach, which is designed to lead to rapid and visible results, and has already been successfully used in Kenya (WBIFP 2003).[49]

c) Focus on the poorest of the poor

A focus of irrigation activities on the poorest of the poor is not necessarily an obvious approach, for irrigations calls for initial investments, i. e. would seem more appropriate for economically active population groups. In many places, though, inclusion of the poorest population groups is indirectly entailed. In Nyanza, Kenya's poorest region, one in which more than 50 percent of households have family members who are either HIV-infected or have come down with Aids, it was found e. g. that while the poorest of the poor are unable to participate fully in irrigation-related measures, these persons do in fact participate to whatever extent they can. When such persons are no longer able to participate in such activities, family members or the village community take over their work for them, ensuring that their basic needs are met. This solidarity is due for the most part to the fact that Aids is (no longer or not to a very high degree) stigmatized in Kenya (or at least in Nyanza), i. e. the victims need not fear discrimination – an achievement that it would be

48 See Part I of this paper.

49 For further information on the inclusion of nomads in irrigation activities, see Neubert et al. (forthcoming).

difficult to overestimate. In other words, HIV/Aids infected people are for this reason able to benefit from irrigation indirectly, through functioning family ties.[50]

Female headed households, where women have e. g. lost their husbands and all their sons to Aids – and there are many such cases in Nyanza – have a particularly difficult lot: These women are forced to bear the entire workload themselves. As far as this growing target group is concerned, DC could give consideration to special support measures designed to facilitate their access to irrigation measures, land (rights), and credit.

d) Allocation of land rights for poor population groups

Possession of land titles or land-use rights is closely associated with reducing poverty. As a rule very poor farmers either have no land title or partition of their land has led to extremely small holdings, and this means that they are not creditworthy. Such farmers are for this reason unable to undertake irrigation measures and make investments in their land. The MWI and the NIB are not authorized to grant land-use rights. However, they can undertake efforts to facilitate the acquisition of such rights and ensure that farmers have secured use rights for certain areas of land. As far as leased land is concerned (a case sometimes encountered in NIB schemes), thought should be given to whether it might be possible to grant such farmers at least provisional land-use rights. This would go some way toward enabling them to make investments in their land and thus to make more use out of the irrigation activities.[51]

e) Training and education

Farmers with little education are often insufficiently prepared for either irrigation tasks or land management. They often lack knowledge about sustainable land management and integrated plant protection. Targeted training for farmers in both issues is thus an urgent need. In particular in cases involving the introduction of farming as such (e. g. the case of nomads or populations who live from fishery, e. g. Nyanza), the target groups as a rule lack traditional preliminary know-how. It is therefore essential for them to learn fundamental farming skills in addition to acquiring knowledge about questions bound up with irrigation management. At the provincial level, too, coordination between irrigation authorities and agricultural authorities is essential as a means of harmonizing training measures and combining them in reasonable ways.

f) Provision of credit for poor farmers

Today poorer smallholders have almost no access to agricultural credits, a state of affairs which they see without exception as one of the greatest challenges facing them. This goes alike for individual smallholders and farmers on irrigation schemes and farmers on NIB schemes. The study furthermore shows that only a very low percentage of farmers on most

50 The research team received reports on two successful NGO projects in the field of irrigation that were geared specifically to Aids patients. This, for instance, would be a good opportunity to study and assess best practices.

51 For more information on land rights, see Neubert et al. (forthcoming); see Orindi / Huggins (2005) and Swallow / Onyango / Meinzen-Dick (s. a.) on the interaction between land rights and poverty.

irrigation schemes even have a bank account. There were only isolated reports of credit being made available. The consequence of this unmet demand for credit is that farmers either take out informal loans from private businessmen, which of course means as a rule extremely high interests payments, or that they are forced to reduce their agriculturally necessary inputs in keeping up with the financial possibilities open to them. It was, for instance, reported that some farmers were unable to purchase enough fertilizer or the protective clothing they need to apply pesticides or that under some circumstances farmers were unable to till their fields at all (we were told in Mwea that 30 percent of the farmers there were unable to till their fields for lack of access to credit).

