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IRRIGATION AND DRAINAGE
Irrig. and Drain. **56**: 1–18 (2007)
Published online in Wiley InterScience (www.interscience.wiley.com) **DOI**: 10.1002/ird.327

WATER AND GLOBALIZATION: CASE STUDY OF CENTRAL ASIA[†]

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ABSTRACT

The present-day world is enmeshed in global networks. The information space has been formed according to rules of Internet and electronic messaging and ensures instantaneous communication and momentary dissemination of any news, thus bringing about apparent unity of the world. Other networks (financial, trade, economic, legal and institutional) have their own rules, while being in motion and interacting with each other they represent a phenomenon of globalization.

In the water sector, with its several aspects, this process has influenced politics, economy, technology, environment, culture, ideology and even religion since the 1950s. Each globalization aspect produced its effect on the water sector in countries, regions, and the world, even in periods and countries where the sector was developed independently.

These aspects play different roles at each development stage. The degrees to which globalization penetrates at regional and national levels are different, dependent on the degree of the anti-effect of governance. Dynamics of the processes are quite representative in central asia, which despite being behind the iron curtain for a long time could not withstand global trends and tendencies. The influence of ''globalism'' on the water sector in central asia is presented in this paper. Copyright © 2007 John Wiley & Sons, Ltd.

KEY WORDS: globalization; Central Asia; water sector; governance

Received 17 November 2006; Revised 16 March 2007; Accepted 23 March 2007

RÉSUMÉ

Le monde d'aujourd'hui est encerclé de réseaux planétaires. L'espace de l'information s'est formé selon les règles d'Internet et de la messagerie électronique et permet la communication instantanée et la diffusion de n'importe quelle information, créant ainsi une apparente unité pour la planète. D'autres réseaux (financiers, commerciaux, économiques, légaux et institutionnels) ont leurs propres règles, et représentent, dans leur mouvement et leur interaction mutuelle, un phénomène de mondialisation. Dans le secteur de l'eau, aux aspects multiples, ce processus a influencé la politique, l'économie, la technologie, l'environnement, la culture, l'idéologie et même la religion, depuis les années 1950. Chaque aspect de la mondialisation a produit ses effets sur le secteur de l'eau à travers pays, régions et continents, même dans des périodes et des contrées où le secteur s'est développé de façon indépendante. Ces aspects jouent des rôles différents à chaque étape de développement. Le degré avec lequel la mondialisation effectue sa pénétration aux niveaux régionaux et nationaux est différent, dépendant qu'il est de la résistance de la gouvernance concernée. La dynamique du processus est très représentative en Asie Centrale qui, bien que derrière le rideau de fer pendant longtemps, n'a pu éviter les modes et tendances mondiales. L'influence du « mondialisme » sur le secteur de l'eau en Asie Centrale est présentée dans cet article. Copyright © 2007 John Wiley & Sons, Ltd.

MOTS CLÉS: mondialisation; Asie Centrale; secteur de l'eau; gouvernement

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INTRODUCTION

The present-day world is enmeshed in global networks more than ever in world history. The information space has been formed according to rules of Internet and electronic messaging and ensures instantaneous communication and momentary dissemination of any news, thus bringing about apparent unity of the world. At the same time, many other networks (financial, trade, economic, legal, and institutional) have their own existence and rules of the game, while being in motion and interacting with each other they represent a phenomenon of globalization. This phenomenon, at least, represents one of the fundamentals of the world's present state, its past transformation, and future prospects.

Obviously, this phenomenon has influenced the water sector as one of the economic branches, at the same time playing a role in environmental management since the 1950s. Globalization investigators, including supporters and opponents, highlight its several aspects:

- political, economic, technological and environmental;
- cultural, ideological, and even religious, though not particularly pronounced.

Currently, in the period of information and communication revolution, these aspects have a strong influence.

Each of the globalization aspects has its effect on the water sector in countries, regions and in the world as a whole. Undoubtedly, these aspects play different roles at each development stage, as well as in relation to the degrees to which globalization penetrates at regional and national levels. This depends on the degree of anti-effect of governance and its opposition to such phenomena. The water sector became involved in various aspects of globalization even in the periods and in those countries where the water sector was developed independently within national boundaries. The dynamics of the processes are quite well represented in the countries of Central Asia, which, despite being behind the Iron Curtain for a long time, could not withstand world trends and tendencies. The effect of globalization is so faceted and multi-factoral that it is necessary to distinguish between positive and negative aspects of the processes. An attempt to analyse the influence of ''globalism'' on the water sector in Central Asia is presented in this paper.

INITIALLY GLOBALIZATION SHOWED ADVANTAGES

Globalization, as a process of propagating certain influences on a global scale, actually became apparent in the water sector in the 1950s. In its initial stage this process was to some extent connected with the development of global professional organizations concerned with water, as well as in activities addressing water issues carried out by the United Nations (UN) agencies, which also emerged during that period. The International Commission on Irrigation and Drainage (ICID) and the International Association of Hydraulic Engineering and Research (IAHR) were founded a little later. They were the pioneers that as early as the 1950s made strenuous efforts to establish national committees in many countries – both developed and developing – and to create a common forum for experience, knowledge and information exchange. These organizations significantly promoted the cross-penetration of water management approaches practised by developed countries into developing countries and the experience of former ''socialist states'' into ''capitalist states'' and vice versa. Of great importance was the fact that it was this very development which contributed not only to scientific and professional capacity building, ''know-how'' exchange, but also to forming human links. Subsequently, these relations exerted considerable impact on the emergence of a professional worldwide water community by the end of the twentieth century.

In recent decades we have been witnessing a rapid upsurge of diverse activities launched by the international water community. Activities carried out by interstate organizations of the UN system played an important role in disseminating ''know-how''. First of all this applies to UNESCO with its water assessment programme, in which a great number of participants from various countries on both sides of the Iron Curtain, as well as from developing countries, have been involved. The same applies to regional commissions of the UN, like the UN Economic and Social Commission for Asia and the Pacific (ESCAP), the UN Economic Commission for Latin America and the Caribbean (ECCLAC) and the UN Economic Commission for Africa (ECA), and associated international scientific

DOI: 10.1002/ird

centres specializing in water-related issues such as the International Institute of Applied Science and System Analyses (JASSA) in Vienna and the Consultative Group on International Agricultural Research (CGIAR).

At that time representatives of water science and practice in the former Soviet Union (USSR) actively participated in worldwide water forums. Suffice to say that the Minister of Water Management of the USSR, E.E. Alekseevsky, was President of ICID and that outstanding Soviet scientists such as A.N. Askochensky, V.V. Poslavsky, K.K. Shhubladze and B.G. Shtepa were vice-presidents of this organization. The 9th World Congress of ICID was successfully held in Moscow in 1975 and the first Afro-Asian Regional Conference in Tashkent in 1976. These events focused attention on significant successes in the fields of land reclamation and water management in the USSR, winning worldwide prestige for Soviet specialists in addressing the issues of water management and concurrently involving them in the process of improving the principles and approaches to water management on a global scale. These specialists had drawn international information and experience from abroad on such advanced methods of water supply as drip irrigation, some kinds of sprinkler irrigation, on approaches to develop automation, especially automation in the operation of hydraulic structures. At the same time, the Soviet scientists made a great contribution to the world's development through their school of hydrology, especially concerning the assessment of water resources, maintaining records of their fluctuation and plotting hydrographs of flow under statistical uncertainty, construction of high dams, some of which (Nurek, Toktogul, Bratsk and others) had no equals in dimensions in the world.

Great efforts were made to elaborate the so-called ''complex methods'' of new land development and irrigation in desert areas on the basis of experience obtained in the course of implementing large-scale development projects in desert areas of Central Asia, in Kazakhstan, and reclamation of formerly abandoned lands in Azerbaijan, the Volga region, Kalmykya and other territories of the USSR. All these activities, while adding authority to domestic science and practice and prestige to the specialists, at the same time helped to enhance external commercial relations, including contracts for the implementation of agreements concluded with various countries as well as deliveries of equipment and technologies from abroad. Business activities in the field of water management had spread not only in countries of the so-called ''social camp'' (Vietnam, North Korea), but also in Third World countries, such as Egypt, Syria, Yemen, Mozambique, Iraq. The creation of the Aswan High Dam on the River Nile was undoubtedly a great success of Soviet hydro-engineering theory and practice. This project had not only large technical, but also political significance, demonstrating to the whole world the technological and organizational potential of USSR hydroenergetics.

The boom in activity in the water sector in the 1960s–1980s resulted in the elaboration of a new water management and land reclamation concept, which turned irrigation, drainage and water management into recognized methods and means to reduce and even eradicate poverty and famine, as well as to solve many social problems of the modern world. Noteworthy in this connection is the comment in the visitors' book by the Prime Minister of Turkey, Mr Suleiman Demirel, during his visit to a site of newly reclaimed lands in the Hunger Steppe in 1967: ''Rulers, who are willing to provide their people with bread, jobs and opportunities of happy development, should come here and make use of this wonderful experience of social reconstruction through applying it in their own countries.''

