



Zentrum für Entwicklungsforschung  
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## Executive Summary: The Third Phase (2007-2010) of the ZEF/UNESCO Khorezm Project

Economic and Ecological Restructuring of Land- and Water Use in the Region Khorezm (Uzbekistan): A Pilot Project in Development Research

**Project Phase III: Change-Oriented Research for Sustainable Innovation in Land and Water Use (2007-2010): Policies – Institutions – Technologies**



**Introduction.** This project has been developed by ZEF since the year 2000 in close cooperation with its partners UNESCO, DLR, and State University Urgench in Uzbekistan. It has started in 2001, and has operated with funds of BMBF in the context of the Aral Sea crisis to provide sound, science-based policy recommendations for sustainably improving the natural resource use in Khorezm region. Khorezm is a district of the Republic of Uzbekistan, and is located in the irrigated lowlands of the Amu Darya River, which is the major tributary to the Aral Sea.

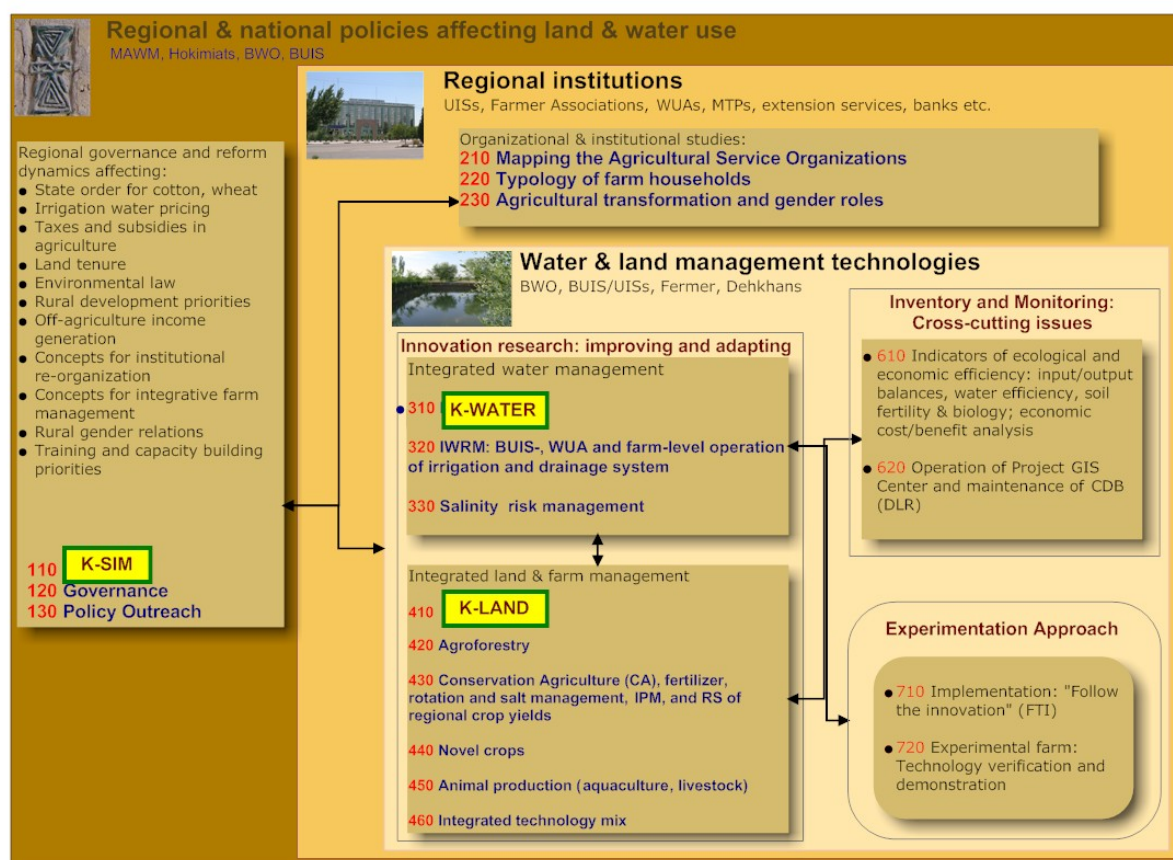
**Goal.** The project specifically aims at providing a comprehensive, science-based plan for *restructuring*, at three nested intervention levels: **policies, institutions, and technologies**. Research in this project will provide (1.) decision support for improved, consistent agricultural policies (national/regional policy level), which is (2.) to be implemented through an institutional re-structuring with the aim of providing sustainable natural resource use (we focus here on the regional institutional level), and should be based (3.) on integrated technology packages in land and water use (technical management level). This is schematically outlined in Figure 1.