Accordingly, credit must be seen as reasonable and necessary in cases where the savings of farming households are insufficient to purchase the inputs they need. However, most banks set up high access barriers to credit or demand overly high interest rates. In many regions there is thus a need for credit lines adapted specifically to the needs of farmers active in irrigated agriculture. This would call e. g. for repayment modalities adapted to cropping cycles. These in turn would permit farmers to purchase seed and other inputs and to repay their credits at the end of the harvest season. Special development partner-supported credits would be one good way to cover this need more adequately.

6.3 The possible future role of German Development Cooperation

The priorities set for Kenyan-German development cooperation are “Promotion of the private sector in agriculture,” “Development of the water sector,” and the field of “Reproductive health and healthcare funding.”

In recent years the water-sector priority has focused on support for the Kenyan partners in reforming the water sector, i. e. support in both formulating legislation and for the institutional implementation of the Water Act 2002. Furthermore, German Technical Cooperation (TC) has engaged in cooperation in the fields of drinking-water supply for mid-sized municipalities and water resources management.[52]

In the priority area “Private Sector Development” German Kenyan cooperation has, in connection with a better coordination of development partners, been concentrated on three regions, with German DC focusing on high- and medium potential areas. These include parts of Rift Valley, West Nyanza, and Central Province. In the area around Mt. Kenya (Central Province) German DC is providing support e. g. for the development of smallholder irrigation (KfW), marketing of agricultural products, and sustainable land management. Development of bottom-up institutions is also part of the portfolio.

For the future, German DC could expand the role it plays in the irrigation sector; the present portfolio provides a number of good points of departure. The concern here is less TC in the field of technical irrigation management – where Japanese, Israeli, and Dutch DC have comparative advantages because of their early engagement and their wealth of experience in the field of irrigation. German DC should instead look to its own comparative advantages. These are 1) policy advice in the water sector and 2) FC in

52 See the sector strategy papers on Water Sector Development in Kenya, April 2003, and the sector strategy paper on Private Sector Development in Kenya, April 2003.

infrastructure; and German DC generally can point to 3) its successes and high levels of competence in the field of land and water resources management. These could and should be put to good use in providing support for an ecologically sustainable agriculture.

Against this background and the results of the present study, we propose that in the future German DC, building on Kenya's water-sector reform, should become engaged in irrigation policy reform formulation and implementation (GTZ). It would also make sense in this connection to include here information and considerations concerning the consequences of climate change for Kenya as well as regarding what adaptation mechanisms would be adequate in the field of water policy.

Moreover, the present portfolio would also easily permit German DC to become engaged in the field of irrigation management in Nyanza (Lake Victoria Basin). The areas on which support could focus here would include in particular poverty orientation, training for farmers, and environmental sustainability, with KfW and GTZ joining forces in the efforts. Furthermore, a larger FC component could generally be used to round up the German engagement in the water and irrigation sector in the broader sense. This would apply for the flanking resource protection measures required for a sustainable land and irrigation management. These would include rainwater-harvesting measures, support for the construction of water reservoirs and retention basins for flood protection, and other water-conserving measures (e. g. afforestation).

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Annex

Table 2: Irrigation potential, broken down by catchment areas			
Catchment area	Potential in hectares, as estimated by the MWI	Potential in hectares, as estimated by the World Bank	Already developed (ha)
Tana	205,000	90,000	68,678
Athi	40,000	49,500	10,818
Lake Victoria	200,000	57,400	10,827
Kerio Valley	64,000	31,200	5,477
Ewaso Ng'iro North	30,000	15,700	10,000
Total	539,000	244,700	105,800
Sources: MWI 2005, World Bank 1987; in Ngigi 2002, 42			

Table 3: Renewable water resources, broken down by catchment areas in BCM/yr			
Drainage basin	Groundwater potential ($106m^3$)	% of groundwater potential	% of total water resources potential
Tana	147.3	23.8	32.3
Athi	86.7	14.0	4.3
Lake Victoria	115.7	18.7	54.1
Rift Valley	125.7	20.3	3.4
Ewaso Ng'iro North	142.4	23.0	5.8
Total	617,8	99,8	99,9
Sources: National Water Master Plan 1992 / National Water Master Plan After Care 1998			