The 1970s–1980s marked a new stage in the propagation of global influence on water development processes. It was during these years that humanity regained, so to say, discernment – progressive forces in the world realized that continuation of unrestrained use of natural resources by Man without care for limitation and ecological requirements may not only lead to regional disasters but even to a global crisis. Though this movement initially failed to gain worldwide momentum, it nevertheless initiated the formation of two important factors of global water policy.

The first factor was the framing of certain world principles that go back to Brundtland's call: ''Man! You have not inherited nature from your ancestors, but borrowed it from your descendants.'' This call won worldwide recognition and created prestige for those countries which started following the principles of nature conservation for future generations. Though *the prestige effect* (being of great significance for political leaders and public movements, especially in developed countries) was not a key factor which could restrain the world from destructive drives towards overconsumption of natural resources, it was however able to exert immense moral and ever-growing political influence. Under the influence of the activities of the Club of Rome (Forester *et al*., 1972) in the 1970s and of the JASSA, the Soviet Union formed an opinion on the need for environmental dimensions in all large-scale

DOI: 10.1002/ird

public actions and programmes. The State Committee for Nature Conservation was established and government panels were set up, for example for the Aral Sea and the Caspian Sea problems. The ''green movement'' was supported by the government, which resulted in a number of governmental rules and decrees. In particular, the Resolution on Socio-Economic and Environmental Improvement in the Aral Sea Basin laid the basis for future joint water resources management in the basin by establishing basin water organizations (BWOs) for the management of the Amudarya and the Syrdarya rivers (''Amudarya'' BWO and ''Syrdarya'' BWO). The Water Codes of the USSR and of the respective republics largely reflected new ideas and corresponded, in many respects, to new world tendencies. On the other hand, the Soviet management technique, being only formally democratic, did not allow proper involvement of stakeholders and the general public in elaboration of the mechanism enabling public participation in and control over implementation of those quite appropriate codes but relied mainly on paper[Q1] decisions. Q1

The second factor was the emergence of documents that formed the legal basis for natural resources and water resources use at both international and national levels, like the ''Helsinki Rules'' (International Law Association (ILA), 1966), then later, after a long-standing campaign, the Ramsar Convention (UNESCO, Office of International Standards and Legal Affairs, 1994), the Convention on Combating Desertification (United Nations General Assembly, 1992), the European Convention ''UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes'' (1992) and the UN Convention on the Law of the Non Navigational Uses of International Watercourses (1997).

It is not surprising that the Central Asian countries, just after gaining their independence, were forced to set up their legislation and interrelations with neighbours on the basis of old traditions but within the UN framework. Though issues of legal force and jurisdiction are very vague in these documents, they nevertheless give some opportunity to conceive the essence of the purposeful political movement of the international community towards equitable and reasonable water resource use, as well as adherence to the 'do not pollute, and the polluter pays' principle.

While reviewing the first phase of globalization in the water sector in Central Asia, as well as all over the whole USSR area, one can note the positive effects of globalization as reflected in legal, scientific and technological progress, in establishment of cultural exchange between the countries that previously were isolated from each other, and in formation of additional value through joint actions. Moreover, the foundation was laid for penetration of water technologies on a commercial basis.

PERIOD OF INDEPENDENCE – NEW MOMENTUM TO GLOBALIZATION

The declaration of independence by the Central Asian countries in September–October 1991 posed a problem for the new governments – where to go, which way to choose for economic and political development? Naturally, the water sector found itself at a crossroads due to its close relation with public priorities and directions, particularly in light of agricultural reforms. Taking into account that the world did not see[Q2] the examples of the transfer from underdeveloped socialism to capitalism and to the free market, the governments of the five republics tried to find a model to emulate among the model capitalistic economies. Q2

The world opened up before Central Asia, and Central Asia opened up before the world. This openness was twofold: groups of a non-political nature, mostly of water professionals and, in general, of highly qualified unbiased Western professionals, were surprised by the realities of scientific and technological capacities that existed and, at the same time, they critically tried to review the shortcomings and mistakes.

Just because of such integration, an understanding developed of the communities and differences between the technical approaches, the shortcomings and the ways to overcome them. Cooperation was gradually established between leading specialists who facilitated joint elaboration of a number of programme documents such as: ''The Aral Sea Basin Program No. 1'' (Aral Sea fund, World Bank, 1994), ''Key provisions of the Aral Sea basin water strategy'' (Global Environmental Facility (GEF) and ICWC, 1996), programmes ''Water Resource Management in Aral Sea Basin (WARMAP)'' (European Union (EU) TACIS Programme, 1995) and others. One cannot but recognize such outstanding specialists as Guy le Moigne, Janusz Kindler, Bob Rangeley, Arrigo di Carlo, Michael Armitage, Jutzchak Alster, Joop de Schutter and many others who made a great contribution to this cooperation.

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Cooperation of these specialists together with regional water institutions contributed to the development of new approaches based on up-to-date technologies, information techniques, computer applications and so on. Moreover, the Western work style with stakeholder involvement has become quite widespread. These two factors promoted public understanding of the importance of environmental demands and conservation. Thus, in 1993, in contrast to the Interstate Coordination Water Commission of Central Asia (ICWC), the Interstate Fund of the Aral Sea (IFAS) established a Commission for Sustainable Development, which, however, managed poor realization of its activities. But ''nature abhors a vacuum'', and thanks to Kazakh specialists, a Regional Environmental Centre was established and succeeded in boosting relevant activities on a regional scale. A cohort of environmental partners joined the water institutions. Finally, this led to implementation of pioneer environmental projects (wetland restoration in the Sudochie lake, biodiversity rehabilitation in the Amudarya and Syrdarya deltas, etc.).

Another aspect of the openness concerned transformation of the region into the scene of a political game. Their main tools, strangely enough, were not the diplomatic activities of newly established embassies and missions but the activities of international financial institutions that skilfully combined their financial facilities with certain political conditions and recommendations. The political orientation of ''Greeks bearing gifts'' had several official aims: prove the disastrous nature and inconsistency of the socialist system and finally undermine belief in its ability; impose, under the pretence of democracy and progress, their vision of future regional development. However, here one aspect was hidden: transformation of the region from a raw materials-producing appendage of the Soviet monopoly into the market for their competing economies and the source, first of all, of fuel and energy resources. Central Asia had available quite powerful industrial, agricultural and human potential. In order to achieve their aims, this potential would have to be destroyed. For that purpose quite favourable local conditions were created – breaking off economic relations with Russia, loss of federal subsidies, and, at the start, the inability of the Central Asian national governments to use their potential for generation of their own financial resources for government regulation and support of the available potential. These conditions have led to economic recession, setback in agricultural production, disruption of scientific potential, huge brain drain, and lowering of educational attainment.

Where should the region's countries be oriented? The requirement of all international financial institutions is privatization. Self-sufficiency as a prerequisite of economic stability and a new form of the slogan ''Rescue of a drowning man is in his own hands'' first led to industrial retardation, and then to liquidation and theft of the huge stock. For instance, in Uzbekistan, the stock of the water sector comprised more than 10 million m^3 of reinforced concrete, 12 000 km of ceramic drainage pipes, 15 000 t of polyethylene goods, hundreds of excavators, levellers, drainage machines, pumps and pumping units, devices, facilities, etc. From 1991 to 1996, this huge capacity was destroyed, and the privatized rest of the stock accounted for less than 10% of the former one. Moreover, many items such as drainage pipes and machinery were completely liquidated and stolen. The states were not able, did not understand, and could not assess such a destructive process, which, finally, led to loss of economic potential in the whole water sector and, as a consequence, in irrigated agriculture. If previously, preventive flushing was undertaken annually in 2000 km of subsurface drains, now it is reduced to 200 km. The only thing to do is just to be surprised at such conditions where 60–70% of the length of subsurface drains remained operational, though their age is over 30 years, of which the last 15 years saw only minor maintenance and preventive repair (10 times lower than required).

Orientation towards complete privatization of irrigated agriculture and denial of forms of cooperation were more damaging. The regional irrigated agriculture, based on larger mechanized forms of production, literally became degraded and lost considerable value of its water and land productivities. Besides, the Japanese approach, which is the most appropriate for the Central Asian countries and oriented towards small-scale farming, while combining cooperative and regional forms of ownership and responsibility, was disregarded and not disseminated in the region.

It is interesting that although suppliers of world grain, such as the USA, Canada and China, as well as of cotton, such as the USA and China, directed their attention to large-scale farming and a high level of mechanization, recommendations for our region were aimed at small-scale privatisation. As a result, the mean plot of arable land was reduced to 1 ha in Kyrgyzstan, 4–6 ha in Kazakhstan and 10–15 ha in Uzbekistan. Practical high-efficiency production of such crops as cotton, wheat and corn is impossible under the given conditions. Thus, in due time, an opposite phenomenon could be observed: consolidation of plots. For example, by 2005 in Southern Kazakhstan province, the mean area of plots increased to 18–20 ha through sub-tenancy, transfer of title to tenancy, etc.

