Towards the 6th World Water Forum —
Cooperative Actions for Water Security

International Conference

12-13 May 2011
Tashkent, Uzbekistan

Adoption of Innovations in Agriculture in Order to Achieve Food Security

Concept Note on Thematic Priority

Regional Process Commission:
Central Asia Cross-Continental Process

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Concept Note on Thematic Priority

Given Concept Note was prepared in light of the Process development framework "From targets to solutions" (Fig. 1) adopted by the World Water Council (WWC) and the International Forum Committee and which sets successive steps for development of proposals on solution of urgent water problems towards the 6th World Water Forum.

The proposed topic corresponds to the key priority 2.2 of the WWF6 thematic framework "Water and food security", which is associated with the topic 4 of the Europe Regional process. This topic is very important in light of fighting hunger and for achievement of MDGs, especially for the given arid and semi-arid region, where agriculture depends on irrigation and is a source of employment for rural population, which accounts for more than 60% of the total population in some countries of the region. Land productivity improvement and food production in the EECCA region were discussed at a Special session of the International Commission for Irrigation and Drainage in Delhi in December 2009, at EECCA INBO Assembly in May 2010, and during the Symposium “Water in Central Asia” organized jointly by SIC ICWC and German Federal Foreign Office in November 2010.

Guaranteeing food security is of critical importance for our region due to its landlocked nature, low incomes of rural population, transition from planned centralized economy to market economy and, in this context, associated growth of competing high-performance water users, such as hydropower and industry.

Challenges for the Future

Despite a significant growth in food production over the past half-century, one of the most important challenges facing society today is how to feed an expected population of some nine billion by the middle of the 20th century. To meet the expected demand for food without significant increases in prices, it has been estimated that we need to produce 70–100 per cent more food with adequate quality, in light of the growing impacts of climate change and concerns over energy security. It will also require finding new ways to remedy inequalities in access to food. Today the world produces sufficient food to feed its population, but there remain more than one billion people who suffer from food insecurity and malnutrition (IAASTD, 2009). This challenge is amplified further by increased purchasing power and dietary shifts in many parts of the globe, barriers to food access and distribution, particularly in the poorest regions.

Despite the emergence of many innovations and technological advances in recent decades, this combination of drivers poses novel and complex challenges for global agriculture, which is under pressure to ensure food and energy security in ways that are environmentally and socially sustainable (National Research Council, 2010a). **Complicating matters further, the past half-decade has seen a growing volatility of food prices with severe impacts for the world’s poor, most notably during the food price peaks of 2007–2008.**

Growth of population combined with relative sustainability of rural population causes a need to increase food production and, first of all, eliminate food shortage, for instance, in Tajikistan and Kyrgyzstan for some food commodities, on the one hand, and a need to create additional jobs in rural area and pay more attention to soil conservation, on the other hand. Given the current agricultural re-structuring, the disaggregation of agricultural users, and the critical reduction of farm sizes (Kyrgyzstan, Tajikistan, etc.), the following problems come to the foreground: irrigation water deficit; reduction of crop areas due to repeated low-water years and droughts; and, deterioration of soil fertility. All this puts the future of agriculture at great risk.

The management of soil fertility is essential to enhancing and sustaining agronomic and biomass productivity. Nutrients harvested in crops (i.e. grains, roots and tubers, stover, fruits, timber) need to be replaced in order to ensure that the innate nutrient capital of the soil is not eroded. Intensively managed agroecosystems are only sustainable in the long term if the outputs of all components produced are balanced by appropriate inputs. Whether the required amount of plant nutrients to obtain the desired yield is supplied through organic (biofertilizers) or inorganic (synthetic chemicals) means or any combination thereof is a matter of logistics, availability, prices, environmental impacts and the scale at which nutrient sources and sinks are assessed. Plants do not differentiate the nutrients supplied through organic or inorganic sources. An important issue is that of nutrient availability, sufficient quantity, appropriate forms, and at the right phenological stage when nutrient availability is critical for optimum growth and yields. In the meantime, orientation to near-term rather than to long-term returns led to abolition of crop rotation and combined with all-round reduction of chemical and organic fertilization by 1.5-2 times as a whole as compared to 1990 causes greater damage to the future of agriculture. Though Uzbekistan, for example, has paid close attention to this problem, and the established National Fund for Land Improvement stabilized the average national land quality score and even improved it by 1.5-2.5 %, this is rather exception to the rule.

Excessive removal of fertile surface soil by water and wind erosion is an important form of soil degradation and leads to desertification. As soil organic matter and plant nutrients are concentrated in surface soils, these materials along with the clay fraction are removed preferentially.

