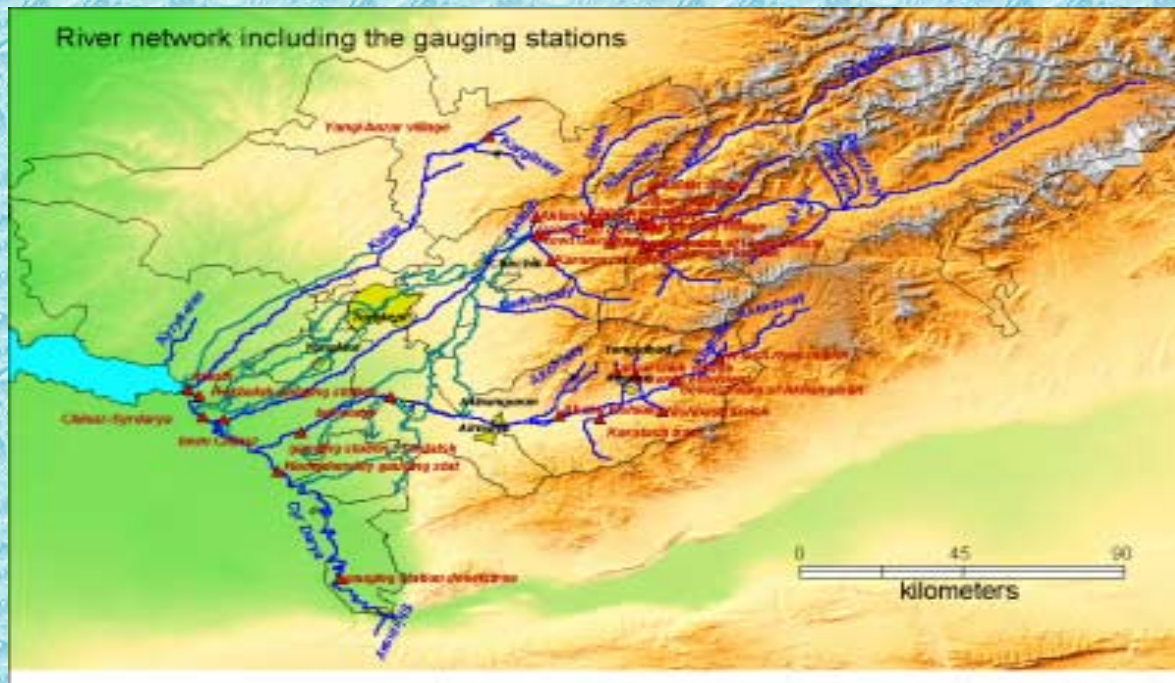
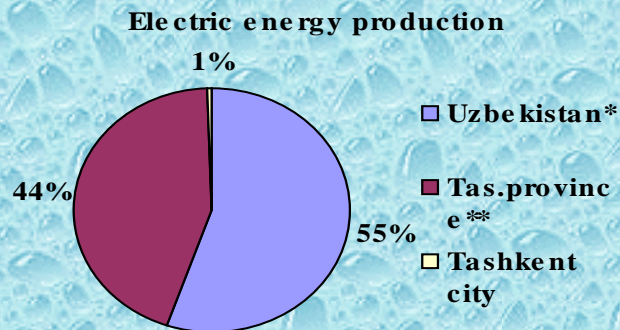
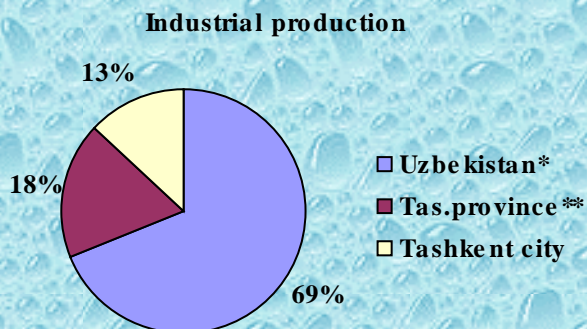
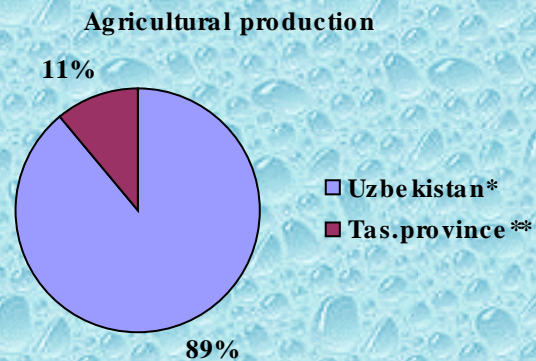
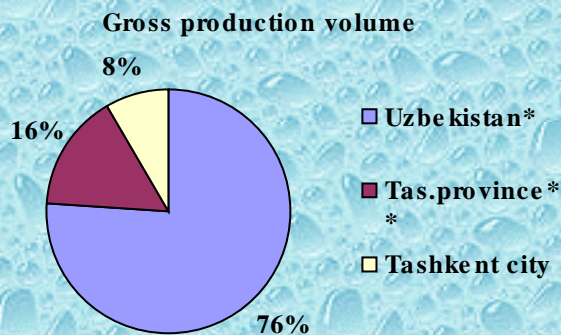
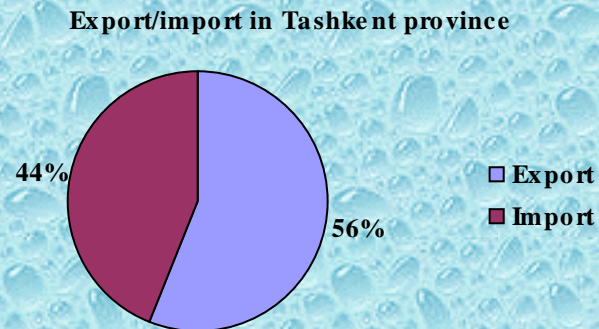
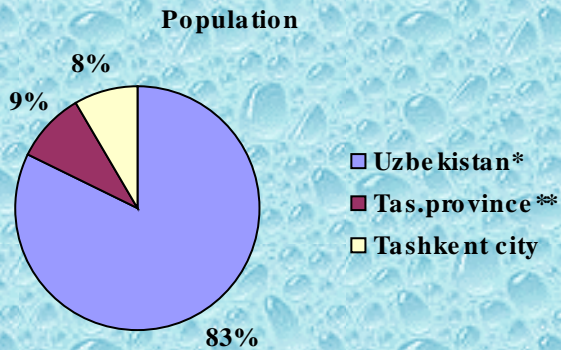