Decrease in irrigated agriculture productivity under transition from the customary mode of communal and teamwork fell at the same time as the drop in agricultural production prices[Q3] (Plate 2).

Q3

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Table I. Comparative data on net productivity in US$ ha^{-1} of irrigation lands in Central Asia[a]

	Productivity in US$ ha^{-1}	
	1996	2001
Kazakhstan	982	356
Kyrgyzstan	760	579
Tajikistan	719	335
Turkmenistan	483	296
Uzbekistan	251	151

[a]Analysis by the author on the basis of WUFMAS and the Water Environment Aral Sea Basin Program, component A-2.

Plate 2 shows that over the last 15 years, grain prices decreased twice, cotton 1.5 times and rice more than twofold. This has led to an abrupt drop in profitability of irrigated land in the region. Data in Table I from the Water Use and Farm Management Survey (WUFMAS) programme (EU TACIS Programme, 1994–98) and the World Bank ''Water Environment Aral Sea Basin Programme'' component A-2 (''Water Conservation'', 1998) show that the mean profitability of irrigated land decreased from 300–980 US$ ha^{-1} in 1993–1995 to 150–580 US$ ha^{-1} in 2002.

At the same time, calls for full payment for water-supply services and the transfer of responsibility for irrigation and drainage operation and maintenance to farmers have meant that farmers and water management institutions were not able to maintain the required operability of the irrigation and drainage systems, particularly of sprinklers and vertical drainage. As a consequence, more irrigated lands were abandoned (about 1.0 million ha in Kazakhstan and 260 000 ha in Kyrgyzstan).

The case of the Makhtaaral district in Southern Kazakhstan province is typical. Here, given efficiently operating vertical drainage in 1980–99, raw cotton yields averaged 3.5 t ha^{-1}. Over 1991–97, drainage fell out over an area of 90 000 ha because of lack of control and maintenance by operational services, followed by the spread of salinization. When the Kazakh government took out a loan from the Asian Development Bank (ADB) and the World Bank for drainage system rehabilitation of approximately 35 000 ha, the drainage system was rehabilitated, but since 2003 it has not been operable due to lack of maintenance as farmers' net income of 250–300 US$ ha^{-1} cannot cover the required maintenance costs of 60–80 US$ ha^{-1}. As a result, cotton yields have been less than half of previously achieved levels at 1.7–1.8 t ha^{-1} for almost a decade.

The water sector faces a similar degradation. A budget deficit and a tendency to cover it through fees from water users have led to a situation that over the last 15 years financing of the main hydraulic networks and structures was substantially reduced to 14–15 US$ ha^{-1} against previously 80–120 US$ ha^{-1}, with a larger share of this financing for the more expensive electric energy.

Thus, in economic terms, increased regional openness to world tendencies had a negative effect and even, to a certain degree, destroyed sustainability in the water sector and irrigated agriculture in general. At the same time, it would be incorrect not to mention the great positive effect of increased attention to water over the last 10–15 years. Undoubtedly, this should have an effect on Central Asia.

WATER IS A DEFINITE SUBJECT OF WORLD ATTENTION

The transformation caused by propagation of the understanding that the world water deficit and its regional manifestations are growing have stimulated active establishment of international organizations and initiatives, involving a lot of governmental and non-governmental organizations, decision-makers, intellectuals and water professionals in the process of mankind development with its water-intellectual, water-ethical, informational and technological dimensions. The World Water Council, four World Water Forums, the Global Water Partnership (GWP), the Kyoto Protocol to the United Nations Framework Convention on Climate Change (1997), the ''World Water Vision'' Report (Cosgrove and Rijsberman, 2000) at the Second World Water Forum in The Hague and the

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Bonn Conference resolution (Ministerial meeting, 2001) played an immense role in attracting the attention of policy makers (and not only water management and nature conservation agencies) to imminent water resources depletion and a necessity for a radical reorientation of the water sector from *meeting water demands* to *managing water demands* and achieving potential productivity of water use in all sectors and industries while reducing unproductive water losses. Dissemination of advanced approaches to address water issues and methods of management and their popularization facilitated practical steps along these lines in many countries. In this respect, of great importance is the understanding that the possibility of meeting the needs of societies (with a specific water consumption of 250–450 $m^3 yr^{-1}$ per capita even in the arid climates of Jordan and Israel) is based not only on modern technical networks and decisions, but also on very strict and principal[Q8] policies pursued by these states, which stimulate water saving and conservation techniques, support pertinent financial and legislative systems of modern water use and management, and demonstrate public participation and involvement in management and maintenance of the water sector. Of no less importance are efforts undertaken by the ADB, the Swiss Agency of International Development and Cooperation (SDC), the GWP and the EU with its Water Framework Directive (European Commission, 2000) in order to demonstrate the advantages of integrated water resources management (IWRM). Instructive examples are the basin management system in France, water confederations in Spain – which have already been in existence for 70 years – and water communes in Italy. All of them combine basin hydrographic management with active participation of water users and their representatives.

Q8

The Japanese experience is worthy of praise, in particular the way this country manages to harmonize the interests of nature and society with an immense population density. Appropriate attention needs to be given to the similar careful and respectful attitude to water as demonstrated in the Netherlands, Canada and Switzerland. Developed countries would have to undertake appropriate activities with countries in transition in order to organize the process of following these and other good examples, and what is essential – to make use of the instruments of rational natural resources use.

INTERNATIONAL FINANCIAL ORGANIZATIONS – THEIR ROLE IN GLOBALIZATION

Positive contributions made by the World Bank and other organizations of the international financial institutions (IFI) system were apparent at the first stage of transition from the former Soviet system to market relations, when highly qualified professionals from these organizations selflessly and driven by high human aspirations tried to render assistance to local specialists in coping with rules and regulations of these institutions now permitted, after 10 years, to introduce certain advanced technologies, equipment, computerization, informatics and sophisticated methodologies. After 15 years of donor involvement, the water and environmental bodies of Central Asia understand the differences in approaches of various donors in their collaboration with partners.

A range of donors supports local beneficiaries in order to create opportunities of self-expressing, sustainable and democratic approaches to solutions of their own issues, firstly with donors' support and then with their monitoring and participation. They support strategic approaches on a long-term basis, training of local specialists in advanced methods and practices, preparation of the country's own professionals and their familiarization with Western ''approaches'' as well as creation of their own approaches adapted to new conditions. For example, the ''IWRM-Ferghana'' projects implemented by the Scientific Information Centre of the Interstate Coordination Water Commission of Central Asia (SIC-ICWC), together with the International Water Management Institute (IWMI), automation of structures and canals in the Syrdarya River and SIC-ICWC Information Exchange all under SDC support, the SIC-ICWC Training Centre activity under Canadian International Development Agency (CIDA) and McGill University support. Such projects have laid a firm foundation for survival and effective functioning. Here donors acted in the interests of local needs and tried to satisfy priorities and tasks set by beneficiaries without political, economic and other conditions in complete trust during the project implementation stage. Local specialists are considered as equal partners and executives. Such donors are: Switzerland, Canada, the Netherlands, NATO with its programme ''Science for peace'', the ADB, the EU with its programmes FP-5, FP-6 and the International Association for the Promotion of Cooperation with Scientists from the New Independent States (INTAS).

DOI: 10.1002/ird

Another group of donors imposes their priorities on beneficiaries, does not trust local specialists, delays fund allocations over long periods and sets conditions under which 70–80% of the donations return to the donors themselves to pay for their consultants, equipment, etc. Moreover, their projects usually are not oriented towards final results – the fact of funds allocation is most important but not its effectiveness.

It is necessary to consider separately the cooperation with the World Bank in the Aral Sea issues. The World Bank is based on a complicated bureaucratic system where decisions on selection, preparation, approval and acceptance of projects through Bank officials take several years, even for projects which are in principle supported and at low cost. The strategic project ''Improvement of water resources and environment use in the Aral Sea basin'', total cost US$12.2 million, uniting five Central Asian countries, funded by the Global Environment Facility (GEF) was prepared over four years. The project was completed in 2003, the terms of reference were not fulfilled, but the money was spent and all were satisfied – the consulting company got its money, the World Bank closed the project, only the region did not receive a strategy, which was expected[Q9].

Q9

Meanwhile, during the first stage of SIC-ICWC and World Bank cooperation, the work was well organized when the ''Main provisions of a regional water strategy for the region'' project, as a basis for the above-mentioned project, was implemented by local specialists and a moderator from the World Bank (Janusz Kindler). But further the World Bank gave local specialists (not institutions) the role of assistants, creating ''black'' jobs with salaries that were ten times lower compared to the salaries of the foreign specialists. As a result of the limitations in financial capacity imposed on borrowers and grant providers, local organizations could not independently take part in bidding and competitions, which led to the demise of research and design institutes.