Table 4: Overview of the irrigation schemes visited

Irrigation Schemes		Organization		Water source			Irrigation Scheme					Production and Marketing			Conflicts over Water		Geography / poverty mapping		
Number	Scheme Name	Type of scheme	External Support (by whom?)	Water source	Water Availability	Water Harvesting/ Storage	Motive Force	Scheme Size (ha)	number of farmers / employees	conveyance system	Application System	Produced Crops	Market	Expansion*	Conflicts	Mediation	Province	District	Year of Establishmnt
1	**Rubiru** Irrigation Scheme	SH	gov	three spr	12	no	G	186	115	opcan	Sp, Bu	food, hort	Dom, Sub	yes	no	N/A	Central Province	Thika	1997
2	**Penta** Flowers	Comm	no	Riv	12	yes	P	25	N/A	pipe	Drip	Flw	Exp	no	yes	Inst	Central Province	Thika	1993
3	**Hongo Ogosa** Village, **Gul Ongere** Irrigation Scheme	SH	no	Riv	12	no	P	4	23	opcan, then individual pumping to the scheme	Hs	food, hort,	Sub, Dom	yes	no	N/A	Nyanza	N/A	1993
4	**Hongo Ogosa** Village, **Sisu** Irrigation Scheme	SH	training (JICA)	Riv	12	no	G	N/A	N/A	opcan	flood	Rice	dom	N/A	no	N/A	Nyanza	N/A	2003
5	Division Rarude, Aram Cluster (**Bondo** District)	SH	N/A	Lake	12	no	G	N/A	N/A	canals, 1 pump	bucket, furrow,	Ho	Sub, Dom	N/A	no	N/A	Nyanza	Bondo	2000
6	**Atandi** Scheme (Rachuonyo District)	SH	gov	Lake	12	no	G	120 ha + 30ha to come	100	furrow	bucket	food, hort	local	yes (pipes, pumps)	no	N/A	Nyanza	Rachuonyo	1982
7	**Gem Rae** Nyando District	SH	yes	Riv	12	no	G	100	370	opcanal	flood	Ce, Ho	Dom	N/A	yes (verbal)	Infor.	Nyanza	Nyando	1940s
8	**South-West Kano**	SH	yes	Riv	N/A	no	G	607 (953 to be develop ed)	over 10.000	opcan	flood	Rice	N/A	yes	no	N/A	Nyanza	Nyando	1993
9	**Ahero** Irrigation Scheme	GovNIB	yes	Riv	12	no	P	1250 (972 for rice cultivatio n)	519	opcan	flood	Ce	Dom	yes	no	N/A	Nyanza	Nyando	1968
10	**West Kano**	GovNIB	yes	La	12	no	P	902 ha, another	N/A	pumps, opcan	flood	Ce, Ho	Dom, Sub	yes	yes	Inst.	Nyanza	Nyando	1976
11	**Perkerra** Irrigation Scheme	GovNIB	yes	Riv	6	no	G	? Plot size average 3 acres	N/A	opcan	flood	Ce, (Ho)	Dom, (Sub)	N/A	Yes	Infor.	Rift Valley	Baringo	1954
12	**El Dume**	SH	yes	Riv	not whole year	no	G	101 (plus 28 jua kali)	300	opcan	furrow	Seeds, (Ho)	N/A	JuaKali already there	no	N/A	Rift Valley	Baringo	before 1985
13	**Elangata Enterit**	SH	yes	Riv	12	no	G	53	73	pipe	furrow	Food, Hort	Dom	No	no	N/A	Rift Valley	Narok	2004/5

Table 4: Overview of the irrigation schemes visited (cont'd)