Under such conditions, agricultural intensification should find new approaches and solutions aimed at maintenance and improvement of soil fertility, increase the use efficiency of farm inputs, and identify higher profitable crops in order to increase profitability and inputs of a farmer to maintain and improve soil fertility, bearing in mind that with abolition of large collective and state farms, the quality of agronomic service organizations (agricultural extension, soil laboratories and so on) necessary for modern farming has deteriorated greatly. Disaggregation of farms also prevents from applying high-efficient machines and equipment for maintenance of fertility. Just for comparison, previously up to 1000 longspan blade levelers and hundreds of chisel-tillers were manufactured, but now these machines are not used in the farms anymore.

Climate change forecasts

Climate change predictions point to a warmer world within the next 50 years, yet the impact of rising temperatures on rainfall distribution patterns in much of the world remains far less certain (IPCC, 2007).

Interventions are required across scales, from small fields to communities, watersheds, catchments and ultimately whole river basins, with a focus on increasing the productivity of both 'green' and blue' water use.

Resilience to climate change will need to be a key property of sustainable agricultural systems in the coming decades, particularly in those regions projected to experience severe ecological shifts due to a changing climate.

According to the World Bank[1], for our conditions "the direct impact of temperature and precipitation as a result of future climate change would cause 6…10 % decrease in crop yields, such as cotton, wheat, tomato, and potato. However, pasture productivity would increase by 9-17 % over decade. Growing water shortage is expected also in the coming decades ".

These potential impacts of climate changes should be mitigated through adaptive measures.

Artificially created shortage of water as a result of energy regime of reservoir operation has a negative effect on yields and use of land resources in the region (if water is enough, favorable climate allows 2-3 harvests a year).

Social changes in the rural area are typical for the recent 20-25 years in all countries within the former post-Soviet space. Countries face various political processes related to privatization and public ownership of land, on the one hand, and to degree of state regulation and support of agricultural production, on the other hand. As a result, in some countries (Kazakhstan, especially Kyrgyzstan) land allotments were broken up, with following gradual consolidation of farms. These changes had considerable impact on land productivity, irrigation water use and management, as well as on social situation of rural people and their participation in innovation processes. The process of rural population stratification is in train and is accompanied by temporal labor migration of millions of people to Russia, Kazakhstan, and Europe. Gender imbalance, with increasing load on women is seen both in predominant care of their families, work on homestead land, and in their increasing responsibility for farms.

By understanding both the constraints and opportunities for women in agriculture, of small-holder farmers (Dekhons for instance) and farmers other than crop producers (livestock, vegetable growers, orchard owners), it will be possible to develop new

[1] WB, Demonstration of sustainable development in Europe and Central Asia, Industrial economics, Incorporate, February 2011, "Increasing resilience of agricultural systems to climate change in Europe and Central Asia ", 201 p.

ways to address their needs and enhance their contributions in order to improve agricultural productivity, food security and poverty reduction.

Promoting agriculture for development presents a serious challenge of managing multiple agendas and collective interests of formal and informal institutions (the state, the private sector and civil society), and their inter relationships, their obligations, processes, mechanisms and differences. It is precisely at this interface that governance, economic investment, power and policy making converge and play their respective critical roles.

Fiscal conditions of agrarian sector. The agrarian sector has been practically left without those subsidies and particularly state financing of agricultural production and irrigated farming that it enjoyed the previous 20 years. As a consequence, irrigated areas decreased sharply, especially in complex soil conditions and in sprinkling irrigation zones in many countries in Eastern Europe and Central Asia. This was not observed in Turkmenistan, which even increased irrigated areas. Despite the reduction of water withdrawals throughout Uzbekistan as a whole, the Republic has preserved its irrigated area. Moreover, urban and peri-urban expansion takes place, particularly in densely populated oases that narrow fertile land by new housing, which is not always allowed by the government. This process took place earlier as well but that time the government kept close control over it and compensated areas by new land development. Now this is not practiced due to lack of funds.

In all the countries in the region, except for Uzbekistan and Turkmenistan, national water sectors are financed through a combination of government subsidies and water user fees; however, as compared to 1990, critical deficit of funds, especially for on-farm water use and for reconstruction and rehabilitation work is experienced everywhere. Recently established Water User Associations (WUA) play a great role in combining forces of water users for organization of water delivery, distribution, and use. Nevertheless, they have not yet achieved financial sustainability due to low membership fees of farmers and their poor budgets. At present, not only WUAs but also practically the whole irrigation system from on-farm canals to main canals, including the whole system of operation, from district water management divisions up to Ministry depend, as much as to 80%, on financial conditions and fees of farms (Tajikistan, Kyrgyzstan, Kazakhstan). This, in turn, affects the quality and operation of irrigation systems and the quality of water supply to farmers. At the same time, in order to improve financial conditions of farmers, none of the countries in the region has created effective market and agricultural product sales system, except for Uzbekistan, where the so-called state order is maintained. Undoubtedly, this has an impact on continuous variation of agricultural product prices and on inefficiency of monitoring. Eventually, raised uncontrollability of water and drop of water productivity pose a great risk.