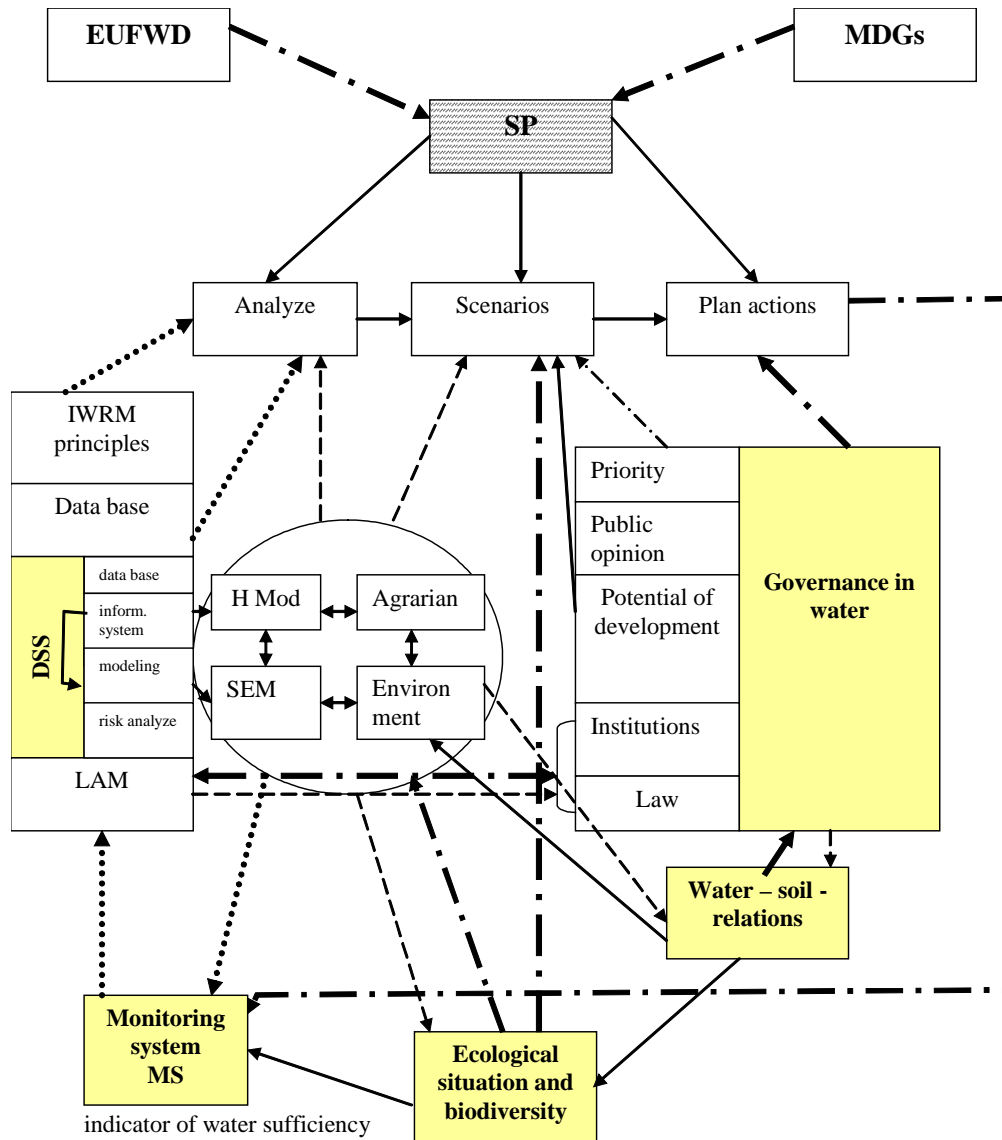


Scenario building for future water management in the Chakir Basin



Professor V.A. Dukhovny
14 December, 2006 , Hohenheim





- > limitation
-> information
- - -> tools
- · - · -> requirement

Scenarios as a part of SP

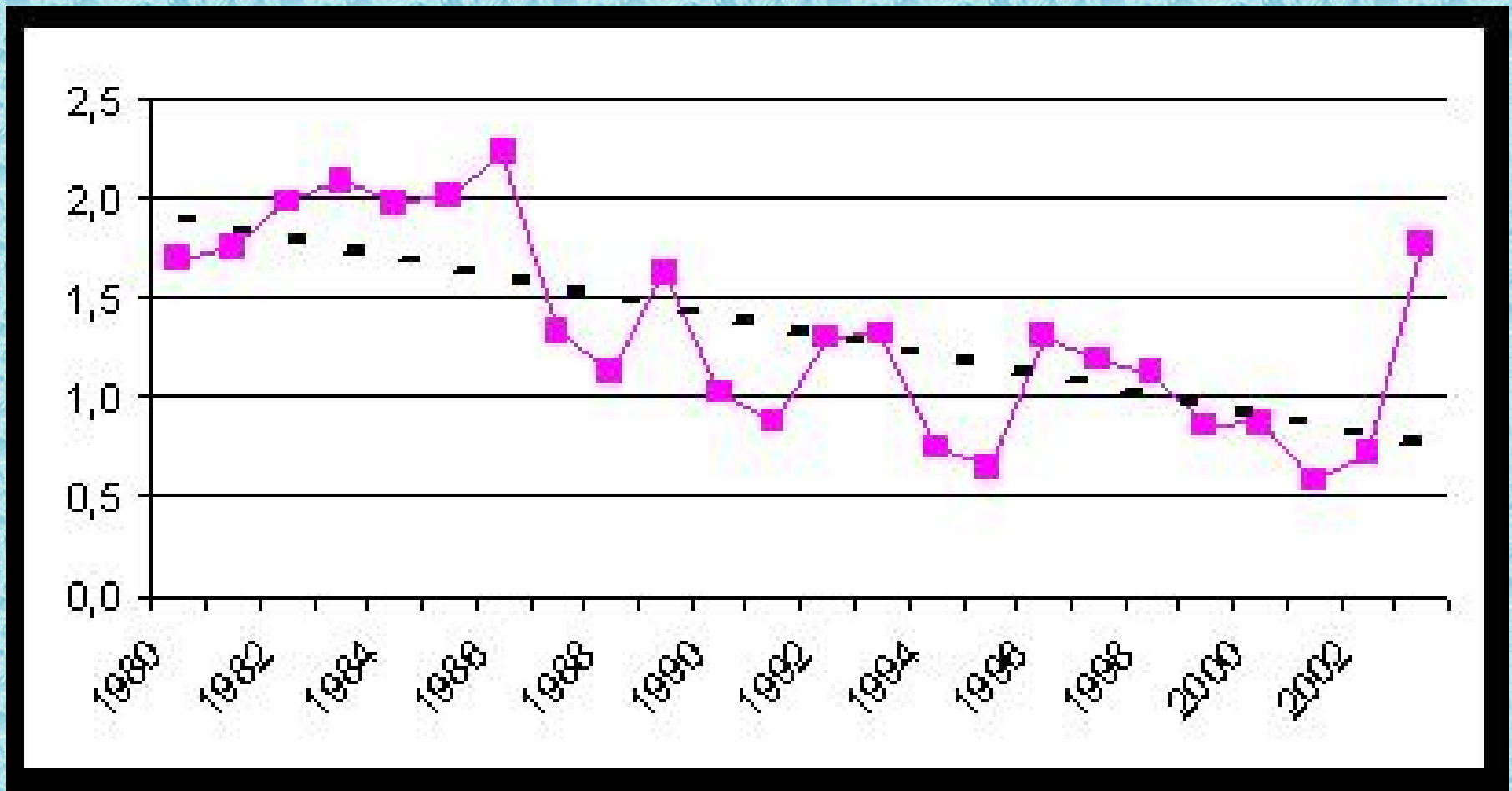
Dependence of population wellbeing on Water Sector

Parameter	Kazakhstan	Kyrgyzstan	Uzbekistan
Rural population, %	44	66	59.6
Employment in Water – connected sphere %	32	53	68
Irrigated area per capita, ha	0.3	0.2	0.1