Irrigation Schemes		Organization		Water source			Irrigation Scheme					Production and Marketing			Conflicts over Water		Geography / poverty mapping		
Number	Scheme Name	Type of scheme	External Support (by whom?)	Water source	Water Availability	Water Harvesting/ Storage	Motive Force	Scheme Size (ha)	number of farmers / employees	conveyance system	Application System	Produced Crops	Market	Expansion*	Conflicts	Mediation	Province	District	Year of Establishmnt
14	**second Massai Scheme**	SH	yes	Riv	12	no	G	49	N/A	pipe	furrow	Food, Hort	Dom	No	no	N/A	Rift Valley	Narok	1979
15	**Panda Flowers** Limited	Comm	no	Aqui	12	yes	P	200	850	drip	Drip	flower	Exp	No	no	N/A	Rift Valley	N/A	2001
16	**Ol-Njorowa**	Comm	no	Lake	12	yes	P	17	445	pipe	Drip	flower	Exp	no	no	N/A	Rift Valley	N/A	1992
17	**Longonot** Farm	Comm	no	Lake, borehol	12	no	P	114	772	pipe	Drip, spri	flower, veg	exp (+dom)	recent	no	instit.	Rift Valley	N/A	1980s
18	NGK **Gitero**	SHF	yes (USA)	river		yes (little)	G	N/A	150	pipe, can	spri, hose	veg	exp+do m	past	no	instit.	Central Province	N/A	1984
19	**Gatune** Irrigation Self-Help Water Project	SHF	UK, GoK	river	not whole year	yes (little. Soon more)	G	506 (?)	216 (reg) 150 (conn)	pipe	spri	veg	exp + loc	yes: storage dam	yes	instit.	Central Province	N/A	2002
20	**Kirimara Ngamini** Irrigation Project (Mutara River)	SH	yes	Riv	not whole year	Y (just started very small)	G	33	78	lincan, opcan	Fur	Food, Hort	Exp, Dom, Sub	yes	yes	Inf	Central Province	N/A	1967/1 968
21	**Mutara River** Scheme II	SH	yes	Riv	8 - 12	no	G, P	300 ha	3.000	opcan	Fur, Hs	Food, Hort	Exp, Dom, Sub	no	yes	Inst.	Central Province	N/A	1981
22	**Munyu Gathanji** Water Project (Pesi River)	SH	yes	Riv	12	no	G, P	50 (13 irrigated)	62	opcan, lincan (only main canal)	Fur, Hs	Food, Hort	Exp, Dom, Sub	yes	yes	Inf.	Central Province	N/A	1987
23	**Kibirigwi** Irrigation Farmers Cooperative Society	SH	yes	Riv	12	N/A	G	71	over 700	pipe	Sp	Hort	Exp, Dom	no	no	N/A	Central Province	Kirinyaga	1975
24	**Mwea** Irrigation Scheme	GovNIB	yes	Riv	12	Y	G	10000 - 6.000	3.392	opcan	flood	Ce (Rice)	Dom	yes	yes	Inst./Inf.	Central Province	Kirinyaga	1960
25	**Gakaki**	SH	yes	Riv	12	yes	G	N/A	N/A	pipe	Spr	Hort	Exp, Dom	yes	no	N/A	Central Province	Muranga	1953
26	**Kiambintu** Irrigation Scheme	SH	yes	Riv	12	no	G	121	400 HH (2.400 ppl)	pipe	Spr	Food, Hort	Exp, Dom, Sub	no	no	N/A	Eastern Province	Mbere	2003
27	**Gathigi / Ishiera** Irrigation Scheme	SH	yes	Riv	12	no	G	81	100	opcan	Fur	Food, Hort	Exp, Dom, Sub	no	no	N/A	Eastern Province	Mbere	1956/1 957
28	**Ciambaraga** Irrigation Scheme	SH	yes	Riv	12	no	G	52	123	pipe	Spr	Food, Hort	Exp, Dom, Sub	no	no	N/A	Eastern Province	Meru South	1996
29	**Mitungu** Irrigation Scheme	SH	yes	Riv	12	yes	G	total gross area 970 ha, 405 ha irrigated	600	pipe	Spr	Ho	Dom (exp)	no	no	N/A	Eastern Province	Meru Central	1970s
30	**Mutunyi Mutethia**	Sh	yes	Riv	12	no	G	70	620 (ard 3.000)	pipe	Spr	Hort (Food)	Dom	yes	yes (before, no more)	Inf.	Eastern Province	Meru Central	1982
31	**Keoriimba Machegene**	SH	yes	Riv	12	no	G	N/A	N/A	N/A	Spr	Ho	Exp, Dom	N/A	no	N/A	Eastern Province	Meru North	N/A

