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**WATER RESOURCES DEVELOPMENT IN THE REPUBLIC OF
MACEDONIA AS IT MOVES TOWARDS FULL
EUROPEAN UNION MEMBERSHIP**

ABSTRACT

Regarding the identification and development of water resources, it is necessary to analyse the scope and the evolution of water resources planning, aspects of water resources management, governmental involvement in water resources planning, regional and sectoral planning, capacity self-assessment within the thematic area of land degradation and desertification and models and databases in water resources planning. There is particular interest in planning for the modernisation of the agricultural and good sectors in relation to water resources and in developing plans for all Macedonian valleys. This paper presents issues related to structures within the frames of the development plan, agriculture, basic characteristics of the water economy and irrigation possibilities. It also highlights the technical basis of water economy structures according to the Vardar Valley programme, protection against floods and erosion, environmental protection and improvement, water protection and best management practices.

Keywords: water resources, agriculture modernisation, food, water economy, Vardar Valley Programme, environmental awareness, waste management, EU

INTRODUCTION

It is necessary to design and create a modern, stable and dynamic agricultural sector, integration of the Macedonian agriculture into the global development processes, development of the rural areas and establishment of favourable economic conditions for the Macedonian farmers, improve the marketing of the agricultural commodities, development of the regional cooperation, and implementation of the action plan for execution of the Agreement for Stabilization and Association with the European Union (Langford et al., 2002). Significant improvement is achieved by carrying out the activities for reform and harmonization of the legislative to the one of the EU, as follows: denationalization of land previously, nationalized from original owners, privatization of companies and transformation of agricultural cooperatives are in their phases, newly passed regulations now regulate usage of goods/assets of public interest, such as water, forests, pastures, agricultural land, fish farms and

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wildlife, veterinary and plant protection regulations are getting approximated with those of the EU. Institutional and financial support has been obtained for the process of liberalization of the agricultural commodities market goes on, in accordance to the Agreement for Stabilization and Association with the WTO, free trade agreements have been signed with several countries in the region, the system for preferred crediting has been abandoned, and all subsidies, as well as stimulations that have been in place since 1996 have been terminated, after the subsidies have been abandoned, financial support of Agriculture in recent years is much higher reaching more than 100 mil euro in 2011 (6 233 500 000, according the web site of Agency for Financial Support of the Agriculture and the Rural Development, 2011). Fund for Agriculture was closed by law and do not exist anymore. New structures were developed as Agency for Financial Support of the Agriculture and the Rural Development. There is not fund for water resources for the water management.

GENERAL DATA

The Republic of Macedonia is situated in Southern Europe, in central part of the Balkan Peninsula. Total surface area of the country is 25,713 km², but although small in size it is very diverse. Participation of plains in the total surface area is about 19 %, the figure reddish and mountain terrains is 79%, while water surfaces are about 1.9%. The agriculture areas cover 25% of the total territory of the country. The territory is characterized by different types of climate: continental, changeable continental, sub Mediterranean, mountainous climate, as well as their various subtypes. Due to the specific conditions, a high level of biodiversity richness characterizes Macedonia. Eight out of nine biomes known on the Balkan Peninsula can be recognized. The agriculture has a very important role in the total economy of the country. The total arable land in Republic of Macedonia is 509 000 ha. The limiting factor of the crop production in the major agricultural regions is water shortage. The vulnerability of agriculture could be very high because of the climate change. The priority is to renew the existing irrigation systems and to expand irrigated area, implementing new modern irrigation techniques to cover more agricultural land. Forests cover more than one third of the total territory of Macedonia. The forestry reserves are not on a satisfactory level and lag considerably behind other countries, especially those of Central and Northern Europe. The high quantity of short trunked offspring trees many of which are highly degraded, together with the small quantity of conifers, results in relatively low timber reserves, low timber mass, and low annual growth per unit of land. Forests in private ownership are scattered on small plots and are low productive in terms timber mass. These forests are largely defoliated and degraded. It is necessary to undertake actions to control the health condition of the forests, to afforest the bare place areas and to prevent from forest fires. About 76% of the territory indicates signs of aridity or semi-aridity. With the global climate changes it is real to expect that this percentage will increase. This leads to desertification, decreasing of their forestation, loss of bio-diversity, and

increasing of the erosive processes. According to the data from the map of erosion, about 38% of whole territory affected by middle and intensive erosion processes. Erosion is mostly treated in the water economy. In Macedonia 1539 water flow have been registred. From time to time, they cause huge damages with their destructive power by precipitating drifts and degradation of the urban and agricultural land. There is no legislature that completely treats with land use management and there are different pieces of acts related to use and management of agriculture land, forests, water, etc. Also, there is no single institution with strict responsibilities in the area of land management and degradation.