The food supply chain (FSC) encompasses all those activities that lie between on-farm production and the point of consumption. FSCs have experienced fundamental change since 1950, becoming increasingly global in extent and marked by upward trends in scale of production, number of lines of manufactured products and levels of economic concentration by sector. The governance of FSCs has consequently become more complex and multi-scalar, involving many public, private and civil society actors.

Presence of such monopoly processers and sellers as Nestle at the regional market does not exclude multiple small market infrastructures, with great possibilities to manipulate food prices. It is significant that some foodstuff have retail prices that several times exceed both wholesale supplier prices and world prices.

If one considers the general balance of food production and consumption in Central Asia, it can be seen (Dukhovny V.A., Stulina G.V., 2011)[2] that, as a whole, the region is provided with grain, milk and diary products, vegetables and fruits, cucurbits, potato, though deficit of these products is observed in some of the countries (for example, poor grain supply in Kyrgyzstan and Tajikistan). However, given the open market available and, especially, the regional cooperation is strengthened, the region can supply itself with food, except for sugar, meat, and meat foods. Besides, it should be noted that here food basket is different significantly from the generally accepted health standards, particularly with greater focus on vegetables, fruits, and bakery products.

In recent decades, domestic patterns of food production and consumption have become interconnected by global markets, and today we rely on both international and national markets to allocate food to consumers and distribute inputs used in food production. In 2008, the cost of global food imports exceeded one trillion US dollars, having grown substantially in the two preceding years. The new economics of food mean that small changes in production can lead to large fluctuations in price. Most countries now rely on buying their food on open global food markets; however, when national governments seek to protect their own supplies, market chains can break down.

Nevertheless, national policies in all Central Asian countries are aimed at achieving food security through their food production. Taking into account favorable natural conditions in the region, the constraints to achieve this are seen in:

- irrigated areas and their productivity;
- amount of water, sound and effective use of water resources;
- artificial water shortage and competition between hydropower (energy regimes) and agriculture.

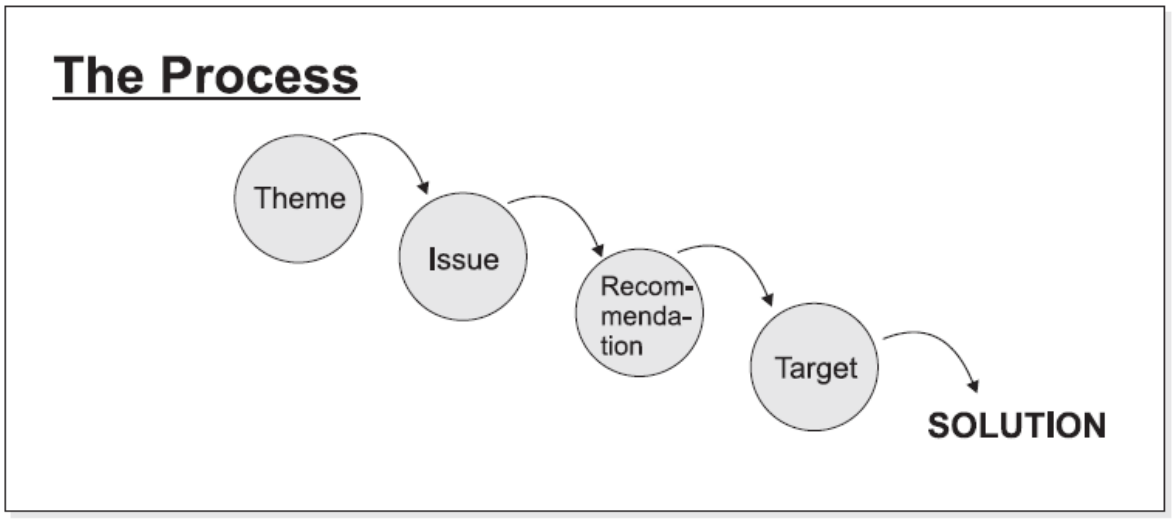
Therefore, it is necessary to consider the entire crop value chain rather than only individual components thereof. Countries in Central Asia will prosper from manufacturing high-value products that can be exported and sold at competitive prices. This implies that farmers/entrepreneurs need to become better linked to domestic and international markets and trade. This would also bypass the demand for continuing with the present unsustainable alternative of subsidies.

[2] Dukhovny V.A., Stulina Galina "Water and food security in Central Asia" in book "Water and food security in Central Asia", Springer-NATO Science for peace and security program, 210 pages, 2011.