Table 5: List of interview partners

	Institution / Locality	Name	Function / Position
	Nairobi (Central Province)		
15.02.	International Maize and Wheat Improvement Center (CIMMYT)	Marianne Bänziger, Ph.D.	Director, African Livelihoods Program, Global Maize Research
		Fred Kanampiu, Ph.D.	Agronomist, African Livelihoods Program, *Striga* Project Coordinator
		Wilfred Mwangi, Ph.D.	Economist, Principal Scientist / African Livelihoods Program
	Kenya Institute for Public Policy Research and Analysis (KIPPRA)	Eric Aligula, Ph.D.	N/A
16.02	Ministry of Water and Irrigation (MWI)	Mr. Muchangi	Senior Irrigation Engineer
	Water Resource Management Authority (WRMA)	Patrick O. Oloo	Chief Executive Officer
17.02.	Embassy of the Federal Republik of Germany	Heiko Warnken	First Secretary, Head of Department for Development Cooperation Kenya, Burundi, Seychelles, South Sudan
	German Development Service (DED)	Anton Gläser	Agriculture Sector Coordinator
Mo. 20.02	Ministry of Water and Irrigation (MWI)	Robert N. Gakubia	Ag. Director of the Department of Irrigation
	Ministry of Water and Irrigation (MWI)	Samuel M. Kioni	Hydrologist
		Anthony Mwenje	Hydrologist
	Kenya Agriculture Research Institute (KARI)	Asaia Sijali	Head of Irrigation and Drainage Programme
		P. T. Gicheru (PhD)	Head of Kenya Soil Survey
Tue. 21.02	Tegemeo Institute of Agricultural Policy and Development	James K. Nyoro	Executive Director
	Rubiru Irrigation Scheme (Thika District)	Mr. Kimotho	Chairman
		Mr. Thimbo	Secretary
		Focus Group Discussion	15 Farmers
	Penta Flowers	Thomas Ochieng	Production Manager
	Nairobi (Central Province)		
Wed. 22.02	Kreditanstalt für Wiederaufbau (KfW)	Dr. Jörg Dux	Director, Regional Office Nairobi
	Japanese International Cooperation Agency (JICA)	Dr. Yasuhiro Doi	Chief Advisor, Participatory Water Management
	National Irrigation Board (NIB) Headquarter	John P. Olum	General Manager
		Citonga Mugambi	Manager
		Francio Murose	Chief Engineer
		Mary Chomba	Chief Accountant
		Hosea Wendoti	Senior Engineer

	Institution / Locality	Name	Function / Position
	Horticultural Crops Development Authority (HCDA)	Jotham Ouko	Principal Horticultural Manager
Thu. 23.03	Thana and Athi River Development Authority (TARDA)	Diana Kimani	Socio-Economist
		Raymond Karindi	Agricultural Engineer
		Christine Kariuki	Agriculturalist
		Samuel Gitonga Mbui	Hydrologist
	Ministry of Co-Operative Development and Marketing	Frederick F. Odhiambo	Commissioner for Co-operative Development
		Miriam Wanyonyi	Senior Assistant Commissioner
		Mucangi Gicheru	Senior Assistant Commissioner
		Sam M. Kitenge	Assistant Commissioner
24.02	Kenya Flower Council (KFC)	John Njenga	Lead Auditor
Nakuru (Rift Valley Province)			
27.02	Provincial Irrigation Office, Rift Valley Province	Godfrey Nyanchama	Provincial Irrigation Officer
Lake Victoria Region (Nyanza Province)			
Tue. 28.02	Provincial Irrigation Office, Nyanza Province	Leopold Asawo	Provincial Irrigation Officer
		Bob Busungu	Deputy Provincial Irrigation Officer
		Nikolas Odhiambo	District Irrigation Officer Kisumu
		Yoshua Onyango	Irrigation Officer
	Hongo Ogosa Village	Hesbon Nyabande	Area Chief
		Dan Ochuka	Development Committee Chairman
		Paul Ochuka	Village Elder
		(Focus Group Interviews with 20 villagers)	
Wed. 01.03	Bondo District	D. M. Jakaiti	District Commissioner
		Lumumba Odundo	District Irrigation Officer
		Jarateng Otonde	Deputy District Irrigation Officer
	Division Rarude, Aram Cluster (Bondo District)	Misita Farmers Group (Focus Group Interview with 17 farmers)	
02.03	Water Resources Management Authority (WRMA) Regional Office Lake Victoria South	Henry Njuguna	
	Rachuonyo District Irrigation Office	Vincent Oyieng	District Irrigation Officer
		Oliver Ogado	Deputy District Irrigation Officer
	Atandi Scheme (Rachuonyo District)	Moses Kawumba	Scheme Committee Secretary
		Focus Group Interview with 20-25 Farmers	
Fri. 03.03	Gem Rae (Nyando District)	Nashon Okech	Scheme Secretary
		Sikuku Oturo	Scheme Committee Member
		Focus Group Interview with 25 villagers	