Tremendous successes have been obtained in Macedonia, but in many areas water irrigation systems function below what could be expected. Having in mind the required increase in food production in the future with the need for sustainable agricultural development a wide range of issues is of major importance. One of them is the influence of the agriculture on water management in the conditions of agricultural pollution.

The development after 1990 has been characterised by the process of transformation of agriculture, privatisation and restitution of the property. The most important sources of pollution are high capacity pig farms with the sludge production, pollution by accident such as wash out of organic fertilizers (San Luis Valley Water Quality Demonstration Project, 1994).

Groundwater is generally a renewable resource, however, the natural supply of groundwater is limited as to time and space. One of the most important issues in water resources research is the management of groundwater systems in order to avoid or minimize bed effects on the environment and to maximize economic benefits (Vukelic et al.,1994).

The accurate planning of water resources systems is a complex interdisciplinary problem which involves complicated environmental, ecological and economical aspects.

STRUCTURES WITHIN THE FRAMES OF THE VARDAR RIVER VALLEY PROGRAMME

Development plan

In its development plans, Republic of Macedonia has always shown a particular interest in the Vardar river valley area (Vukelic et al.,1998) The changed conditions in its economy and the possibilities offered by the new Law on investment of capital of joint ownership, the democratisation of the society and the introduction of the market economy have created conditions for a new approach to future strategic interest in this programme since the Vardar valley coincides with the European development corridors.

Energy. From energetic aspects, the construction of the hydro-electric power plants along the Vardar river valley within the period 2000-2015 represents a basis for long-term development of the electric power system of the Republic. The studies and projects that have been carried out so far point to the

need of using the hydro-potential of the Vardar river and its tributaries. To that effect, 12 hydro-electric power plants are planned to be constructed along the Vardar river course, from Skopje to the border on Greece, 200 km length. Two hydro-electric power plants are envisaged to be constructed on each of the tributaries-Treska and Crna Reka, or a total of 16 hydro-electric power plants with a total installed power of aggregates of about 1000 MW and annual production of 2.2×10^9 kWh.

Country water potential. The total water potential of Republic of Macedonia in an average year amount to 7.8 millions m^3 , out of which 5.6 millions m^3 from the Vardar river valley, the Crn Drim river with 2.2×10^9 m^3 . The total arable land in Republic of Macedonia is 509 000 ha (Statistical Yearbook, 2011). So far, irrigation systems have been constructed for 126617 ha, out of which 99918 ha in the Vardar catchment area, 18432 ha in Strumica catchment area and 8267 ha in Crn Drim catchment area (Expert Report on Water Resources Management, 2010). The construction of multi-purpose hydro-systems in Vardar area shall enable irrigation, water supply for the population and the industry, electric power production, fishing, tourism, protection against floods and pollution, as well as amelioration of small waters.

Environment. The protection and improvement of human environment issues are covered by protection of water and land, seismic hazard and protection of cultural monuments (12 th Annual Report of the Council on Environmental Quality, 1981). The Vardar river is the main recipient of the basin area, covering 80% of the territory of Republic of Macedonia. Therefore, from ecological aspects, the main emphasis is put on protection of the waters of the Vardar river and its tributaries. Protection is planned to be realized by construction of 135 stations for treatment of industrial waters and 9 complexes for treatment of waste waters from urban settlements.

Water Economy and Agriculture

The initial waters of the Vardar river are used directly for irrigation of about 8000 ha, about 30 ha for carp fish ponds and $5.5 \text{ m}^3/\text{s}$ for industry and for the Negotino steam power plant. The use of Vardar river waters is of particular significance for development of the economy. Considering the non-uniform distribution of precipitations and the annual flow, the regulation of the Vardar River water regime, its rational multi-purpose use, is an important factor for further development of the economy in the Vardar valley. The income from irrigated crops, compared to the non-irrigated in the same area increases for as much as (2-5.33) times, while some crops like rice and vegetables, can not be produced at all without irrigation.

Basic Characteristics of the Water Economy

The hydro-amelioration systems (HMS) in Macedonia, depending on the way of using waters for irrigation (running waters, reservoirs, lakes and groundwater) represents a technical, technological and economic entity.