One example of the high effectiveness of donor support is the SDC. It has allocated funds for implementation of the automation and monitoring system in hydraulic structures of the ''Syrdarya'' BWO in the Ferghana Valley. The Kyrgyz company ''SIGMA'' was contracted to do the work under the supervision of SIC-ICWC. Earlier the company had worked for the space industry. ''SIGMA'' automated all structures in a short period of time at average cost of US$6000 per automated point. The accuracy of the water distribution rose from ± 10 to $\pm 2\%$ in the discharge of the Toktogul cascade, under the extremely variable flow regime of the Naryn River with daily flow fluctuations of up to $200\,m^3\,s^{-1}$. For comparison, the same work done by French companies in the Southern Golodnostepskiy canal (Uzbekistan) had an *almost three times* higher-order cost per gate. Appreciation by the well-known French automation expert Hervé Plusquellec of the work done by ''SIGMA'' is characteristic. According to actual data on automation system performance in the Uchkurgan waterworks facility, one can note that the system operated stably and performed key functions of automation and data collection on waterworks technological parameters during 2002–2006. Through automated regulation of the water level in the upper basin and regulation of the discharge in the feeder canals of the Big Fergana Canal and the Northern Fergana Canal, the system ensured stable water supply in these canals, given the considerable discharge fluctuations in the upper basin of the waterworks because of the daily power-generation regime at the Uchkurgan Hydropower Station. Moreover, it is necessary to note that the costs of the system were much lower than of those in Western countries. Thus, the effectiveness of donors' assistance could be increased to a greater extent provided that there is more trust in, and reliance on, the local capacity of countries/beneficiaries.

The analysis of the donors' contribution to the Aral Sea basin programme 1 (ASBP-1) and a number of other projects implemented together with SIC-ICWC's institutions (Table II) shows that on average only 30% of the funds – which are published in Overseas Development Agency (ODA) reports as assistance to developing countries – actually reaches the beneficiaries. The extremes are SDC, INTAS and ADB projects where 70% of the funds are directly allocated to the beneficiaries (Table II) and the assistance of United States Agency of International Development (USAID) and the TACIS programme of the EU, where this accounts for only 10–25%. There is no doubt that donors must retain functions of permanent control over final results and general monitoring of implementation progress, but they should abstain from exercising painstaking supervision of every working step. To ensure successful implementation of integrated regional programmes there is a need to establish Boards of Donors that could address coordination and interaction issues. Such a kind of arrangement will allow the international donor community to effectively utilize funds and avoid dissipation of resources, duplication of advertising campaigns and rivalry among donors. At the same time, this might facilitate augmentation of donors' community prestige, concentration on joint efforts of providing assistance to developing countries and improving local living conditions.

DOI: 10.1002/ird

Table II. Analysis of donor funds in 1000 US$ allocated directly to beneficiaries

Project	Donor	Project cost in 1000 US$	Of which allocated to beneficiaries
''Key provisions of the water resources management strategy in the Aral Sea basin''	Global Environmental Facility (GEF)	540	420
''Generalization of past irrigation and drainage pilot projects in Central Asia''	World Bank	100	100
''Water and environmental management in the Aral Sea basin''	GEF	22 500	5 200
Development of recommendations for sharing costs and benefits under joint interstate and intersectoral use of water and energy systems in transboundary rivers and modelling optimal regime of Naryn-Syrdarya cascade	United States Agency of International Development (USAID)	22 160	1 866
''Automated control and monitoring system in headwork of interstate canal Dustlik'', ''Training in IWRM Ferghana''	Canadian International Development Agency (CIDA)	1 520	600
''Water resources management and agricultural production in Central Asian countries''	European Union (EU) TACIS	10 781	2 796
''Capacity building in the Aral Sea basin'', ''Development of a modelling tool on the basis of water – socio-economic development–nature interaction in Central Asia for training and application by decision makers''	United Nations Development Programme (UNDP)	220	104
''Automation and control system of Uchkurgan and other waterworks facility in the Naryn River''; IWRM Ferghana Valley	Swiss Development Cooperation (SDC)	5 954	4 116
''Integrated water resources management in the Aral Sea basin in order to restore wetlands in Southern Prearalie''	NATO	240	195

WATER SECTOR MONETIZATION

Significant lack of investment in water resources development led to the appearance of two negative phenomena. The first is the ''water-commodity'' tendency promoted by many monetarists, who call for full payback for water storage, extraction, delivery and use, and the second is privatization of water entities.

The slogan coined by former World Bank Vice President Ismail Serageldin ''water is the oil of the 21st century'' gained a great deal of support from financial circles. They saw in it a way to water monetarization and making it a source of profit like global goods – oil and gas. The USA in some states supports water rights incorporation. In regions of intensive development like Denver where all water was distributed during the 19th century, this has led to monthly auctions where the cost of one share for 1 m^3 of water increased up to US$20. Stakeholders firstly sold shares for saved water and then water from all irrigated areas. If this trend expanded all over the world, mankind might lose up to 40% of the food produced by irrigated agriculture. It is no threat to America – this rich country will feed its population but what will the developing countries do? Who will buy water to support the poor and the environment?

But water (unlike oil) is a vital element of the noosphere[1] – it is the blood of life, subject to nature and social provision, where non-observance will lead to the death of mankind. Only air is equal to water in its meaning for human beings, because nothing can replace water and air. Without oil and gas people can live their whole life, but without water they would last only one week! Oil can be replaced by coal, firewood, hay or electricity. Brazilians already successfully use bioethanol instead of oil, but nothing can replace water. The principle of water as an economic value, according to the Dublin Declaration, should only support its rational use but not its trade. Water

DOI: 10.1002/ird

can become a good only after satisfaction of social and ecological needs under certain conditions: water scarcity, possibility of its delivery at any time without damage to basic needs and capability of competing uses to pay for excessive water.

Attempts to legalize the trade of water as a commodity were made in the North American Free Trade Agreement (NAFTA) and in the World Trade Organization (WTO). The new General Agreement on Trading Services (GATS) puts the water supply services under the category of ''environmental services''. Kavanah[Q10] and Mander (2002) are absolutely right in proving that water monetarization and privatization according to the law of the free market deprives water of its properties as a social good since in this way access to water is ensured only for those who have the money to pay for it.

Unfortunately, these trends touched the Central Asian region as well – with encouragement from some of the donors the upstream countries began to compare water with gas and oil and required from downstream countries not their share of the common cost but charges for water as a good.

Fragmentary acquaintance of poorly prepared representatives of the ''new democracy'' with international experience supported by some international consultants[Q11] began to campaign for the sale of natural water from transboundary rivers to downstream countries, for example Naryn water to Kazakhstan, Tajikistan and Uzbekistan at 12 US cents per m^3! Water sale by the ''Imperial valley'' system to Los Angeles and San Diego or water auctions in Colorado are taken as a precedent, but it is forgotten that not the water but the license for water was sold.

At the same time, sale of free water within WUAs and between them, as well as creating economic incentives for water saving, should be supported and expanded.

Another side of the ''water-good'' trend led to market largest mega-companies[Q12] with their aspiration for privatization. Though it was covered by generous goals – covering the deficit of funds for water resources development by attracting private capital – it led to an increase of water charges, and decrease of payback and investment outflow from the water sector. Fortunately, the privatization experience was limited to the participation of Tractebel in Kazakhstan, from where this company was forced to leave; the potential of social possibilities of water and power consumption turned out to be unprofitable for such methods.

Discussions on issues of private participation in water management have still been seething with passion. But one thing is clear – water management as such, being an element of state security, cannot be turned over to private ownership; the private sector may be involved only with regard to providing certain services for water management under strict state supervision, constraints and regulation. Companies and capital attraction to water management improvement, water infrastructure development, water conservation and waste utilization should be promoted by the state because experience of water managers can help in water conservation improvement.

GLOBALIZATION OF WATER RESOURCES

Can we speak about globalization of water resources on the whole? For instance, if in Brazil 17 000 $m^3\,yr^{-1}$ of water is available per person, this can have no effect on coverage of water shortage even in northern Mexico, which has 1400 $m^3\,yr^{-1}$ per person, let alone shortages in the sub-Saharan region or the Takla-Makon desert. Mankind's water demand is so huge and transportation so expensive that transfer of water from water-rich Turkey to money-rich Israel mainly remains the subject of plans and comparisons rather than of feasible actions.

Nevertheless, thanks to Toni Allan and Michael Rosegrant, much work has appeared that treats water as a resource of global character. In his very interesting summarization, Ashok K. Chapagain found that water globalization is reflected in (Chapagain, 2006):

- establishment of many global and regional institutions intended to address the problem of transboundary water use and development of policy coordination between governments. As examples he cites the Mekong River Commission, the Regional Commission for the Okavanga, and the Nile Basin initiative;
- water transfers from one basin to another;
- the bottled water trade;
- privatization of water by recognizing it as an economic good;
- virtual water as the way of global influence on water use efficiency and deficit settling.