	Institution / Locality	Name	Function / Position
	South-West Kano Irrigation Scheme (Nyando District)	Elisha Nyammaya	Chairman of Committee
			2 Members of the Committee
Lake Victoria Region (Nyanza Province)			
Friday 03.03	Ahero Irrigation Scheme (Nyando District)	Stephen Apome	Irrigation Officer
		John Mike Ocharo	Chairman Steering Committee (SC)
		Moses Odhiambo Achero	SC Marketing, Production, Water
		Paul A. Osumba	Ass. Chief Ahero Irrigation Scheme
		Group Discussion	with 4 Farmer Representatives
	Water Resources Management Authority (WRMA) Regional Office Lake Victoria South	Rose Anpwega	Regional Manager
Sa. 04.03	West Kano Irrigation Scheme (Nyando District)	Owila Obiero	Irrigation Officer West Kano
		Samuel Otieno Okoth	WUA Chairman
		Andrew Odeny Gone	WUA Secretary
		Tom Agallo Adede	Secretary Manager Farmers' Cooperative Society
		John Obura Owuoth	Chairman Advisory Committee
		Charles Walter Olang	Secretary West Kano Scheme
		Emmanuel Obumba	Farmers' Cooperative Society
		Japheth Onyango	WUA Treasurer
		Vincent A. Anyanga	Area Assistant Chief
		Monicah Ondieu	Farmer
Rift Valley Province			
Mo. 06.03	Weiwei Irrigation Scheme (Pokot District, Kerio Valley)	Asiah Pendou	Farmer Representative (Chairman)
		Edwin Keitany	Irrigation Officer
		Peter Wekesa	Kerio Valley Development Authority
		Harrison Loyatum	Kerio Valley Development Authority
		Focus Group Interview	with 70 Farmers
Tue. 07.03	Perkerra Irrigation Scheme (Baringo District)	Ben Massawe	Scheme Manager
		Josephine Kipkaliny	Farmers
Rift Valley Province			
07.03	El Dume Irrigation Scheme (Baringo District)		