**These concepts are being developed in a long-term scientific research program that blends applied scientific research with reliable, tested development-oriented interventions at all three mentioned intervention levels. The ultimate goal of these concepts is to provide for sustainable land and water resource management while at the same time improving rural livelihoods.**

**Policy recommendations, scientific publications and academic human capacity building are major outputs of this project. This change concept is being developed with a specific regional focus on Khorezm district of Uzbekistan but options for outscaling will be explored through strong cooperation with local partners and a collaboration arrangement with GTZ.**

**Phases.** The project proposed here refers to Phase III in this comprehensive, long-term project that covers 10-12 years in 4 phases. Phase I saw the establishment of central databases and infrastructure, and Phase II field surveys and trials for understanding institutions and processes, that allowed the development of simulation and optimization models (FLEOM, a farm-level optimization model; and first steps towards a Khorezm-wide simulation model (KEOM)). **In Phase III we will be testing the integrated concept for restructuring land use on a research farm, on-farm and with institutions, which will lead to the**

**development of policy recommendations and informed decision making by Uzbek policy makers, by the water administration, and by farmers.** This is then to be outscaled in Phase IV, to allow adaptation of the concept and its implementation in Khorezm.



**Figure 1: Overview of the research activities planned for Phase III.**

**State of the Art.** Research in Phases I and II has focused on four large clusters (Natural Resource Management Strategies, Production Systems, Economy, Society and Institutions) with the overall goal of adapting and developing innovations tailored to the specific requirements of Khorezm through integrative modeling. Comprehensive GIS data bases were established for the region. The situation of groundwater levels and groundwater and soil salinity was investigated. Precise water budgets for on-field, on-farm, and regional irrigation water management were established. The potential and benefits of technological innovations such as soil conservation agriculture, the introduction of alternative crops (potatoes, sorghum), the improvement of crop rotation and fertilizer management, agroforestry, and pisciculture were thoroughly tested – partly on-station, partly in on-farm trials managed by researchers.

This was seconded by economic research that analyzed the overall economic performance of Uzbekistan and Khorezm, and detailed the potential of crops, trees, and fish ponds as well as of better irrigation and drainage water management for on farm income generation. Social research looked at the institutional framework conditions for land-use related policy making in Uzbekistan. This includes a commented edition of laws related to agriculture and natural resource use, analyses of the effects of the de-collectivization on the farming sector, the dynamics of agricultural knowledge, research on the Water User Associations emerging since 2003, and a look at the functioning of local administration in the water sector. Many of these studies have become available early 2006 or are in the stage of final edition, and represent a

substantial knowledge basis amassed over the course of 5 years of research with over 40 researchers. Based on a preliminary assessment of these data, we are now able to provide sound and fresh scientific insights into the regional development problems. This analysis is far from being completed and will provide, in the combination of further field research with the modeling of long-term, long-distance effects of land use policy decisions, reliable options for improvement.

The project has set up effective functional links to national, regional, and local policy- and decision-makers and stakeholders such as farmers and WUA managers. The project is the only long-term research project in the region and has established itself as a major reference point within the international donor community. The comprehensive project database is today not only used by the researchers, but also by local institutional and administrative bodies (WUA, BWO, BUIS, *Hokimiat*, and the Ministry for Agriculture and Water Resources).

Due to the complexity and interdependencies of the social, economical and biophysical factors, the approach of parallel multi-disciplinary knowledge generation and integrated modeling of cause-effect relations starts showing promising results, which however need to be complemented in Phase III (a) by “filling in the missing parts of the puzzle” through targeted research on technologies and innovations, and (b) by addressing the policy and institutional aspects through a set of activities tailor-made to the specific transitional situation of Uzbekistan. This will be based on field research and modeling.

The project will therefore work at various intervention levels, as depicted in Figure 1: (1) the policy domain where national and regional decisions are made that affect natural resource use; (2) the institutional domain of regional organizations that supply services on the farm and water management level which are crucial about how the resources are used; and (3) the technology domain at which novel land and water management operational procedures, strategies and technologies (in short, *innovations*) are being applied.

Cross-cutting those three domains are the inventory and monitoring, with a vital input from the DLR which continues operating the project’s GIS center and maintaining its Central Data Base, and the efforts at measuring project effects and success through a set of carefully selected indicators.

**Field research.** Regarding field research, two avenues will be pursued in parallel. *First*, the land and water use technologies studied during Phase I and II (conservation agriculture, agroforestry, and so on) will be integrated into an optimal ‘technology mix’ through field research on the synergy effects of having several of these technologies being applied in a combined fashion. This will be realized in the relatively protected environment of an experimental landscape unit, where careful and intensive instrumentation will allow for a scientific assessment of the effects of the innovations on the natural resources. This landscape unit will be of the size of approximately 60-120 ha. The *Hokimiat* Khorezm has already indicated that it will release this land from state orders. These activities are summarized under work package **720** (Table 1).