Water availability by own water resources, m ³ /cap/year	1260 52 %	9439 100 %	1840 73 %
Contribution of water to generation of national income, %	27	58	52

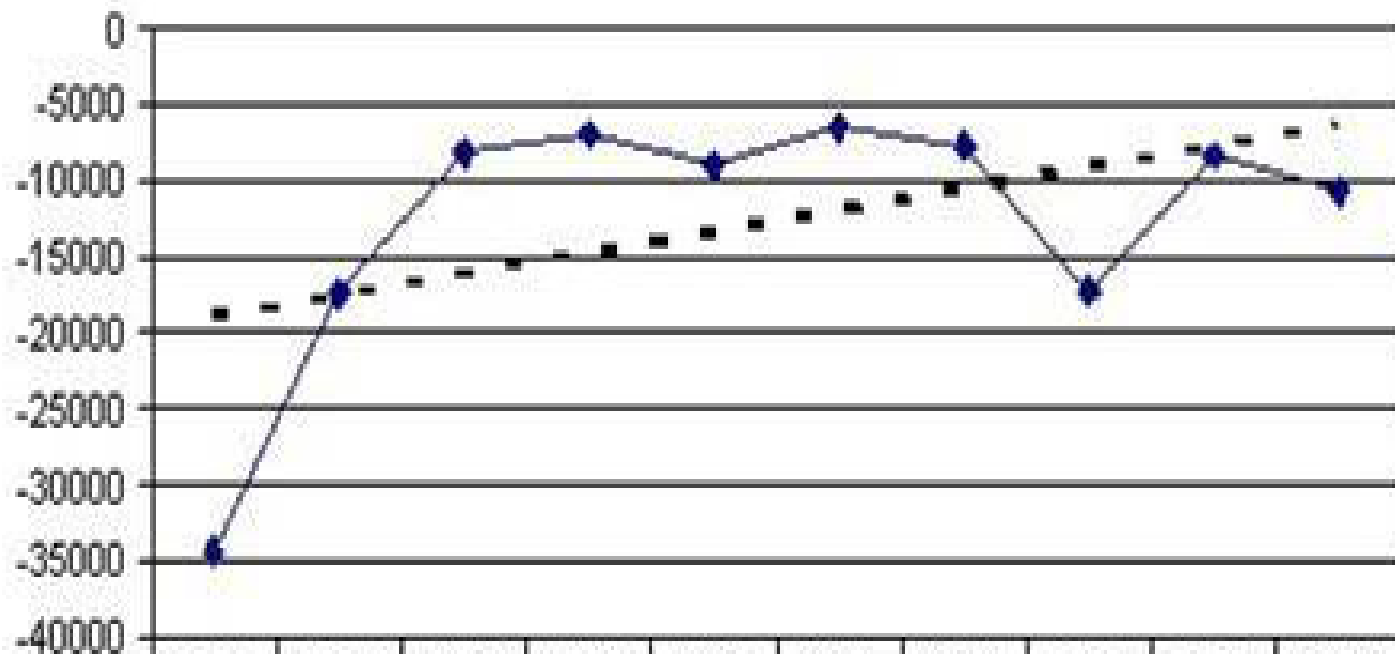
Analytical survey

- ❖ **assessment of the environment**
- ❖ **assessment of present water conditions**
- ❖ **identification of destabilizing factors**
- ❖ **assessment of existing material, financial and other resources**
- ❖ **evaluation of available water development**
- ❖ **assessment of institutional and legal aspects**
- ❖ **identification of the key challenges of future development**