DOI: 10.1002/ird

The first two points are of a regional nature, rather than global. The quantity of the bottled water trade of 144 million m^3 (Gleick, 2002) is insignificant so that one cannot speak about the possibility of covering the water deficit on a global scale. Moreover, no one can cite examples of bottled water export/import between countries. Locally, however, bottled water can be essential as a drinking water supply source. Water bottling technology, as well as equipment for this purpose, is easy to procure and install; therefore, this is a local process for meeting the demand of any country or region suffering from shortage of water of good quality.

Privatization of water by recognizing it as an economic good, as mentioned above, is more a tool of financial and economic pressure, and the number of its supporters, especially in light of water conservation for the environment (who should pay for nature's demand?) has been decreasing. There are more concrete mechanisms to influence global movement in terms of water. These are:

- production prices of irrigated agriculture as the main water consumer in the world;
- electric energy prices and their dynamics in light of the growing prices of thermal resources and the attempts to transform hydropower into a geopolitical tool similar to gas and oil;
- growing ''virtual water'' pressure as the way to provoke international competition in contrast to a need for development and support of irrigation in developing and transition countries.

Recent agricultural production prices in the world market are far from reflecting the actual crop production costs in irrigated lands. The collapse of the USSR occurred at the same time with an abrupt landslide of agricultural production prices, which was mainly caused by subsidy policies of the world leaders, such as the USA and EU. One cannot better the description of this process by[Q13] A. Shady[2]: Q13

> 'Subsidizing of national agriculture by developed economic systems is the cause of large distortion and lack of support to billions of the poor. These systems can assist the rich to become richer from agricultural subsidies currently reaching 300 billion US$/year. Major actors are the EU through its Common Agricultural Policy, which accounts for half of the EU's budget, from which 100 billion US$ were allocated to European farmers in the form of subsidies in 2002 and the USA, with its subsidies reaching 40 billion US$ in 2002 and ever growing. At the most, 10% of subsidy recipients, accounting for 313,000 farms, received more than 104 billion US$ subsidies in the USA in the period 1995–2004. This is 72% of the total subsidies during this period. When considering all countries of the Organisation for Economic Co-operation and Development (OECD), this form of support accounts for 31% of the total farmer's receipts, including: 18% in the USA; 36% in the EU; 70% in Japan and 75% in Switzerland'.

The example of cotton prices is characteristic. The USA, while producing 3.6 million t of raw cotton, grants almost US$4 billion per year to cotton-growing farmers, i.e. US$1000 t^{-1}. This means that the cost of production of each tonne of raw cotton for American farmers is half that for Central Asian producers. The USA, one of the world's major cotton suppliers after China, sets dumping[Q14] of the world cotton prices from US$1750–1880 t^{-1} to US$880–1200 t^{-1} over the last 10 years of the 20th century. Q14

In practice, Western subsidies made it impossible for Central Asian fruit and vegetables to compete with European products on the Russian market, and Russia has been buying cheaper fruit and vegetables, which taste much worse. Thus, developed countries protect their national markets and agricultural production in their countries and, concurrently, promote commodity intervention in developing countries. As mentioned above, this has led to the situation that present world prices of agricultural products have gone down by nearly two times[Q15] in comparison with 1980. In this connection, *development of agricultural production in many developing countries became unprofitable and started declining if it did not have powerful state support*. Figuratively speaking, developed countries have been turning developing countries into ''drug addicts'' dependent on imports as a ''narcotic shot in the arm''. Today the consequences of this ''shot'' might be not as painful as it could be in the future when domestic commodity producers are eliminated, and world prices once again go up resulting in even more miserable living conditions for the poorest populations in these countries. Q15

If the country imports more than 30% of its food products, then such a situation constitutes a threat to the food security of that country. But agricultural production is closely connected with the overall economic development of

DOI: 10.1002/ird

each country, since the agricultural sector obtains its resources from eight sectors of the economy, but itself provides inputs necessary for the functioning of 60 other sectors of the economy. According to studies carried out by the Russian Academy of Agricultural Sciences, ''every person employed in agricultural production provides another 5 workers with jobs beyond the agricultural sector'' (Russian Academy of Agricultural Sciences[Q16], 2005).

Advocates of globalization claim that large-scale agricultural and industrial production and unlimited trade would be the determinants in fighting famine and environmental degradation. They forget that capital's egotism and its derivatives, as well as the aspirations of the rich to become richer, while getting rid of general global famine and poverty challenges by means of crumbs of charity, stand in the way of these good intentions. Such charity has also created a global network of near-philanthropic lobbyists who under the pretence of helping the poor and hungry capture a substantial share of funds for their pockets.

Hydropower production prices are another factor of global effect on the water sector, particularly on irrigated agriculture. The fact that the key power production centres are usually located upstream creates competition for flow regimes with irrigated agriculture, which is generally located in the mid- and downstream parts of rivers. Here a risk arises that the two tendencies – the suggested growth of energy costs (Figure 1) due to the increase in oil prices and the drop in agricultural production prices – would create incomparable[Q17], in economic terms, possibilities of meeting the upstream countries' demand for compensation for the so-called ''lost profit''.

Hitherto, this problem has been created only with respect to the Naryn-Syrdarya cascade. Kyrgyzstan and Tajikistan utilize their water resources first of all in the interests of meeting their own energy demands and concurrently for exerting certain pressure on downstream countries. The attempts of upstream countries to utilize their consummated and future hydropower potential in such a way that they obtain the maximum profit are understandable. Besides, in Soviet times, the principle of the general international law such as ''do not harm, otherwise pay'' was understood and applied in masterplans for the Amudarya and Syrdarya rivers. The way to integration was envisaged to be by exploiting the hydropower potential in such a way that conflicts with the irrigation interests in the mid- and downstream and with the demand at the delta would be avoided. Today, all the regional countries exploit their hydropower potential only on the basis of the large water-management systems constructed during the Soviet period, but they departed from well-recognized principles by moving from irrigation to mainly power-oriented releases from upstream waterworks. This problem was partially solved by the Agreement of 1998 between the governments of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan and the Republic of Uzbekistan, ''About use of water and energy resources in the Syrdarya river basin''. According to this agreement the excess electric energy generated above the demand through summer releases should be compensated by the mid- and downstream countries at agreed prices. Currently, electricity prices (2–3 US cents per kWh) are still

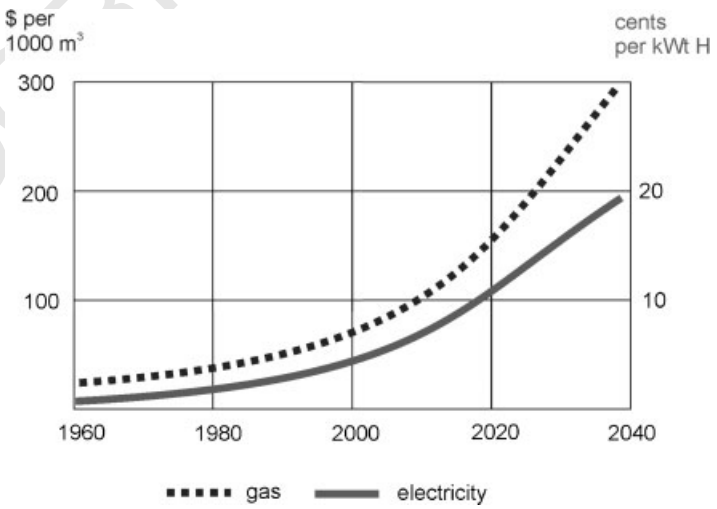

Figure 1. XXX[Q18] This figure is available in colour online at www.interscience.wiley.com/journal/ird

DOI: 10.1002/ird

comparable with market prices (1 kWh of thermal energy costs 4.5 US cents), but what can be expected in the future? Therefore Uzbekistan is striving for almost full satisfaction of its demand for additional water through releases from the Andizhan reservoir and, partially, through construction of in-stream reservoirs. This works well in wet and normal years but fails in dry years.