From Target to Solutions

According to methodological recommendations of the International Forum Committee, a regional process should follow the selected theme and develop towards the targets, with output to final recommendations specific for each region and, moreover, specific for each country. Development strategies should be enacted according to the comparative advantages of regions in countries and become part of the central approach of a nationwide development program.

Given Conceptual note does not claim to be exhaustive for all the countries, and it is expected that members of given thematic priority's work group will elaborate it with respect to peculiarities of their countries (Fig.1). Moreover, stakeholders will be involved at each stage of proposal development exactly under considered solution.



Schematic representation of the process involved in the development of "solutions" for the World Water Forum 6 (redrawn from the presentation of Prof. B. Braga at the Stockholm world water week, 8 September, 2010).

Fig. 1

Despite the excellent developed global thematic program on this direction (FAO, ICID), the regional concept program is presented in form of a target tree, with two main targets as set in the Program document:

- Increase agricultural production by improving water and land productivities;
- Long-term flow irrigation for irrigation purposes;
- Implement additional measures in order to use more collector and drainage water in agricultural production.

The selection of those main targets is governed by two serious constraints:

- expansion of irrigated areas in food-deficit countries is limited by areas that are feasible to develop, exceptional expensiveness of such development (8-12 thousand dollars per hectare), and shortage of water available;
- increasing water shortage due to climate change, population growth, industrial development and growing demands of population and industry. Moreover, one should note that in recent years, because of changes in operation regimes of large reservoirs from irrigation to power-generation ones to the benefit of electricity generation, the amount of water available for irrigated agriculture has decreasing regularly.

Following the program development sample prepared by FAO on "Water and food security", we propose to develop the “target tree” on each of solutions as follows:

- justification of proposed measures;
- "road map" and time horizon;
- key stakeholders broken down into those “benefiting from effects” and “organizers of actions”.

Theme 3

Target 3.1. Increase productivity of water by 40-50 % and that of land by 20-25%

Recommendation 3.1.1.	**Development of extension services for rational water and land use in agricultural production as part a general concept of elaboration of and increasing the efficiency of organizations providing agricultural services. through cooperation among Water user associations (WUA), farms, research and innovation organizations in order to demonstrate and disseminate best practices aimed at achieving productivity increase.**

Brief justification

Experience of large-scale adoption of extension services within the framework of Water and Land Productivity Improvement Project - WPI-PL (SDC, SIC ICWC, IWMI), as well as from previously implemented projects such as "WUFMAS", "WARMAP – Component 2" proves that organization of a system of demonstration plots, pilot polygons combined with training of WUAs and farmers, field classification, and farmer’s (field) schools should become a basis for a National agricultural extension concept . This would help to improve water and land productivities based on

developed approaches and methods and without significant investments. Moreover, the productivity improvement potential corresponds to figures indicated in Target 3.1. Thus, as a result of establishment of extension service, the WPI-PL Project showed 27% increase in land productivity and around 35 to 40% improvement of water productivity on average!!! Local regulation in form of District Water-Land Commissions can contribute significantly to this endeavor further.

Taking into account that in the future, water shortage will grow in a number of Central Asian river basins, the irrigated agriculture would develop under conditions of limited water use. It is important that national plans of Central Asian (CA) countries reflected the balance of interests among both water users and water suppliers (Fig.2).