The existing potential of HMS covers 173000 ha, and it consists of: 16 irrigation systems encompassing 133000 ha by catching $731.5 \times 10^6 \text{ m}^3$ of water from reservoirs, 42 irrigation systems covering about 20000 ha, pumping water from natural water courses, reservoirs and lakes, and 48 irrigation systems covering about 20000 ha, in which water is taken from natural water courses, by gravitation. During an average dry year, it is possible to provide irrigation from the existing hydro-amelioration systems of as much as 6 % of the irrigation areas (Vukelic, 1997). The water supplying system, depending on the way of water catchment and the available specific yield of the existing capacities, mostly, do not provide the demands of the population and the industry.

Technical Basis of Water Economy Structures According to the Vardar Programme

By the Vardar Valley programme it is foreseen utilization of the water potential of the Vardar river and its tributaries, the Treska, Pcinja and Crna rivers. For hydro-amelioration system are planned to be constructed along the Vardar river water course from Skopje to the Greek border, covering 54282 ha of arable land and water supply systems (Skopsko pole-19600, Lisice-3780, Pepeliste-1506, Dosnica-8000, Gevgelisko pole-8030, and Kumanovsko pole-11000 ha). Here are also other smaller HMS: Skopsko pole-1993 (small reservoir), and Kumanovsko pole (small systems)-2656 ha.

Water supply of population and industry in the Vardar valley is a problem, requiring manyfaceted investigations in future for the consumption centres of Skopje, Kumanovo, Veles, Negotino, Gevgelija and many villages settlements. Considering the limited possibilities of the natural sources and the underground waters, the water supply of population and industry in future can be resolved by water catchment from groundwater and reservoirs. By the future development of water supply, it is planned to satisfy the needs of population and industry: Skopje-source of Rasce, Kozjak and Matka reservoirs on the Treska river and Paligrad on the Kadina reka, as well as groundwater, Kumanovo-Slupcanska reservoir and groundwater, Veles-Lisice reservoir on the Topolka river, Babuna and Basino on the Vardar river, Negotino-Dopsnica reservoir on the Dosnica river, Gevgelija-Konjsko reservoir on the Konjska river, and Valandovo-groundwater and natural wells.

Protection Against Flood and Erosion

The Vardar Valley is frequently susceptible to floods caused by waters of the Vardar river and its tributaries. The last floods of 1962 and 1979 year caused large damages to the economy, populated places, agricultural land, roads and alike. The damages were particularly high in the Skopje region, which was the reason for undertaken certain measures for protection against floods, however complete protection of Skopje and its surrounding against floods is provide by the construction of the Kozjak reservoir.

In future, it is necessary to increase the percentage of protection against floods, which will be provided by construction of protection embankments and by regulation of the water regime of the Vardar river by construction of reservoirs in the Vardar valley. The regulation of large waters and flood protection is also of interest for the Republic of Greece since part of the areas of the Vardar river basin in the territory of Greece are also susceptible. In addition of flood protection, in future, it is also necessary to undertake measures for preventing land erosion, such as special ways of land cultivation, afforesting of erosion-prone land, regulation of torrents, etc.

ENVIRONMENTAL PROTECTION AND IMPROVEMENT

Water Protection

The Cadastre of Pollutants of Vardar River was elaborated in two phases: in the first phase, a poll was conducted through all the inhabited places and industrial facilities which are a constituent part of the urban areas along the Vardar river course, and in the second phase, based on the conducted poll, a selection of industrial capacities classified as pollutants and potential pollutants was made and complete technical documentation on the state of their waste waters was prepared. According to the knowledge acquired during the visit to the populated area and industrial capacities presented in the Cadastre of Pollutants of Vardar River it may be concluded that the state regarding the waste waters related in this recipient is critical to the extent of a catastrophe due to the following: central waste waters filtering stations do not exist in any of mentioned populated areas, the industrial capacities release their unfiltered waste waters partially in the urban sewerage systems and partially directly into the recipient, there are systems for filtering of waste waters at the level pre-treatment or complete treatment in a small number of industrial capacities (however, these systems are pretty old and non-efficient and some of them are even non-usable so that the waste waters are mainly released through the existing by-passes), in the inhabited places and industrial capacities there is a partially constructed sewerage infrastructure mainly of a mixed type through which the complete amount of fecal. Technological and atmospheric waters are released directly into the river, and the depositing of the communal and industrial waste materials in the towns is inappropriate and not well organized (it is performed in places which do not satisfy the health department regulations so that they add to the pollution of the total environment, especially air, soil and ground water), (Dimitrijevic et al., 2000).