Moreover, prospects for hydropower development in the region, including an opportunity to construct the cascade of the Kambarata Hydropower Station on the Syrdarya River, Ragun on the Vaksh River, Dasht and Dzhuna on the Pyandj River attracted the attention of the World Bank and even of large funding bodies in the USA, Iran, China and Russia. A possibility of exporting hydropower to Pakistan, Afghanistan, China and other energy-deficit countries will create a commercial power sector and the ability to demand, as a lost profit, 2–2.5 times higher prices for winter electric energy. The solution would have to be found in several directions at the regional level, such as:

- short-term approval of the new Agreement on the Syrdarya and the Amudarya rivers, which would have to fix the conditions of the new construction and operation regimes of canals including the interests of hydropower, irrigation and environmental releases. In particular, this Agreement clearly needs to set obligations of the parties regarding requirements of the rivers' demand as natural objects and of other countries' demands. The principle ''do not harm, otherwise pay'' implies that any country that causes damage or is planning to undertake actions that may cause damage should enter into negotiations with neighbouring countries and will have to implement a set of measures to prevent the expected change, or compensate losses or pay compensation for damage;
- thus, agreed actions are needed to prevent probable damage. At the same time, one should bear in mind that successful parity management of transboundary waters is feasible only if all the countries are not aiming at maximum effect for one country, but at observance of the so-called Pareto principle, according to which every party would get a maximum effect without damaging other parties;
- present relations in the Naryn-Syrdarya cascade scheme result in regular neglect of the Syrdarya River's demand in summer and floods in the lower reaches in winter. If one evaluates the social and economic losses and presents the results to those in charge of hydropower, then it would hardly be advantageous for the latter to strive for maximum profit. Thus, if there is agreement on achieving equal profits, the solution could be found: the effect of hydropower development while meeting clearly reasoned social and environmental demands, with specified compensation;
- the riparian countries by uniting with the countries interested in electricity would have to establish a water-power consortium for the construction and operation of hydropower station cascades that would balance the demand of electricity supplies proceeding from the demand of country recipients and the satisfaction of irrigation, nature and other downstream users' demands as specified by the SIC-ICWC;
- for each river basin, establishment of a river basin council as a public body that directs activities of the BWO and is comprised of ICWC members, i.e. representatives of the national governments responsible for provision of water, as well as representatives of all provinces located in the basin and big water users such as the hydropower sector, delta management, and environmental conservation. The involvement and public control over management will promote equal and equitable water use and allocation in transboundary rivers.

It is advisable to consider and apply the experiences of Canada and the USA, where hydropower station management is separated from river water management, and those in charge of hydropower buy water from the US Bureau of Reclamation or from Canadian provincial water organizations through the owners of water reservoirs.

THE CONCEPT OF ''VIRTUAL WATER''

Thanks to Tony Allan's work, the concept of virtual water has recently been developed as the volume of water required to produce a product or a service and that, as it is exported from country to country, creates an opportunity

DOI: 10.1002/ird

to reduce water demand, especially in water-scarce countries (Allan, 1998). In a case study of the Middle East countries, such as Israel and Jordan, the concept was demonstrated as a means of country survival when water availability was less than 500 $m^3 yr^{-1}$ per capita. Hoekstra and Hung and especially recently Chapagain have made a great contribution to the dissemination of this concept (Hoekstra and Hung, 2002; Chapagain, 2006). The approach is quite interesting from the position of researchers and for the analysis of end-distribution of water used in various products and services between countries. However, this does not make any new discovery in the general picture: taking into account virtual water, the G8 countries consume 1676 $m^3 yr^{-1}$ per capita, whereas the other countries use only 1160 $m^3 yr^{-1}$ per capita.

But the top position among water users is taken by the USA, with a consumption of 2483 $m^3 yr^{-1}$ per capita, and the least amount of water of 702 $m^3 yr^{-1}$ per capita is consumed in China. A very interesting situation takes shape: the USA uses more than 330 billion $m^3 yr^{-1}$ of products produced with foreign water (and hence is responsible for pollution and depletion of almost 8% of the world's total water resources). Chapagain estimated similarly that the EU countries used 20% of the water taken out of the Aral Sea. This estimation did not consider losses in irrigation systems; with this contribution[Q19] 'the EU's share in depletion of the Aral Sea would exceed 30–35%, taking into account that the efficiency of irrigation systems is 0.56–0.6. From these positions, undoubtedly, the ''virtual water'' approach is interesting for balancing the effectiveness of one or another crop production under different conditions, for selecting the most effective crops and comparing their potential purchase in external or internal markets. However, all authors make estimations only in terms of water, while forgetting all about economic indicators – income derivatives, especially in processing, marketing, consumption, about economic benefits of agricultural production, the role of associated effects and the social importance of irrigated agriculture.

Moreover, the water dependency index, considering virtual water, is introduced in contrast to food independence. The water dependency index as it is proposed and the assessment of water deficit based on virtual water, give a perverted idea of the possibility of national food self-sufficiency. Worner noted correctly that under price fluctuations in the international market, an opportunity for developing countries to provide their people with food at reasonable prices may be lost due to a jump in import commodity prices or a drop of export commodity prices (Worner, 2003). Therefore, the index as proposed by Hoekstra and Hung, which might be satisfactory (water dependency index as the ratio of the net virtual water import to the total national water appropriation) may respond to an export price drop and reduce imports, thus improving supposed ''water self-sufficiency'', though at the same time food self-sufficiency may turn out to decrease considerably.

From these positions, national food security is more important than far-fetched water security. An index showing the share of consumed food that is produced in a country will guarantee that free market jumps will not create critical social situations in the country.

All works mention in passing the very important aspect of irrigated agriculture in developing countries, i.e. its social importance as one of the main factors of rural employment and source of income not only for those occupied directly with irrigation but with associated sectors, services, etc. In this context, the analysis under the EU-supported River Twin Project (2006) is representative regarding the role of irrigation in generating the gross domestic product (GDP) in the rural area of the irrigated Tashkent oasis. The size of income generated in large-scale irrigation schemes is comparable with that obtained from production and consumption of crops in own production plots. The latter sometimes exceeds the first-mentioned component of rural incomes. The calls of some globalists to orient towards the experience of countries ensuring employment in industry are hardly feasible for developing countries with low incomes, taking into account that the cost of one work position in industry (US$10 000–16 000) is several times higher than one in agriculture (US$1000–2000).

Thus, virtual water as an indicator of food production profitability or non-profitability in any country is just a potential theme for research and macroeconomic exercises. As applied to countries in transition with a deficit of available assets and poor purchasing capacity, virtual water is a counterweight of national or regional self-sufficiency regarding food or primary agricultural products. The subsidy policy in developed countries along with propagandizing of the virtual water concept can undermine the financial potential of local producers in the future as well, when food and agricultural production prices will increase (this is in reality proceeding from WTO policy). Then famine challenges will worsen as we allow destruction of the infrastructure potential in the countries.

DOI: 10.1002/ird

HOW TO APPLY AND RESIST THE GLOBAL CHALLENGES? NATIONAL POLICIES VIS-À-VIS GLOBALIZATION

So, from the point of view of information, research and technological exchange, openness and opportunities to apply institutional, managerial, communication and various innovation advances, the global tendencies need to gain widespread development and be used in the water sector and water-using branches, first of all, in irrigated agriculture. Along with this, the specific ''spirit of water'' needs to be developed. This implies the spirit of the sanctity of, general accessibility to, and general responsibility of society for, water and water users for maintenance of its exclusiveness and rational use – the general understanding that it is impossible to monetarize water and transform it into a commodity, to pollute and deplete water. It seems that there are good lessons to learn from various countries, including Japan, Canada, the Netherlands and Switzerland. These water-abundant countries have established an understanding of the uniqueness of water as both nature element and public good. This does not mean that water should not be evaluated in economic terms; moreover, only a stable and reliable financial background dedicated to conserve and improve the water potential may serve as a basis for a future sustainable balance in society under conditions of imminent water shortage.

Water ethics, which are widespread among all religions and ideologies, would have to be realized in a water treatment culture, in cultivating understanding among all generations that water is unique for both humans and nature and in elaboration of a specific global water code as a book with indisputable rules regarding water relations in the context of water rights! From this point of view, the international water law and UN documents (human rights, international conventions) do not give clear recommendations and guarantees of enforcement mechanisms regarding the right to safe water, the right to water for food production and the right to water for nature. This implies that these documents cannot be used as the basis for future sustainable water supply for people and society as a whole. The respective impediments are vagueness and uncertainty of many provisions in international water law that may be interpreted by any country to its own benefit, on the one hand, and the lack of understanding of the enforcement mechanism as a chain of obligations and rights of actors and the possibility of influence from the bureaucratic mechanisms of national, provincial (governor) and local hydro-egoism at all levels of the water hierarchy – from basin to water consumer – on the other. The understanding of a need for elaboration of strong and obligatory rules and regulations within interstate agreements and the principles of water management at national level would have to be opposed to the above mentioned[Q20]. In Central Asia, water-related, transport, energy, economic and other interests are very closely interlinked, especially taking into account certain isolation of national boundaries, and only cooperation – and water as its pivot – may ensure sustainability and long-term prosperity and peace in Central Asia.

The more reliable ''compass'' in this cooperation concerns efficient regional legal and institutional frameworks coupled with a present-day national system of water governance, which includes National Water Codes and future development strategies stipulating efficient and rational water use, widespread implementation of integrated water resources management (IWRM) at all levels of the water chain, along with public participation and water user initiatives. All this would have to be based on local traditions of careful water management. At the same time, one should also bear in mind that the forces of monetary globalization and monetary egotism will be searching for various forms and loopholes to exert pressure on economy, policy, culture and education, in order to perpetuate the power of money and discontinuity of social stratification problems. As Aly Shady underlines in the above-mentioned summary:

> 'In the water sphere, one should not ignore those who are involved in water challenges proceeding from their grasping interests. These are large corporations that actively work in the world's food production chain: industrial contribution to agriculture (realization of the 10 best commodities amounts to 370 billion US$), among which Syngenta, Bayer, BASF, Monsanto and DuPont; food companies of the processing industry and traders (realization of the 10 best commodities amounts to 363 billion US$), among which Nestle, Cargill, Unilever, Midlend Arkera Daniels (ADM), Craft's foodstuff; food retail dealers (realization of the 10 best commodities amounts to 777 billion US$), including Wal-Mart, Carrefour, Royal Ahold, Metro AG, Tesco. Besides, there are great interests of hydropower corporations, manufacturers of hydraulic machines and their accessories, financial corporations of charity and egoistic nature[Q21].'