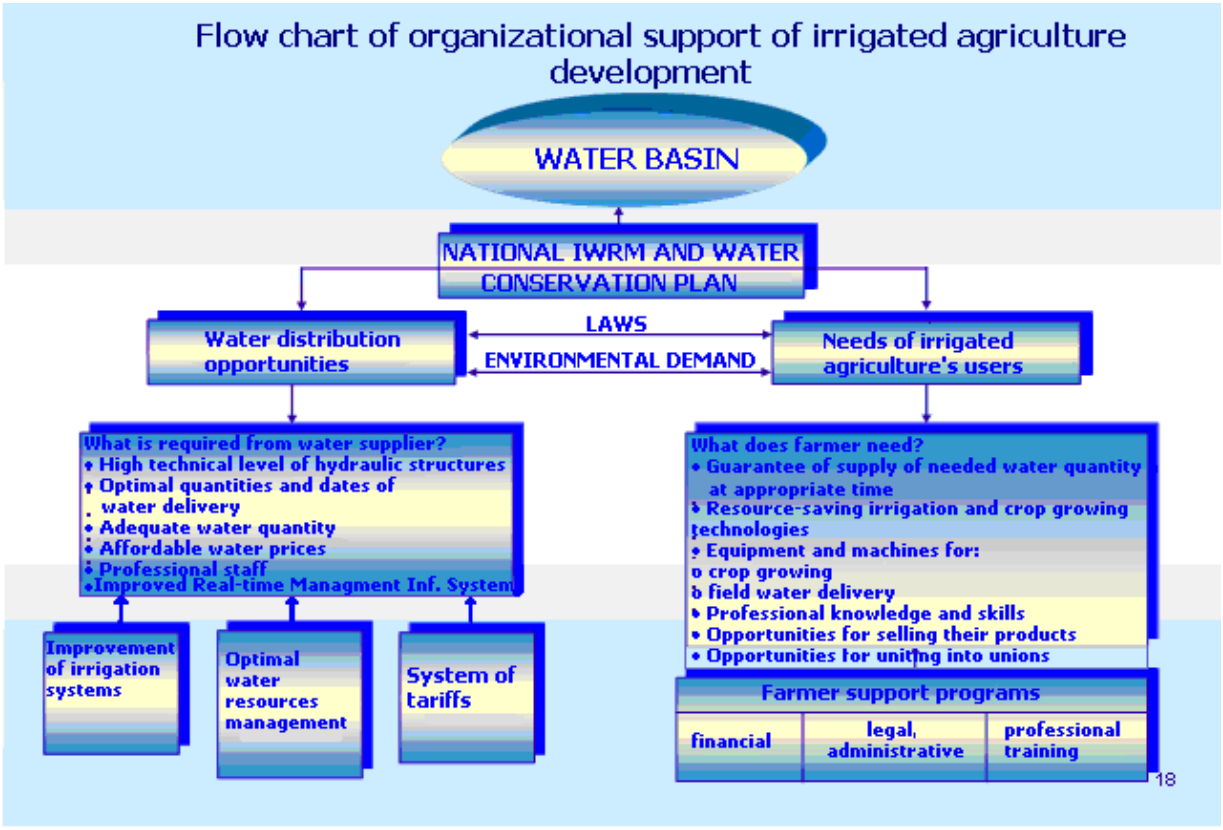


Fig.2. Flow chart of organizational support of irrigated agriculture development

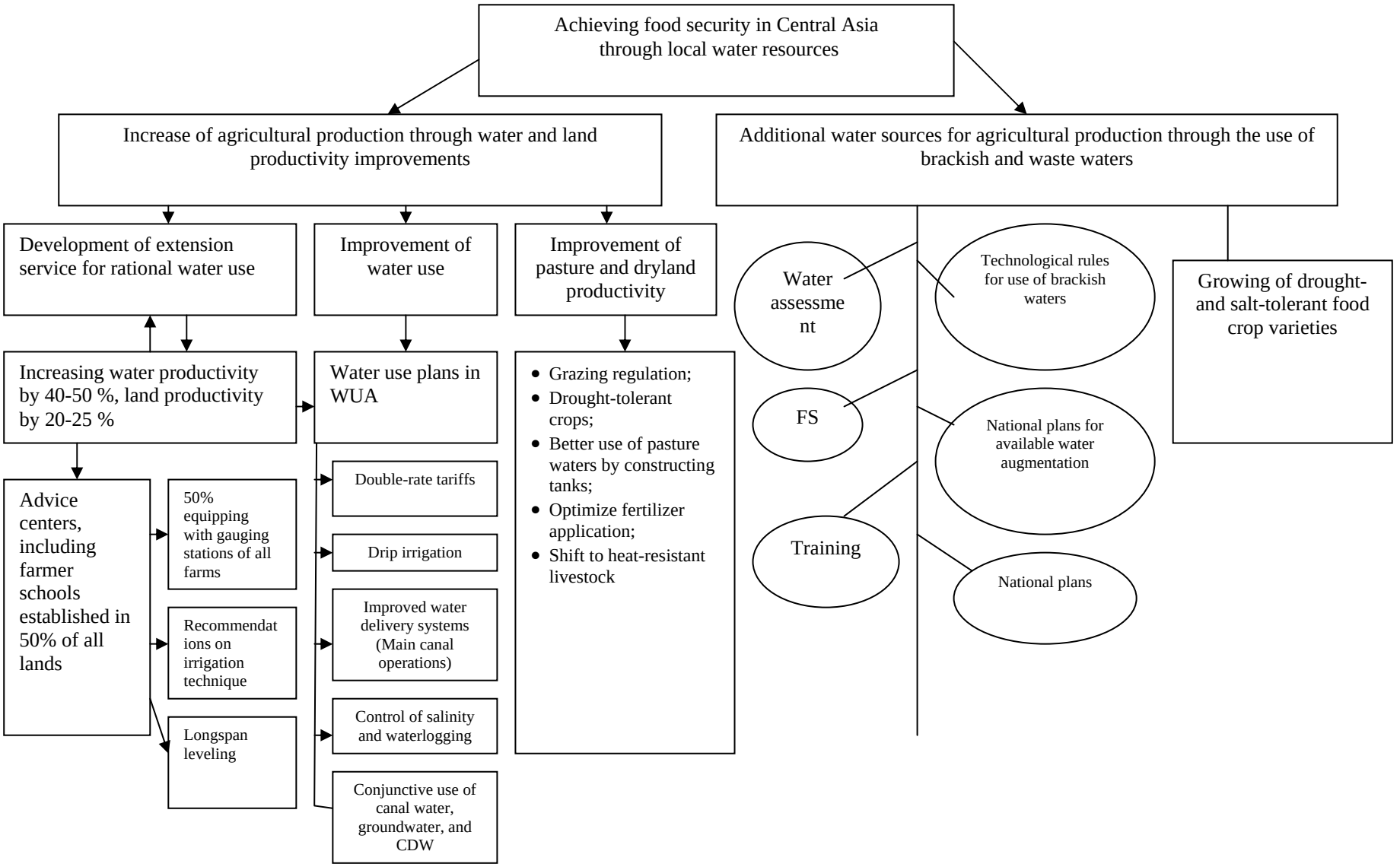


Fig. 3. Target tree for Adoption of Innovations in Agrarian Sector in order to Achieve Food Security

Road-map and time horizon

- Program "Achievement of potential water and land productivities through extension services" adopted by National ministries of agriculture/agriculture and water resources in the region – end of 2011;
- “Provisions on organization of extension services” developed by scientific and production institutions and approved by National ministries of agriculture and water resources and submitted for adoption of an executive order on organization of extension services – first half of 2012;
- Extension service development program, covers up to 50% of the total national irrigated area – 2014, including:

    - equipped gauging stations of all farms;
    - recommendations given on irrigation technique,
    - re-used longspan blade levelers for irrigated land leveling – 2012;
    - mapping of fields and selectively improved surfaces.

Future existence of "estimation service" should be selfsupported by the contract base.

Main stakeholders

Organizers: National Ministries of agriculture and water resources (Ministries of agriculture); donor agencies, scientific and production institutes and associations.

Beneficiaries: farmers, WUAs, local administrations

Recommendations 3.1.2.	**Improvement of water use by WUAs and agricultural producers.**

Any modernization should first center on optimizing the current system of water distribution and supply while introducing a flexible irrigation scheduling and replace the present norm based irrigation and through improving infrastructure, maintenance and institutional water management procedures. Innovative technologies are appropriate as a second step. Improvements of the drain network must focus on major and local outlets before more costly interventions are considered.

Research and practical application of improved water use techniques inside WUAs indicate to great reserves for reduction of unproductive losses at the interface “main canal-WUA-water user” that occur due to maladjustment of water supply along canals to water demand of farms joined to WUA. Experiences of WPI-PL Project in the Fergana Valley and of RESP II in Uzbekistan demonstrate effectiveness of daily planning of water distribution in WUA and application of double-rate tariffs for water delivery services (Fig.4). These low-cost methods involving only integration of forces

and involvement of stakeholders can be supplemented effectively by application of hothouse (film) covers and drip irrigation systems as soon as farmers augment their money.

Objective – include 50% of irrigated land into the recommended system of water use planning and water distribution control.