Growth of population, %

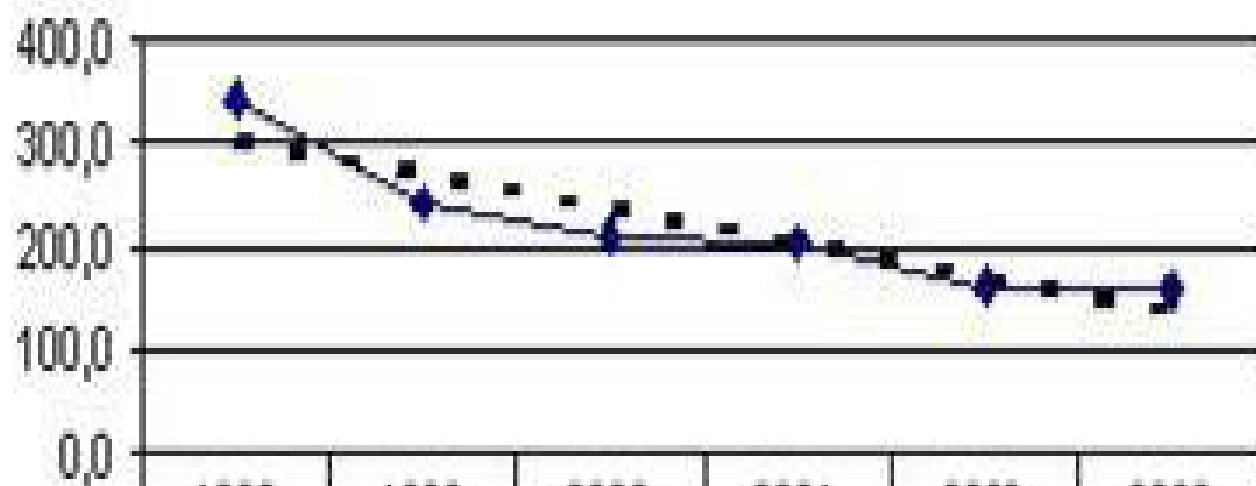


Saldo of migration population persons



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
◆ Balance of migration	-34414	-17478	-8245	-7061	-9116	-6564	-7801	-17344	-8376	-10744

Dynamic of investment on all sources on Tashkent province, mln. \$



	1998	1999	2000	2001	2002	2003
◆ Investments, mln USD	340,4	240,6	209,9	202,7	160,5	157,8

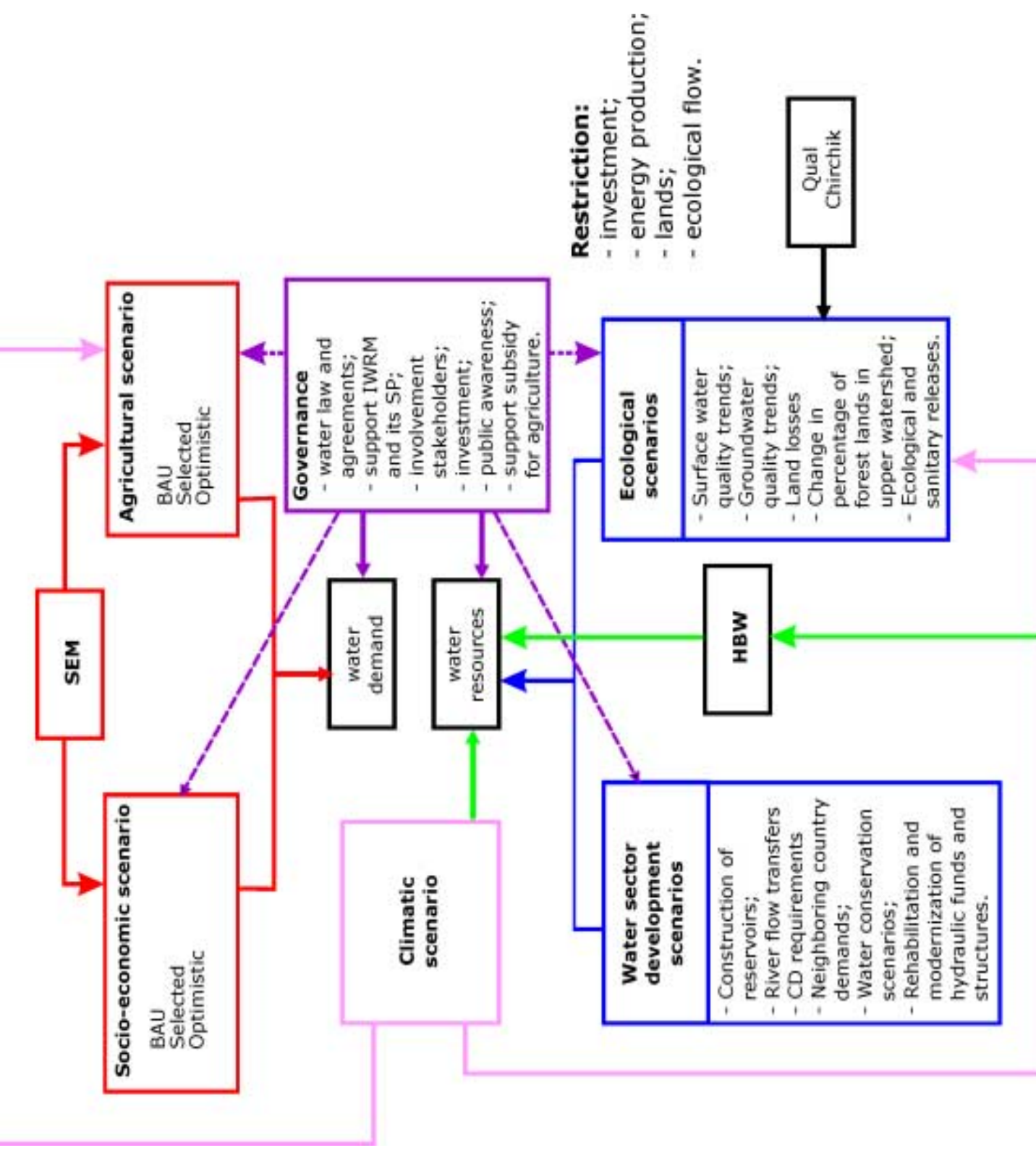
Present environmental losses:

Toxicological risk – 3.3 mln USD:

Fish productivity – 1.05 mln USD;

Human health – 10.0 mln USD;

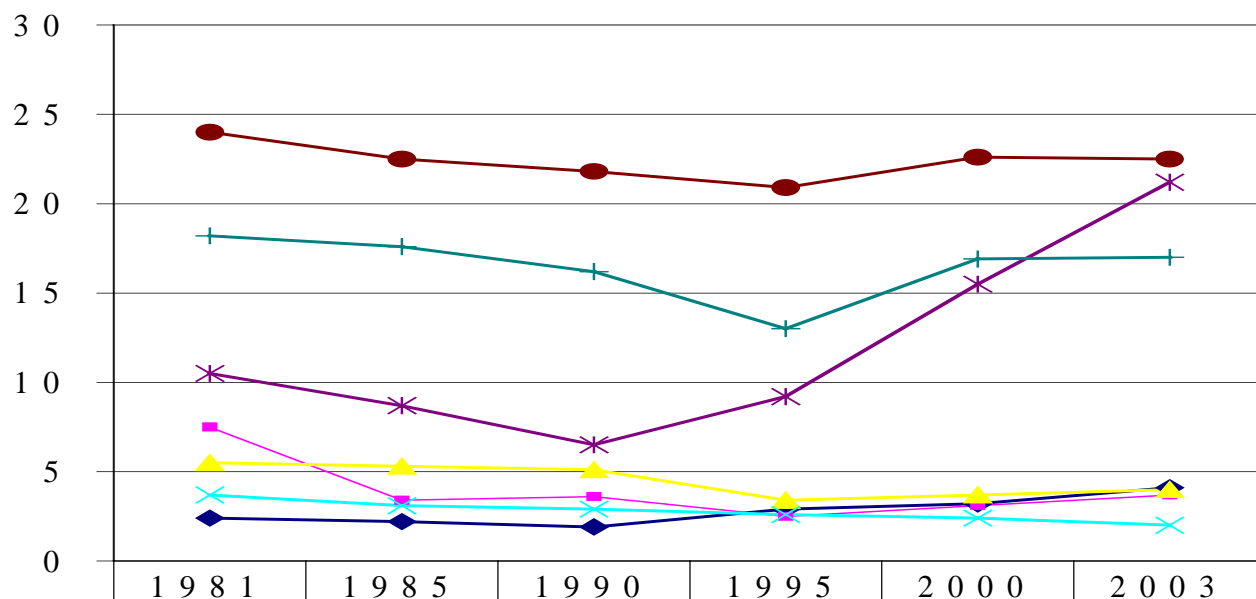
Agricultural – 12.5 mln USD.



Future socio-economic development is determined by a few key lines that are characterized by the following indicators:

- ❖ **demographic indicators (growth, morbidity, migration, employment);**
- ❖ **gross national income and its growth rates;**
- ❖ **change in industrial production volume;(?)**
- ❖ **change of energy demands and requirement;**
- ❖ **change in volume of service sector output;**
- ❖ **capital investments, including local, loans, foreign;(?)**
- ❖ **capacities to meet national food demand.**

Dynamics of main crop yields in Tashkent province, t/ha



◆ cereals	2,4	2,2	1,9	2,9	3,2	4,1
■ corn	7,5	3,4	3,6	2,5	3,1	3,7
▲ rice	5,5	5,3	5,1	3,4	3,7	4
✕ raw cotton	3,7	3,1	2,9	2,6	2,4	2
✱ potato	10,5	8,7	6,5	9,2	15,5	21,2
● vegetables	24	22,5	21,8	20,9	22,6	22,5
+ cucurbits	18,2	17,6	16,2	13	16,9	17

Specific driving forces for countries in transition (1)

❖ **Socio-economic scenario**

❖ **Demography:**

- ✓ **Transnational migration of population;**
- ✓ **Internal migration – urban - rural;**
- ✓ **Internal zonal migration;**
- ✓ **Resettlement of qualified staff.**

✓ **Macroeconomics:**

- ✓ **State priorities;**
- ✓ **Industrial decline and available non-used capacities;**
- ✓ **Transport availability;**
- ✓ **Investment possibilities;**

- ✓ **Foreign investments;**
- ✓ **Investment climate;**
- ✓ **Internal market and internal prices.**