DOI: 10.1002/ird

How to resist these phenomena? There is only one way. This is to strengthen national and regional policies that oppose and make use of global tendencies, regional capabilities and advantages. John Ralston Saul in his book *The Collapse of Globalisation* demonstrates that the theory that prioritizes the freedom of the market and competition as the main driver of the economy and progress has led to a chain of crises like the collapse of the Asian economy in the late 1990s, recession of Canadian development in the same period, and the aggravation of unemployment even in OECD countries in absolute terms (Saul, 2006). In contrast are the cases of China and India, which by adapting to globalization trends have been dictating to the world their rules of the game and opposed to those trends obtain their high and stable development rates. The reason for their success is a strategy and purposeful national policy that take into account the market's driving forces and global challenges.

The driving forces of globalization are the specifics of the modern market: particularly, the market of food, fuel and energy resources; deficit of some natural resources; respective natural and social phenomena. One may literally say that these forces, besides apparent management mechanisms and tools, are controlled by specific ''icebergs'' such as international financial institutions and international financial and business monopolies generated by this globalization. Protectionism, subsidies, public relations and even the fight against terrorism appear now as ''pro-globalization'', while trade barriers, customs fees and liberties, international unions and agreements, and wise national policies are the sides of ''consglobalization'' that advocate national rights, food self-sufficiency, etc.

China showed an excellent example of benefiting from its anti-global strategy in cotton production and processing. Taking into account low raw-cotton prices, China processes all of its cotton, 4.5 million t yr^{-1}, in textiles manufactured with support of the government and buys about 1 million t of cotton per year at low prices and processes it. Now China is the world supplier of textiles at the expense of advanced technologies and a cheap labour force. In contrast to subsidies in developed countries, China has developed its own system of supporting agriculture and the water sector. As a result, these two sectors achieved the highest level of development regarding both growth rates and crop yields, thus making possible the feeding of China's population (running into 1.3 billion) and providing export of goods.

The role of subsidies in irrigated agriculture and in the water sector depends on the forces that manage the subsidies hidden from the sphere of Central Asian interests. Whereas subsidizing of food and technical crop production in developed countries is, among others, aimed at market penetration in developing countries, the latter would have to protect their commodity producers. The only response to ''external'' subventions must be internal subsidies or protection of domestic producers through introduction of customs and tax barriers for foreign importers. But here domestic bureaucrats, intermediaries and lobbyists enter the game with their private interests, eager to make money at any cost, and frequently they promote imports to the detriment of fellow-countrymen instead of favouring own production. The consequences of such harmful actions affect not only agricultural producers; they exert negative impacts on the whole complex of social welfare in rural areas, development and maintenance of transport communications, secondary processing industries and supplementary enterprises, etc.

All these form tight tangle and incompetent[Q22] solutions, which seemingly look helpful, but often end up in failure on the national scale. Let us take for instance the provision of subsidies for water management. The World Bank and other IFIs, starting from the moment of obtaining independence, continually urge the Central Asian countries to suspend rendering support to water management. To the credit be it said of the Uzbek, Kyrgyz and Turkmen leaders they have not allowed it. Kazakhstan authorized almost complete abolition of sources that had formerly supported water management, and especially land reclamation. Initially, everything went well in this country; the Ministry of Finance was pleased, but on the other hand, wells of vertical drainage, in particular in southern areas of Kazakhstan, went out of service. Farmers could not afford to cover the operation and maintenance costs at the expense of their income. Gradual salinization (that had been forgotten in the past) has now proliferated like a cancer all over southern Kazakhstan, and crop yield on lands which formerly used to produce 3–3.5 t ha^{-1} yr^{-1} of raw cotton, decreased to 1.7–1.8 t ha^{-1} yr^{-1}! To the Kazakh government's credit, at present an impressive programme for subsidizing agriculture and the water sector provides a great deal of support to these sectors in Kazakhstan.

Q22

Along with improvement of national policies, a response to globalization would have to be regionalization – cooperation of regional communities, which permit development of common measures of regional security: water, power, food and ecology. It will allow the smoothing of demographic land and water resources and ensure peace and prosperity in the region. The results produced on our demonstration plots in all the countries of Central Asia

DOI: 10.1002/ird

show that the most inexpensive grain is grown in Kazakhstan, most cost-effective sugar and potatoes are produced in Kyrgyzstan, fruit and vegetables in Tajikistan and Uzbekistan and maize in Uzbekistan. If it is possible to reach an agreement (as is the case in the EU) on domestic and regional foreign-trade prices on agricultural produce, then the region would be able to fully provide itself with all necessary food products. It is appropriate to mention here that forward-looking calculations for 2025 allow this conclusion to be drawn: if this is not done then Kyrgyzstan and Tajikistan will fail to meet their demands for food products even in the case of planned development of irrigation.

Cooperation within Central Asian states based on the understanding of mutual interests of all participants should be a barrier to harmful hydro-egotistic trends because 60% of the rural population in the Central Asian countries and 100% of all the population, directly or indirectly, depend on water and irrigated agriculture, and, the latter, as in other countries, is linked with water supply sustainability and security.

Without negating positive implications of global challenges for our countries, one should note certain salient tendencies and unseen undercurrents which pose a number of threats – so the Central Asian governments must give consideration to them in their strategic planning and decision making.

The people of the Central Asian countries united by long-term common cultural, human, social, legal and religious traditions, need to be oriented to the positive sides of globalization and elimination of its negative sides by regionalization.

NOTES

[1]The noosphere is ''the sphere of human thought'' in addition to the atmosphere and biosphere.
[2]A. Shady, Point of view regional committee of Area world on past forum situation, 2006.

REFERENCES

Allan JA. 1998. Virtual water: a strategic resource, global situations to regional deficits. *Groundwater* **36***(4):* 545–546.

Allan JA. 2001. Virtual water – economically invisible and politically silent – a way to solve strategic water problems. *International Water and Irrigation* **21**(4): 39–41.

Bigday O. 2005. *Oligopolization of Agrarian Sector in USA*. Russian Academy of Science: 24–26.

Chapagain AK. 2006. *Globalization and Water*. Balkema: 148.

Cosgrove WJ, Rijsberman FR. 2000. *World Water Vision: Making Water Everybody's Business*. Earthscan: London, Great Britain.

European Convention. 1992. *UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes*.

European Commission. 2000. *EU Water Framework Directive*, Directive 2000/60/EC, Brussels, Belgium.

European Union TACIS. 1997–1999. *WARMAP Project. Water Use and Farm Management Survey (WUFMAS)*. Tashkent, Uzbekistan.

European Union TACIS. 1999. *Water Resorce Management in Aral Sea Basin (WARMAP Project)*, Tashkent, Uzbekistan.

Forrester, et al. 1972.

Gleick P, et al. 2002. *Globalization and International Trade of Water*, 33–56.

Global Environmental Facility (GEF) Program . 1999–2000. *Component A-2 ''Water Environment Aral Sea Basin Program''*.

Hoekstra AY, Hung IQ. 2002. *Virtual Water Trade: Quantification of Virtual Water Flows between Nations*. UNESCO-IHE, RRS, No. 11, Delft, the Netherlands.

Hohenheim University and SIC-ICWC. 2006. *Rivertwin – Chirchic Project*. Reports on grey papers.

International Law Association (ILA). 1966. Helsinki rules on the uses of the waters of international rivers. Report of the 52nd Conference, 477.

Interstate Coordination Water Commission of Central Asia (ICWC). 1996. *Key Provisions of the Aral Sea Basin Water Strategy. The Principal Provisions of Regional Water Strategy approved by the Governments of Central Asian States*. Tashkent, Uzbekistan.

Interstate Fund of Aral Sea (IFAS). 1994. *The Program of Concrete Actions on Improvement of Environment Situation in the Aral Sea Basin for the Nearest 3–5 Years Taking into Account Social and Economic Development of the Region (ASBP-1)*. Almaty, Kazakhstan.

Kavanagh T, Mander J. 2002. *Alternatives to Economic Globalization: a Better World is Possible*. The International Forum of Globalization, Berret-Koehler publisher: San Francisco.

Kyoto Protocol

Ministerial meeting. 2001. Bonn Conference Resolutions, Bonn, Germany.

Renergen W, Marteus P. 2003. The globalization timeline. *Integrated Assessment* **4***(3):* 147–144.

Rosengrant MW, Ringler C. 1999. *Impact of Food Security and Rural Development of Reallocating Water from Agriculture*. International Food Policy Research Institute (IFPRI: Washington, DC, USA.