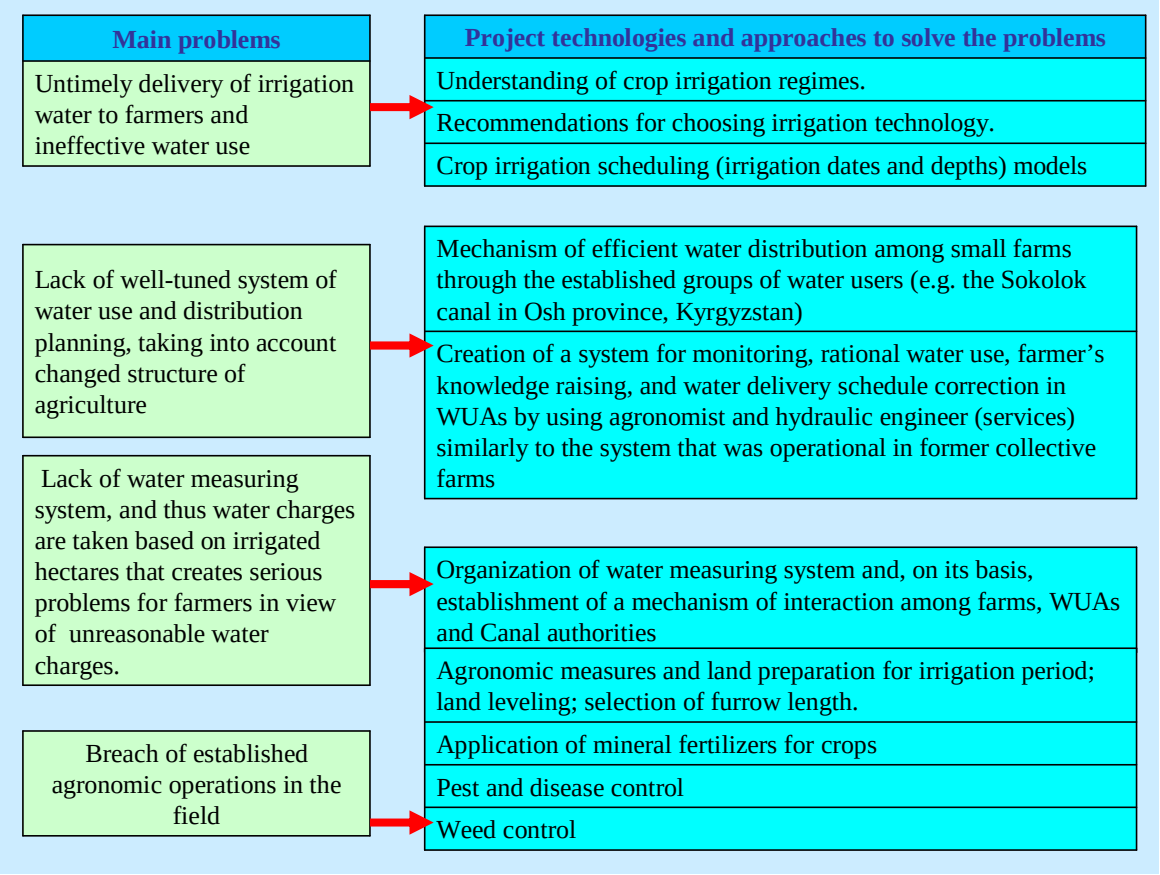


Fig. 4. Main measures for water use improvement at WUA and farm levels in order to achieve potential water and land productivities

Road-map and time horizon

- technique of "daily water distribution" in WUA approved by the Ministries (Committees) for water resources and adopted for wide application at province and basin levels – end 2012 - early 2013;
- double-rate tariff for water services applied in all farms and the latter equipped with water measuring devices – 2013…2015;
- hothouse farms promoted and developed and soft loaning introduced – 2012…2015;
- state support of drip irrigation arranged – 2012…2015.

Though currently opportunities for applying new irrigation technique are limited by financial resources of farmers, it is necessary to organize work of research and scientific-production associations in the way of potential use of foreign irrigation technique and development of own local one. To this end, it is reasonable to:

- create a range of modified irrigation technique products for conditions of farms and irrigation schemes of large water user associations;
- develop experimental samples of irrigation modules using various methods for different land areas (2…5 ha; 50…70 ha; 400…600 ha), also using alternative energy sources;
- adapt best foreign technologies, machines and mechanisms to Central Asian conditions;
- conduct research on setting the limit price for new irrigation facilities, depending of methods and elements of irrigation techniques, as well as on degree of their stability;
- identify relationship between technological parameters of irrigation technique and its impact on agroecosystem sustainability, water-conservation effect, and crop yields;
- manufacture crop irrigation technique modules, including drip irrigation, subsoil irrigation, and aerosol moistening and try-out irrigation processes in small plots, experimental and pilot ones.

Donor organizations and national programs on water productivity improvement should support development of the above activities at stages of research and application.

Stakeholders

Organizers: National Governments, National Ministries of agriculture; scientific and production organizations; international financial institutions, private companies.

Beneficiaries: farmers, WUAs, local administrations

Recommendation 3.1.3.	**Improvement of pasture and dryland productivity**

Although as a whole precipitation is very small in the region, pasture resources could be conserved and augmented, especially if bear in mind the expected 17% increase in precipitation in pasture zone. In this context, productivity should be improved through regulation, planning, and control of load on pastures, including licensing of grazing and production of drought-tolerant grains on dryland in combination with water-retention and increased fertilization. Rehabilitation and better use of wells on pastures, including construction of tanks, earth reservoirs, etc. play an important role here.

In livestock farming, it is necessary to shift to heat-resistant species of cattle and light beasts and to improving crop-livestock interactions in addition to pasture improvement.

Stakeholders

Organizers: National Ministries of agriculture, agrarian banks, commercial service facilities.

Beneficiaries: farms, market, land-reclamation organizations, local administrations.

Direction 3.2. Additional water sources for agricultural production through the use of brackish and waste waters

Target 3.2. Increase the use of waste and collector-drainage water to about 5 km3 a year

Brief justification

At present, only 4-5 km^3 out of 17 km^3 of free collector-drainage water discharged into rivers and close sinks are used for irrigation. Similarly, we observe uncontrolled discharge and only partial use of almost 3 km^3 of wastewater from industries and households. The lack of systematic control results in non-consideration of this huge reserve in current and future water use plans in most cases. Meanwhile, the use of such water within the IWRM-Fergana Project allowed mitigating water shortage in dry year 2008.