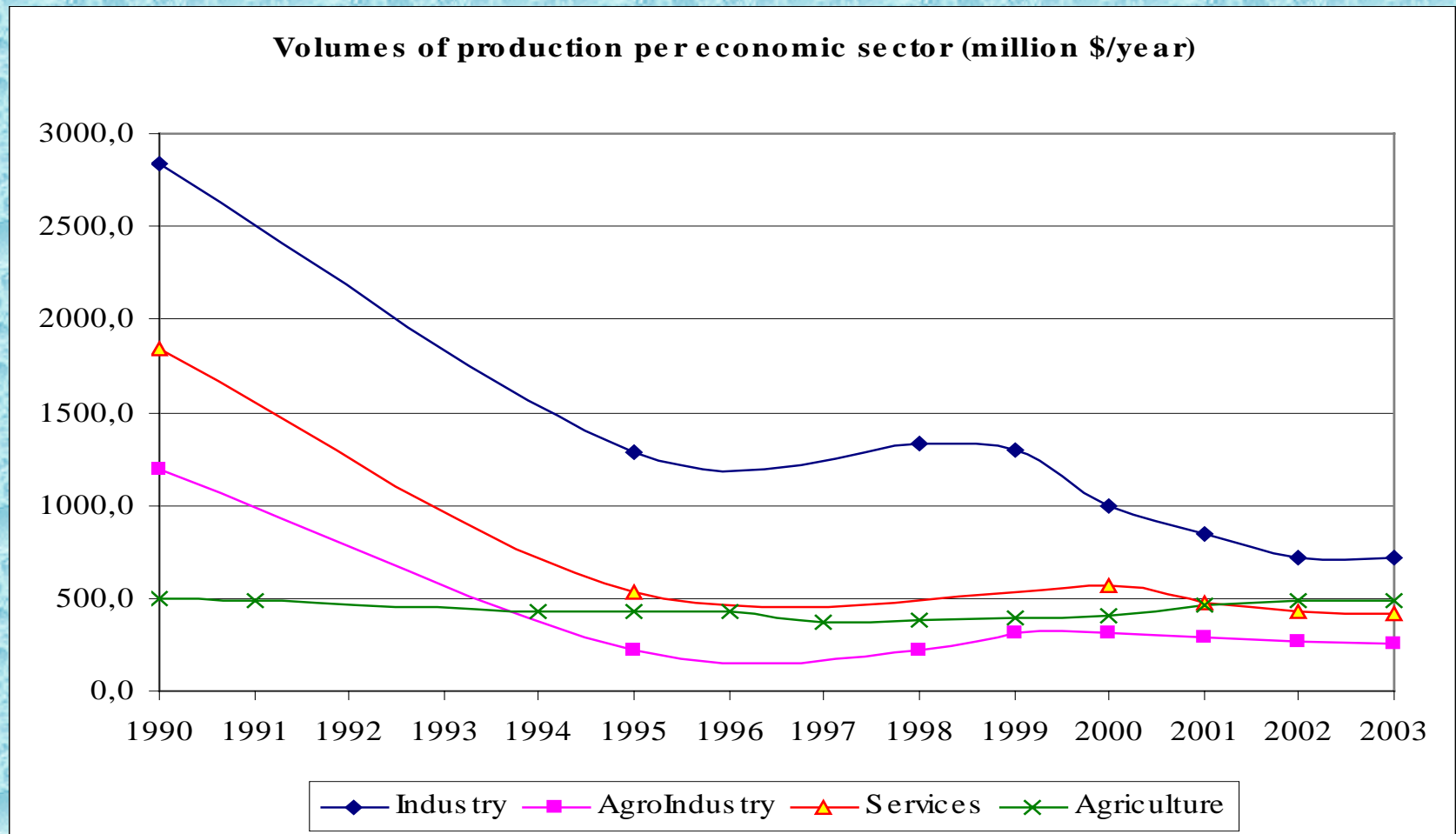
c) agricultural development

- ✓ **Public policy on restructurization and planning;**
- ✓ **Agricultural support;**
- ✓ **Water and irrigation priorities;**
- ✓ **Possibility and wish to reclaim and develop irrigated lands;**
- ✓ **Family support;**
- ✓ **Service and market infrastructure establishment;**
- ✓ **Extension service;**
- ✓ **Price and tax system;**
- ✓ **Link with the world food market;**
- ✓ **Ratio between market and purchasing prices.**

Relationship between yield of land in cooperative and private farms, tn/ha on 2003

Crop	Cooperative farms	Private farms	Ratio
Corn	3.84	4.6	1.19
Vegetable	22.48	30.3	1.34
Grape	2.38	4.9	2.05
Fruits	3.21	5.7	1.77
Potato	21.10	29.9	1.41

Dynamics of production volumes per sector for 1990-2003.



Sequence of combination of Scenarios

- ❖ Water resource (regime, quantity) are created by combination of four options – two climatic and two water farming

Climatic Scenarios	Water development scenarios	
	W_0	Wopt
1	C 1 W_0	C 1 Wopt
2	C 2 W_0	C 2 Wopt

❖ Water demand is defined on the basis of building boundary curves for social-economic and agricultural scenarios (BAU and optimistic) by the comparison of needed and required investments. Combination balance between Water resources and water demands will permit to check requirement of environmental scenarios.

Business as usual scenario

- **Population growth trend is at the same level (for both rural and urban population)**
- **Economic growth at current level (2003-2005)**
- **Economic structure without changes**
- **Industry and services without changes**
- **Capital investment amount at the same level**
- **Extension of private farming, gradual transition to free market economy.**
- **As to irrigated agriculture, no changes in:**
 - ❖ **institutional aspects of water management and actual water delivery regime;**
 - ❖ **costs for rehabilitation and maintenance of inter- and on-farm irrigation and drainage systems.**
 - ❖ **machinery maintenance costs.**