DOI: 10.1002/ird

Saul JR. 2006. *The Collapse of Globalization*. Atlantic Books: London, Great Britain.
Shady A. 2006. Point of view[Q38] regional committees of world on past forum situation.
UNESCO, Office of International Standards and Legal Affairs. 1994. *Convention on Wetlands of International Importance especially as Waterfowl Habitat*. Paris, France.
United Nations Convention[Q39] on International Watercourses. 1997. *UN Convention on the Law of the Non Navigational Uses of International Watercourses*.
United Nations *Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, 17 June 1994*. Paris, France[Q40].
United Nations[Q41] General Assembly. 1992. *Convention to Combat Desertification, particularly in Africa. Resolution* 47/188.
Worner J. 2003. *Virtual Waters – Virtual Benefits? Scarcity, Distribution and Conflict Reconsidered*. Proceeding of UNESCO-IHE RRS, No. 12. Delft, the Netherlands.

Q38
Q39
Q40
Q41

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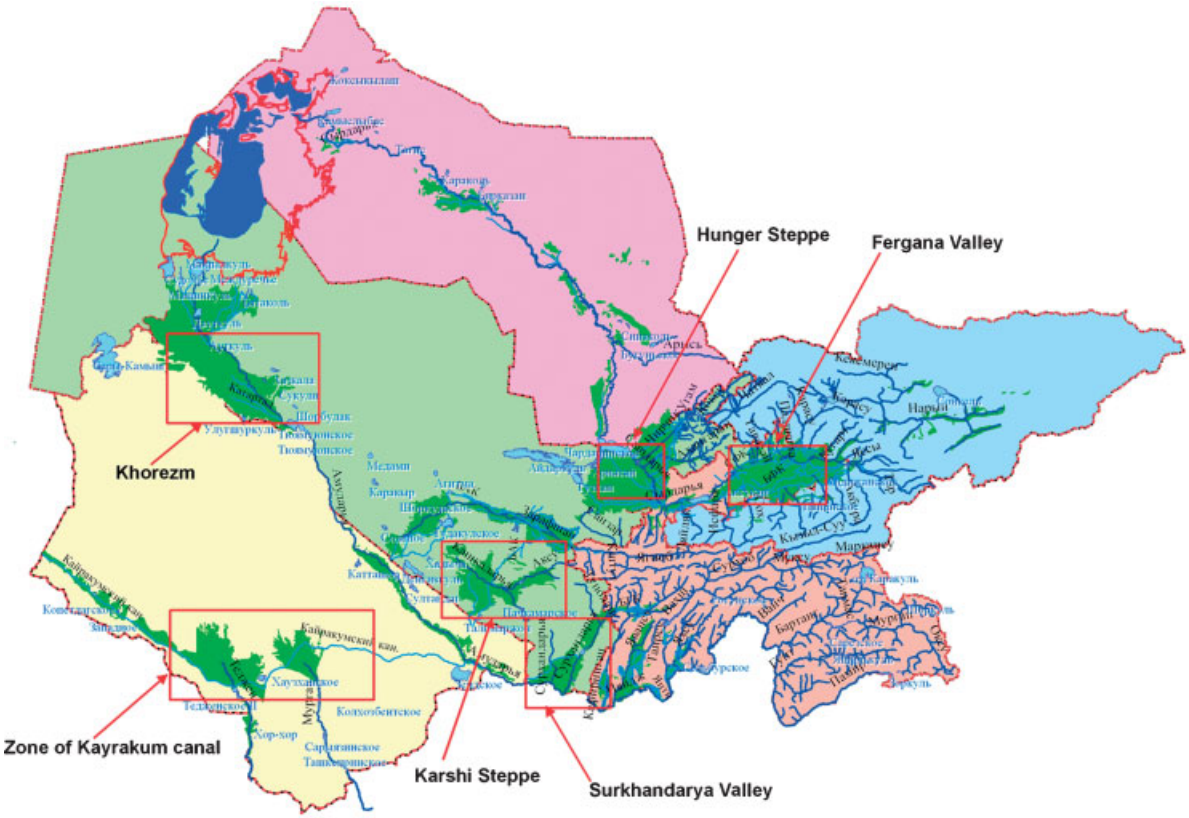

Plate 1. Map of principal irrigation system in Central Asia

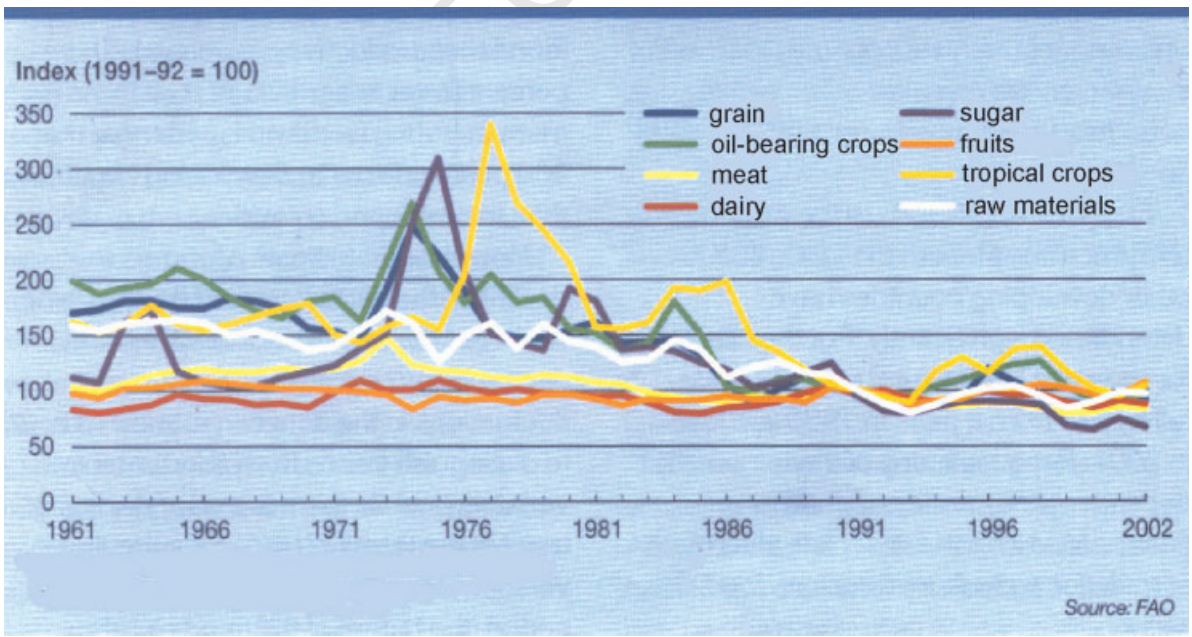

Plate 2. Q4

Q4

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Author Query Form (IRD/327)

Special Instructions: Author please write responses to queries directly on Galley proofs and then fax back.

Q1: Author: paper? Do you mean 'bureaucratic'? Please clarify.
Q2: Author: see? Is 'recognize' meant? Please clarify.
Q3: Author: please provide text reference to Plate 1.
Q4: Author: please provide caption for Plate 2.
Q5: Author: dated 1997–99 in References.
Q6: Author: not in references.
Q7: Author: fell out? Is 'stopped working'? Please clarify.
Q8: Author: principal? Do you mean 'principled'? Please clarify.
Q9: Author: clarify meaning? 'but the region did not receive the expected strategy'.
Q10: Author: Kavanagh in Refs.
Q11: Author: this sentence unclear. Please clarify meaning.
Q12: Author: market largest mega-companies? Meaning?
Q13: Author: footnote copy does not make sense?
Q14: Author: sets dumping? Suggest: has caused the lowering of world cotton prices from . . . ?
Q15: Author: gone down by nearly a half?
Q16: Author: not in references.
Q17: Author: incomparable possibilities? Meaning? 'would mean it was economically impossible to meet the upstream . . .'?
Q18: Author: please provide caption for Fig. 1.
Q19: Author: closing quote mark missing?
Q20: Author: the above mentioned? Expand here to clarify?
Q21: Author: quote OK as ends here?
Q22: Author: tight tanle and incompetent solutions? Meaning? Please clarify.
Q23: Author: not found in text.
Q24: Author: not found in text. Also place of publication missing.
Q25: Author: place of publication missing.
Q26: Author: not found in text. place of publication missing.
Q27: Author: not found in text.
Q28: Author: not found in text.
Q29: Author: not found in text.

Q30: Author: details missing.
Q31: Author: OK as book title? Please add publisher and place.
Q32: Author: not found in text. place of publication missing.
Q33: Author: not found in text. place of publication missing.
Q34: Author: place of conference missing.
Q35: Author: not found in text.
Q36: Author: More detail?
Q37: Author: not found in text. Journal title OK as marked? Please correct page range.
Q38: Author: meaning unclear. Detail to come?
Q39: Author: place missing.
Q40: Author: not found in text. Also author missing.
Q41: Author: place missing.