Giver direction is planned to develop in two recommendations: 3.2.1 – organization of measurement of these types of water, adoption and dissemination of technological rules for and control over the use of wastewater and collector-drainage water; 3.2.2 – adoption of drought- and salt-tolerant crop varieties.

Recommendation 3.2.1.	**Increase in the use of waste and brackish waters**

Road-map and time horizon

- identified parameters of usable waste and collector-drainage waters; assessed resources of waste and collector-drainage waters, taking into account their variability and decreased discharges of drainage water in dry years; developed national catalogues of waste and brackish waters – 2011-2012;

- prepared regional and national rules for the use of waste and collector-drainage waters, based on requirements and technological and economic feasibility of such use for different natural and climatic conditions – 2011 – 2012;
- drawn up national plans for the use of waste and collector-drainage waters – 2013;
- trained middle and lower level staff – 2011 … 2013;
- the national plans applied – 2013 – 2015.

Stakeholders

Organizers: Ministries of water resources (agriculture and water resources), State environmental committees, research institutions, donors and IFI, Academy of Sciences

Beneficiaries: provincial and local organizations, hydrogeological and reclamation field offices, WUAs and farmers, other water users.

Recommendation 3.2.2.	**Research, selection and dissemination of salt-tolerant crop varieties, using collector-drainage water**

Different degrees of crop tolerance to salinities of soil and water have been known for a long time but have not been widely used in practice. For example, white durra, sorghum, panic grass, and sunflower are grown successfully with saline water of up to 2.0 g/l and can stand up to 3 g/l in sandy soil.

Salt-tolerant crops and varieties are selected in our region as well. For example, the Uzbek Academy of Sciences developed cotton variety “Turon”, which is highly salt- and drought-tolerant and currently disseminates this variety under irrigation norms at 2,000 m^3/ha. However, evidently, a special genetic-practical program for cultivation of salt-tolerant food crops should be elaborated in order to achieve high cost effectiveness in developing and using low-productive dry and salinized land, while irrigation this land with brackish water.

Stakeholders

Organizers: Ministries of agriculture, Academy of Sciences and its plant-breeding branches, donors and IFI.

Beneficiaries: farmers, WUAs, provincial and basin water management organizations, local authorities.

General positions focusing on political process

All the above-mentioned proposals need certain clearly-based political support in form of a number of basic documents on institutional, legal, and financial-economic aspects of the national food security program. It is clear that such program is linked closely with the support and development of the Integrated Water Resources Management (IWRM). Implementation of IWRM involves:

- improvement of the water sector structure by separating the functions of “governance and management”, “water demand management” and “water supply management”;
- support and soft loaning of WUAs, Water user unions, and Irrigation canal user unions;
- encouragement of water measurement and water conservation, etc.

Political-level measures include also the following:

- adoption of the "Program for achievement of potential water and land productivities through the development of extension services", including allocation of investments, approval of status of such services, their institutionalization within WUA or Basin authorities or District WUA support departments, with establishment of precise procedure for remuneration of extension services, depending on results;
- support to farmers and WUAs in their equipping with water measurement devices;
- practical support of farmer initiative on the development of hothouses and drip irrigation using India’s example, where the government subsidizes 30% of costs;
- development of a national program for the use of waste and brackish waters, including planning, measuring, and adoption of technological rules for use of these types of water;
- development of a program for selection and dissemination of drought- and salt tolerant varieties of crops, particularly food crops;
- development of commercial fish farming;
- attraction of donors’ attention to a need for development of low-cost methods for partial desalination of brackish waters from drainage wells (3-7 g/l) in order to remove harmful salts and keep potassium, calcium and other minerals that are good for plants[3];
- taking into account regional characteristics, education of young generation for healthy diets, which would include plenty of vegetables and fruits, limit meat consumption within 30-32 kg/person/year; rejection and opposition to taking

[3] Detail research conducted during the Soviet period has produced quite promising results at small pilot scale and, under present technical capabilities, can be upscaled!!!

"western" diet as a living norm, which is characterized by up to 60-70 kg/person/year of meat consumption, which is bad for health.

- water, first of all, must be used for drinking water supply and sanitation, and, second, for ensuring of food security. In this context, reservoirs located within the territories of upstream countries should be operated in combined irrigation-energy regime.
- it is necessary to take measures for improvement of irrigated land conditions, large-scale rehabilitation of irrigated land, protection of humus layer, efficient land use, etc.
- it is necessary to support agricultural producers in form of soft loads, subsidies, relief from taxes and compulsory payments of crop production, as well as through application of hothouse farming and advanced technologies in irrigated agriculture, etc.