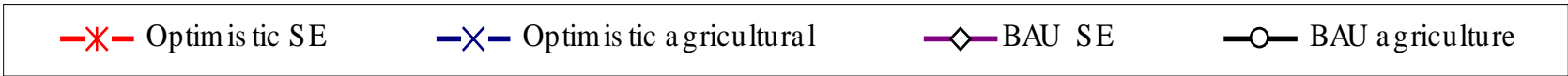
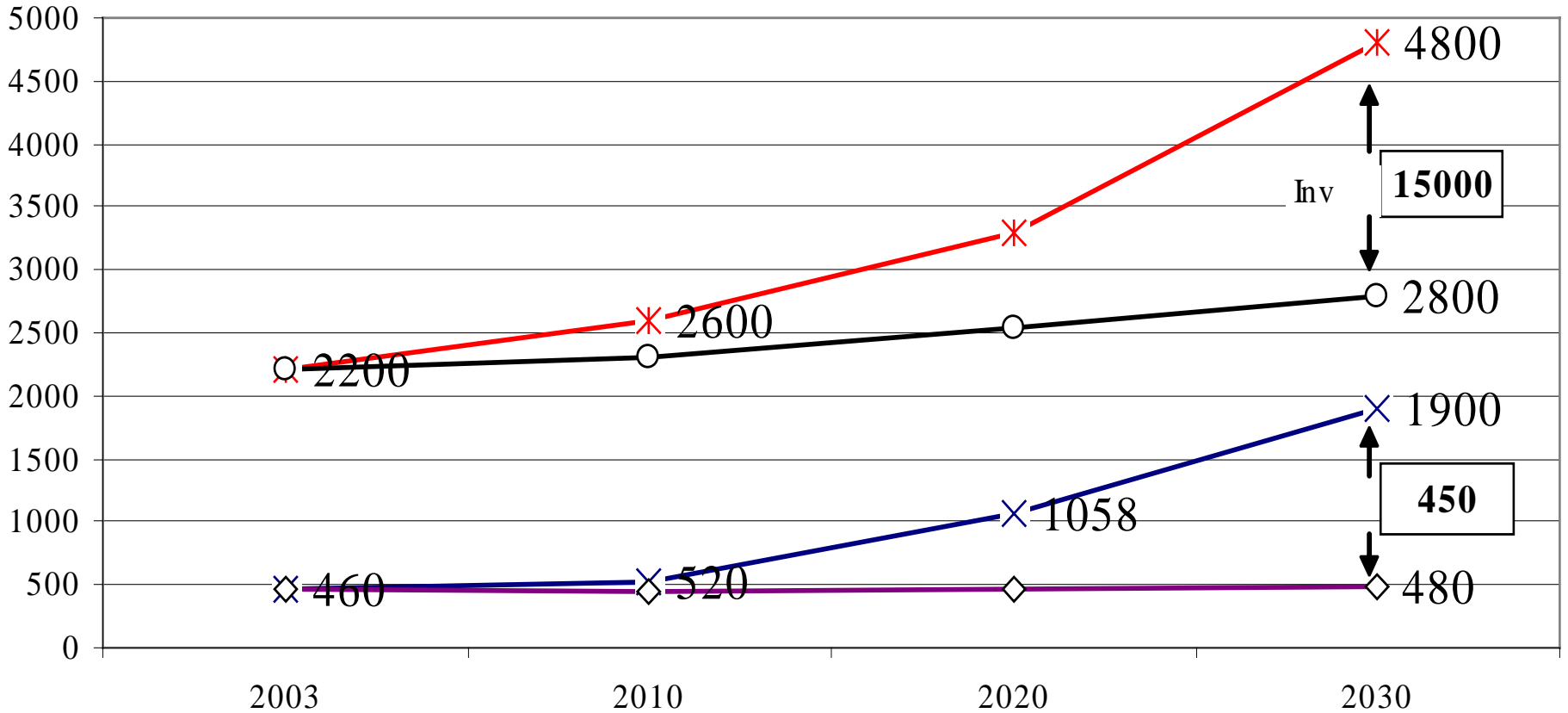
Optimistic scenario

Stable population

- **Moderate, sustainable economic growth.**
- **Gradual sustainable industrial development, full use of potential.**
- **Increased role of private small and medium scale business.**
- **In irrigated agriculture:**
 - ❖ **speeded up privatization of farms, with appropriate raise in farmers' income;**
 - ❖ **institutional changes, implementation of IWRM;**