*Second*, some of the innovations will be taken out to ‘real’ farms, for interaction with the stakeholders and intensive research on their performance. But innovations are not confined to land use technologies alone, they also address water management and land use decisions on higher levels. Therefore, we designed a stakeholder-orientation process which we called “Follow-the-Innovation” (FTI; described under work package **710**) as it allows to engage in implementation-oriented research with stakeholders at different levels (farmers, water managers), thus embedding the innovation in the resource use activities as a first step for out-scaling the technologies to the wider region.

**Models.** Research topics in Phase III therefore address decision-making on various levels, through providing options for institutional and farm-level resource management embedded in options for an “enabling policy environment”. This decision making is specifically supported through scientific modeling. One model, K-LAND, will allow optimizing specifically the joint management of land, soil, water, crops, and farm economics, on the farm level (work package (WP) **410**). Recipients will be farm managers and extension service agents at the level of Uzbek Farmer Associations (UFAs) and Water User Organizations (WUAs). A second model, K-WATER (WP **310**), will allow providing an integrated water resource management through all spatial scales, from the region (Khorezm) down to the subregion (*tezim*), WUA, farm and field. Both models will be integrated in a higher-level policy support tool, K-SIM, which will allow long-term forecasts of various development scenarios (WP **110**). The policy level will be addressed by research on the reform process and governance (**120**), and by an appropriate dissemination strategy for addressing regional and national decision-makers as well as the scientific community (**130**).

The models will be built on research results from Phases I and II of this project, and additional field research carried out during Phase III. Research during Phase III will address socio-economic aspects by mapping the agricultural service organizations that act on the regional level (WP **210**), setting up a comprehensive farm typology addressing agricultural change (**220**) and studying the rural transformation process with specific regard to gender relations (**230**) that will prove important for designing interventions later. Field research will further address the water management at various scales in an integrated manner (**320**), and specifically address the management of drainage and soil salinity (**330**). Field research will address the land management through long-term studies on agroforestry and particularly, the potential of nitrogen-fixing trees (**420**). Additional work will look on how to integrate conservation agriculture with other, ongoing studies on fertilizer management, and salt and crop rotation management (WP **430**). Furthermore, we will investigate the potential of some alternative crops such as potatoes, sorghum, dry (aerobic) rice, and a niche cash crop, indigo (**440**). Animal production (**450**) will be addressed through research on aquaculture systems and the animal livestock production in the region. The integration of various crops (trees and annual crops) and other systems will be specifically addressed in on-station research (WP **460**).

An important aspect of this research is the monitoring of environmental (water, soils) and economic indicators (WP **610**) that will help assessing the project’s effects on resource economy. The central data processing responsibility remains with the project’s GIS center in Urgench, which, as in the previous phases, will be maintained, updated and managed by DLR (WP **620**).

**Approach.** This calls for an approach to research and innovation development that covers both research and implementation. This approach allows for blending the more basic (supportive) research that identifies options for and potential of innovations with the more application-oriented on-farm research. The basic research deals with fine-tuning policy, institutional arrangements and technology packages to be implemented and tested in a research farm context, whereas the on-farm research addresses the wider-scale adoption of innovations throughout the region.

The innovation-oriented research (‘FTI’) will be set up in close cooperation with the respective stakeholders. For example, optimized water management options will be implemented at the level of water-distributing administration. Farm-level technologies will be implemented by farmers throughout the region. The adoption and ensuing adaptation process in collaboration with stakeholders will generate research questions so that an interactive process will ultimately lead to reliable and tested innovation packages that can be taken out for wide-scale implementation.

The experimental landscape research unit, on the other hand, will be intensively instrumented for assessing and monitoring the effects of the innovations in concert on carefully selected indicators of ecological and economic sustainability (water quality and quantity, soil quality, economic cost-benefit analyses of households, and off-farm economic costs/benefits).

The places where innovations are tested with stakeholders will also be instrumented to assess these indicators, although at a much less elaborate, more practice-oriented scheme using easy-to-assess, quick indicator systems. This will be supported by computer modeling to assess the long-term effects.

**Deliverables.** The main deliverable of the project will be a comprehensive regional restructuring plan based on scientific findings and long-term simulations of integrative computer models. The plan will include a description of the policy environment required to enable restructuring, and the institutional re-arrangements necessary to support sustainable land and water resources management. The plan will be composed of a set of options for institutional management and land restructuring developed during 2001-2006 and tested through an integrative, participatory approach, (such as WUA management, conservation agriculture or agroforestry). This project phase will also conduct research on the potential of various technologies that we identified as promising, but which could not yet study (such as livestock integration, aerobic rice, and niche crops). The scientific and technical support for these options will be provided in the form of models and GIS-based suitability maps.