	Institution / Locality	Name	Function / Position
08.03	District Irrigation Office (Narok District)	Mr. Karango	Deputy District Irrigation Officer
09.03	Elangata Enterit		
	Narosura		
Nairobi (Central Province)			
Thu. 16.03	Kenya Wildlife Service (KWS)	Julius K. Kipng'etich	Director
	DERO Community & Cultural Organization	J.V. Ng'wuono Hongo	Executive Director
Naivasha (Rift Valley Province)			
Fri. 17.03	WRMA Naivasha Sub-Region	Dominic K. Wambua	Assistant Hydrologist
	Office of the President (Nakuru District, Naivasha Sub-District)	J.K. Maikara	Senior District Officer
	Panda Flowers Limited (Flower Business Park)	Eugene Reekstring Joseph Kibuta	General Manager of Panda Flowers General Manager of FBP Human Resource Manager
	Ol-Njorowa	Simon Harris Christopher Trudigo	General Manager Chairman of Welfare Committee
	Longonot Farm	Mr. Millbury Discussion with	General Manager 3 Employees
Mt. Kenya Region (Central Province)			
Mo. 20.03	Provincial Irrigation Office	George Kahuro Stephen Maingi	Provincial Irrigation Officer District Irrigation Officer, Nyeri District
	Provincial Commissioner´s Officer	J.K. Rugut	Provincial Commissioner
	Irrigation and Drainage Office (Kiemi East Division)	John G. Muraya	Irrigation and Drainage Officer
	Burguret River Water User Association (BRWUA)	Stephen Mbau Johnson Kimani Samson Njagi	Chairman of BRWUA, Chairman of Catchment Area Advisory Committee Member of BRWUA Secretary of BRWUA, Representative of Zone II
	NGK Gitero Irrigation Scheme		
Mo. 20.03	Gatune Irrigation Self-Help Water Project (Burguret River)	John Miano Ndirangu Steven Mwirigi Jame Wambui Group Discussion	Chairman of scheme and Vice-Secretary of Burguret River WUA Secretary Treasurer with 4 Farmers

	Institution / Locality	Name	Function / Position
	Water Resources Management Authority, Ewaso Ng´iro North River Basin Region	Maitima S. Mukindia	Regional Manager
		Apollo M. Minjine	Water Conservation Officer
		Simon W. Wangombe	Groundwater Officer
		Mrs. Judy Njoki Kigamba	Water Quality Officer
Tue. 21.03	District Irrigation Office (Nyandarua District)	Michael Thuita	District Irrigation Officer
		Joseph Dedan	Irrigation Engineer
	Kirimara Ngamini Irrigation Project (Mutara River 1)		Chairman
		Daniel Kagwanja	Secretary of the Project
		Joseph Gicheru	Secretary of the RWUA
		Peter Muruthi	7 Project Members
	Kiamariga Irrigation Project (Mutara River 2)		
	Munyu Gathanji Water Project (Pesi River)	Geoffrey Mwangi	Chairman of the Project
		Focus Group Discussion with 12 Farmers	
	Cattle Ranch Mutara River (3) (Laikipia District – Rift Valley Province)	Mr. Kosgei	Assistant Manager
		Veronika Shekwe	Ranch Clerk
Mt. Kenya Region (Central Province)			
Wed. 22.03	District Irrigation Office (Kirinyaga District)	Benson Mwangi	District Irrigation Officer
	Kibirigwi Irrigation Farmers Cooperative Society (KIFCO)	Michael Ndeimana	Chairman of farmers society KIFCO
		Silas Rigotho Kariuili	Vice Chairman
		Joyce W'Ngari	Assistant Manager
		Joseph Maine	Bookkeeper
		John Mugera Igati	Hon. Secretary
		Alex Gitari Mjuki	Committee member
		John Muriithi Njogu	Scheme plumber
		Joseph Brunga	Committee member
		Frederick Murini	Technical Assistance
		Purity Kamonde	Store-keeper
		Evans Mutange Akoto	Scheme manager/ MoA
	Mwea Irrigation Scheme	S. M. Kamundia	Senior Irrigation Engineer / Manager
		Francis Thotho Mwaura	Chairman of Mwea WUA
			Chairman of the Thebe (?) RWUA
Thu. 23.03	District Irrigation Office (Muranga District)	David Nguru	District Irrigation Officer
	Gakaki Irrigation Project (Muranga District, Kahuro Division)	Keziah Wanjak	Committee Member
		Josphat Kanyingi	Chairman
		John Wawenie	Vice Chairman
		Phylis Wambui	Vice Secretary (Gender Equity)