Social economic and agriculture scenarius

F Volume of production
mIn.USD



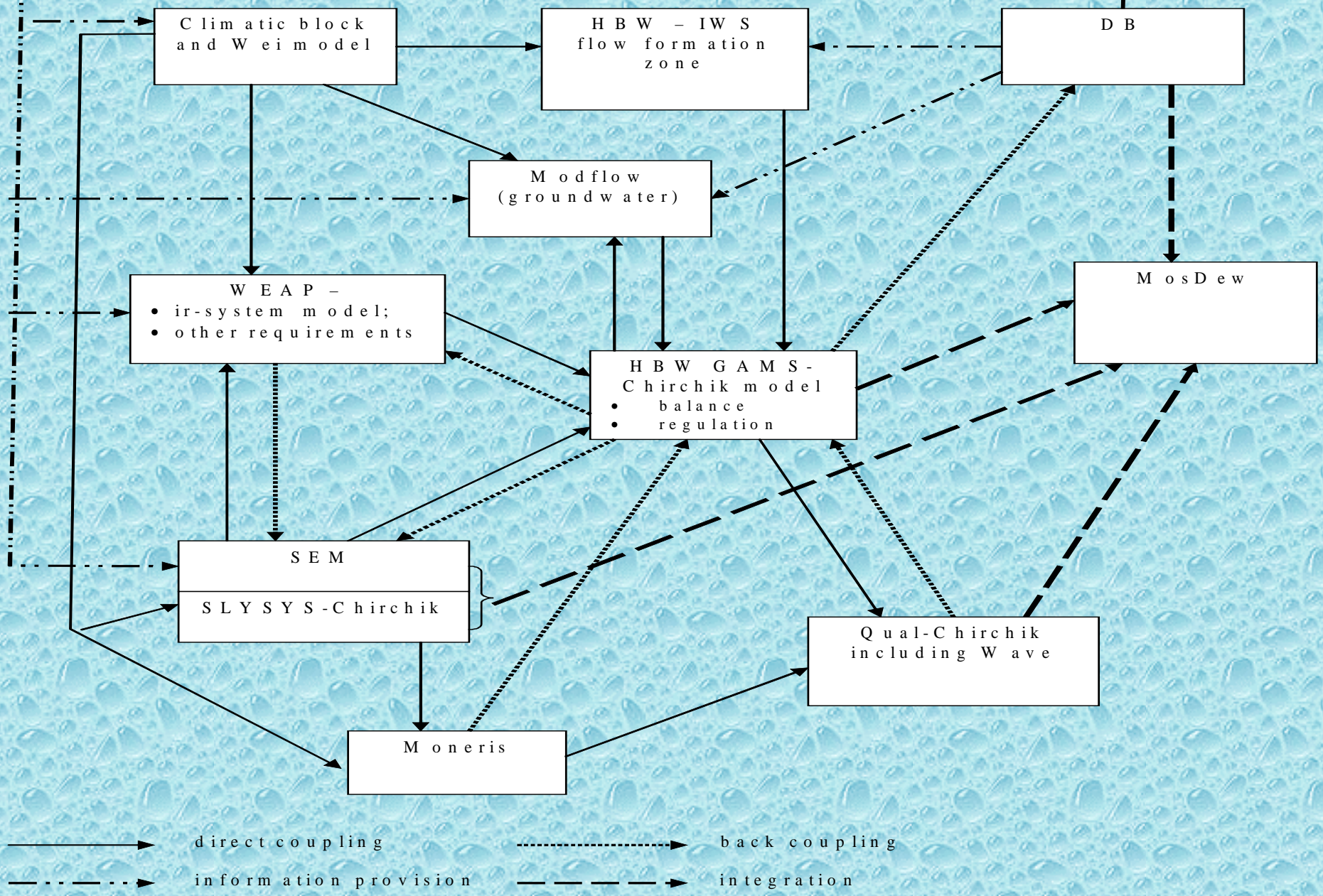


Diagram of relations between models

How to find needed scenario ?

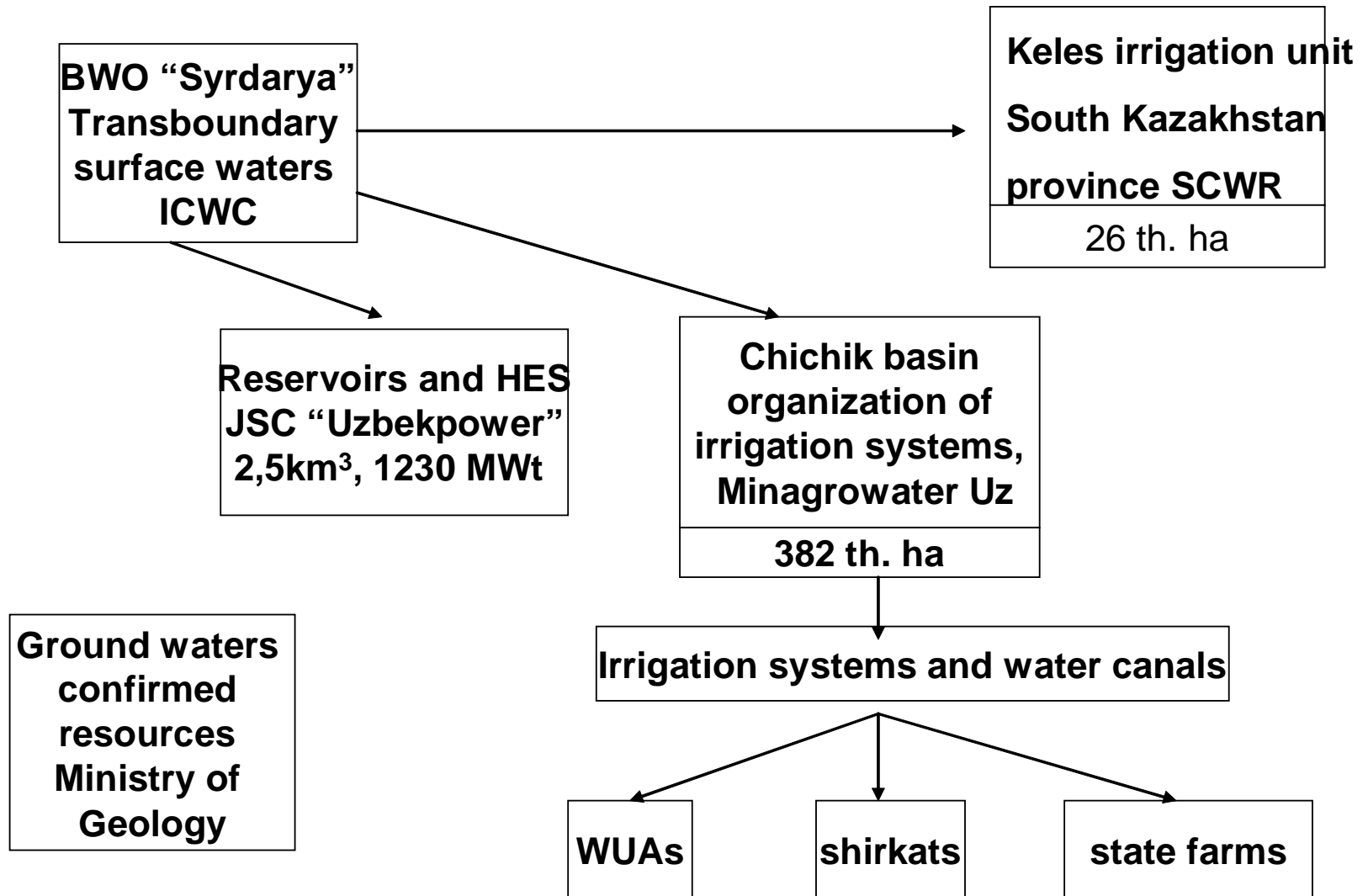
Sequence of options .

- Restructuring of farms
- Increasing input of fertilizers
- Change of crop patterns
- Approach to credit line
- Reallocation of state investments
- Rehabilitation of irrigation system
- Modernization of irrigation technique
- Creation of market infrastructure
- And others

COMPARISON OF INDICATORS FOR SELECTION OF SCENARIOS

- **Balance of water: resources and demands**
- **Balance of investments in sectors and total**
- **Satisfaction of ecological requirement**
- **Growth of GDP per capita**
- **Growth of employment**
- **Balance of energy: resources and demands**
- **Satisfaction of food basket**

Managing system of water resources



Transfer to hydro environmental management (proposal)