The project will continue academic capacity building with 18 Post-Docs, 14 Ph.D., 28 M.Sc., and numerous B.Sc. students, over half of them from Uzbekistan. The expected scientific output will be documented in 30-40 scientific publications, and through public outreach including workshops, internet presence and a documentary film. Furthermore, we expect integration with German TC in Central Asia based on data sharing and close cooperation between ZEF and GTZ. This will allow introducing viable concepts of change generated in the project into the donor and development community of Uzbekistan in which the GTZ plays an important role so as to influence decision-making at both national and international levels. The results will be used for the preparation of the next (last) project phase, starting 2011, during which further outscaling of novel institutional constructs and technologies and full transfer of the achieved results to the people of Uzbekistan is intended. At this point in time, we expect the project to be taken over by the partners and numerous alumni of the project.

**Partners.** This project is prepared by the Center for Development Research (ZEF) of the University of Bonn. It relies on the partners it has been working with in the past years. UNESCO will provide logistic and policy-oriented support on the national level in Uzbekistan, and UNU-EHS management and dissemination support in Uzbekistan and Bonn. The State University Urgench in Khorezm is the main local implementation partner.

The German Space Agency (Deutsches Zentrum für Luft- und Raumfahrt; DLR) will provide spatial information and analysis based on data from satellite images and from the project's central database. DLR will be responsible in particular for the work packages **620** (Operation of GIS Center Khorezm and maintenance of central data base), **412** (GIS-and remote sensing based land suitability evaluation) and **413** (remote sensing of cotton productivity and yields) and will contribute to Integrated Water Resource Management (**322**) in cooperation with University of Würzburg.

The International Maize and Wheat Improvement Center, CIMMYT, will continue providing input and support for adjusting the crops and crop production systems, and this collaboration also represents an entry into the CGIAR system. Several government bodies in Uzbekistan such as the Ministry for Agriculture and Water Management (MAWM) and the regional administration of the *Hokimiat* Khorezm have endorsed the project. The latter has expressed its willingness to release the necessary land for a research farm.

The project will move in a direction of a much deeper integration with technical cooperation (TC) activities. We build on the involvement of TC organizations for the policy dialogue and outscaling activities. However, we recognize that this depends on both the TC organizations willingness to cooperate and their funding. GTZ has expressed its willingness to enter into a partnership with ZEF on the basis of a joint program, to be developed and implemented on the basis of a formalized agreement for cooperation. This follows a general strategy of translating basic research into implementation of innovations. This will become the guiding principle of the process-oriented approach that will be defined and determined in close cooperation between the two German organizations (ZEF, GTZ), UNESCO and Uzbek farmers, as well as partners from academia and administration in Uzbekistan.

GTZ has recently developed a new working concept for Central Asia that is strongly rooted in regional development, capacity building and organizational development, and regionally addresses an area encompassing the wider lower Amu Darya area, i.e. including Khorezm and Karakalpakstan. Thus, the ZEF project will also widen its scope to provide adequate scientific input for the GTZ's TC activities in this region. A joint steering committee will coordinate the integration of the cooperating partners, and the field managers of both sides will manage the day-to-day cooperative work.

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**Table 1: Work Packages Overview**

<b>Intervention Levels</b>	No.	Work Clusters	No.	Work Packages
	new			
<b>Policy</b>	110	K-SIM	111	K-SIM
			112	K-SIM Computer Science
	120	Resource governance	121	Governance and the reform process
	130	Policy outreach (workshops and Papers)	131	Policy outreach (workshops and Papers)
<b>Institutions</b>	210	Mapping AgSO	211	Mapping AgSO
	220	farm typology	221	farm typology
	230	Agricultural transformation & gender	231	Gender relations in agricultural entrepreneurship
<b>Water and Land Man.</b>	310	K-WATER	311	K-WATER
			312	Hydro-Geology
	320	IWRM	321	IWRM: BUIS, WUA, farm
			322	optimized water allocation
	330	Drainage and salinity management	331	drainage and salinity management
			332	water risk management
			333	drip irrigation
	410	K-LAND	411	K-LAND
			412	Land suitability maps
			413	Remote sensing of crop yields
			414	Forestry action plan
	420	agroforestry	421	Agroforestry, long-term trials
			422	Agroforestry, N-Fix and soils
	430	conservation agric.	431	CA, fertilizer, salts, rotation Integration
			432	IPM
	440	novel crops	441	potatoes, sorghum
			442	Novel crops: Rice
			443	Novel crops: Indigo
	450	animal production	451	aquaculture
			452	Livestock feasibility
			453	Livestock integration
	460	integrated land use	461	Complex integrated LU Packages (farm res.)
<b>Cross-Cutting</b>	610	ecological and economic indicators	611	Water efficiency
			612	Soil fertility and ecology, OM budget
			613	Economic cost-benefit analyses
	620	GIS	621	GIS Center and database management
<b>Approach</b>	710	Innovation research	711	Innovation research
	720	Research farm	712	Research farm