	Institution / Locality	Name	Function / Position
			2 Committee Members
		Benson Mwangi	Treasurer
Fri. 24.03		Ephantus Irungu	Secretary
	Tamtrout LTD (Fishfarm)	Nicolaus Sila	Manager Tamtrout LTD
	Tambuzi Flower Farm	Silas Mbaabu	Production Manager
	Matanya, Individual Water User	Charles K. Karinki	Farmer
	Ol Pejeta Conservancy	Batian Craig	Wildlife and Security Manager
Mt. Kenya Region (Eastern Province)			
Mo. 27.03	Provincial Irrigation Office (Embu Town, Eastern Province)	G.M. Maithya	Provincial Irrigation Officer
		Mr. Oirango	Assistant Irrigation Officer
	Kiambintu Smallholder Irrigation Scheme (Mbeere District)	Felister Muchiri	Vice Secretary
		Francis Koome Simon	District Irrigation Officer
		Group Discussion	with 6 Farmers
Mo. 27.03	Gathigi / Ishiera Irrigation Scheme (Mbeere District)	Njne N. Mathuluo	Irrigation Officer Mbeere District
		Harrison N. Albogo	Irrigation Officer Evurori Division
		John Mugu	Crops Officer Evurori Division
		Abeid Said	District Agricultural Extension Officer
		Eustace Mituki	Chairman Kathigi Irrigation Project
		Lawrence Nawiga	Secretary Ishiera Irrigation Project
		Ephantus Mycey	Committee Member Kathigi Project
		Frederick Nyaga	Committee Member Kathigi Project
		Richard Irori	Farmer in Kathigi Irrigation Project
		Flora Dida	Committee Member Ishiera Project
		Josack Njagi	Committee Member Kathigi Project
		Timothy Nyaga	Committee Member Kathigi Project
		Patrick Njogiu	Committee Member Kathigi Project
		Michael N. Mate	Committee Member Kathigi Project
		Francis N. Mwea	Member Kathigi / Ishiera Project
		Denis Eitonga	Committee Member Kathigi Project
Tue. 28.03	Ciambaraga Irrigation Scheme (Meru-South District)	Jusius Rugendo	Scheme Leader
		Peter Mbungu	Scheme Secretary
		Dishon Njul	Farmer (Group F Reander)
		Patrick Mucungu	Farmer (Group G Reander)
Wed. 29.03	District Irrigation Office (Meru Central District)		District Irrigation Officer
		Wolf Bagwitz	DED, Technical Advisor

	Institution / Locality	Name	Function / Position
	Mt. Kenya Region (Eastern Province)		
30.03	(Meru Central District)		
Fri. 31.03	District Irrigation Office (Maua Town, Meru-North District)	Kaberia Imuili John N. Ngeru	District Irrigation Officer Irrigation Officer
	District Agriculture Office	Mr. Ng´ang´a	District Agricultural Officer
	Kiorimba Machegene (Meru North District)		Frontier Agricultural Extension Officer
		Francis Munyna	SACCO Chairman
		James Mutua	Sacco Secretary
		Paul Kinyua	Production Secretary
		Daniel Miubi	Committee Member
		Peter Kohia	Treasurer (Production)
		Daniel Mututo	Treasurer (SACCO)
		Gerrasio Muriira	Vice Chairman
		Jamie Nlairote	Accountant Clerk
		Douglas Mugambi	Plumber
		Focus Group Discussion	with 8 Farmers
	Nairobi (Central Province)		
03.04	National Environmental Management Authority (NEMA)	Maurice O. Mbegera	Director “Compliance and Enforcement”
05.04	Network for Water and Sanitation International (NETWAS)	Pauline Mwaniki Mishek Kirimi	Programme Officer
	Ministry of Agriculture, Department of Land Development and Management	Mr. Muchoki Mr. Kuria Mr. Ndwiga	 Senior Deputy Director Assistant Director
	International Centre of Insect Physiology and Ecology (ICIPE)	Dr. Dagmar Mithöfer	Economist – Horticulture Programme
	Kickstart	John Kinaga	Assistant Director
	Water Resource Management Authority (WRMA), SIDA/DANIDA	Jeremy Notley	IWRM Advisor
	Embassy of the Kingdom of the Netherlands	André C. Vermeer	Policy Officer Environment / Water, Development Cooperation
06.04	Water Sector Reform Project (MWI / GTZ)	Stephanie Gakuo	Communication Specialist

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