After the accomplishment of the Cadastre of Pollutants of the Vardar River, there exist possibilities for realization of the second phase of the Programme of Measures and Activities for Protection of the Waters of Vardar River and its tributaries Against Pollution which involves elaboration of conceptual solutions for filtering of the total amount of waste waters from the inhabited places (Racz et al., 1996). For purpose of obtaining of the most

favourable economic-technical solutions, it is necessary to elaborate several variant solutions of central filtering stations with an emphasis on measures to be taken for industrial waters.

WATER MANAGEMENT FOR AGRICULTURE

There is a wish to state an opinion regarding the midterm development, with a partial quantification of expected production amounts, and a comprehensive representation of the strategic determinations and intentions that need to be followed during the upcoming midterm period (5-6) years, with a purpose of provoking dilemmas, incentives for discussions and opportunistic opinion.

1. Natural Environmental Conditions-relief and geographic location, climate, hydrographical condition, soil features, vegetation.
2. Agriculture Zones
3. Basic Capacities of the Agriculture Complex- agricultural surface.
4. Livestock capacity- number of cow heifers, the number of heifers and milk sheep. Total number of pigs and number of pigs heifers.
5. Hydro-systems and Machinery
6. Processing Capacities
7. Brief Review of Production Results
8. Most Important Strategies for Future Development

The natural conditions for agriculture production in Macedonia are favourable, and they are very suitable for production of certain specific cultures, but at the same time, the natural conditions act as limitation factors for production of other important cultures, like the cereals, sugar beet, sunflower etc. Expectations and projections are relatively moderate, because the production structure is not possible to be modified within a short period of time in this sector of the economy.

Dependent on the local conditions different types of water management with different levels of service will be appropriate (Schultz, 1993). In the arid and semi arid zone agriculture is normally impossible without an irrigation system. Drainage systems may be applied as well for salinity control and the prevention of water logging (Morris, 1979).

NEW APPROACH TO THE RURAL POLITICS

In this chapter there are the followings parts: current situation, consequences of the conditions, new approach to the rural development. The main goal should be the joint effort in encouraging the following processes:

- democratization and participating in government decision making,
- decentralization of the development rural policy and implementation, i.e. modelling the regional characteristics of the rural environments,
- promotion of cooperation (cooperatives, associations, foundations) on instead of individualism,

- mobilization of the potential and human recourses,
- promotion of economic, social and cultural quality of life among the rural population, and
- development of entrepreneurial processes of a wider range in the households, from national craftsman to cooperation with the modern industry.

CONCLUSIONS

Full membership status of the European Union (EU) is a goal of the Republic of Macedonia. This desire for incorporation within the EU is derived from the country's political, economic and cultural cooperation with the EU, as well as from Macedonia's cultural and civilisation links with the entire European region. The road to full membership began with the Agreement for Cooperation between the Republic of Macedonia and the EU that came into force on January 1, 1998. By signing the Agreement for Association and Stabilisation with the EU on April 9, 2001, in Luxemburg, the Republic of Macedonia defined its own types of economic and social structures, which it will work towards. The Republic of Macedonia aims to fulfil the criteria for the development of a market economy by making adjustments to the administration to create a stable economic and monetary environment. The White Book issued by the European Commission in 1995 set the legislative regulations, which candidate countries must apply and implement in accordance with the so-called *aquis communautaire*. In addition, the White Book identifies the elements considered essential to the implementation of a unified market, which, because of that, are a priority. The Agreement for Association and Stabilisation between the Republic of Macedonia and the EU aims at securing a framework for political dialogue, promoting the extension of trade and economic relations between the parties, providing a basis for technical and financial assistance from the EU and providing a framework for support to subsequent integration, as well as innovation specific to this Agreement, to nurture regional cooperation in all fields. By obtaining full membership, the Republic of Macedonia will gain:

1. A stable political and economic environment, which will facilitate community development as a whole

2. Greater national security through involvement in the common mechanisms of foreign and security policy

3. The opportunity for participation in the decision-making process for all future issues, something that is of critical importance for the Republic of Macedonia

4. Access to a large market for the Macedonian economy

5. Expansion of trade and stimulation of economic development and employment

6. New development opportunities that arise from economic and monetary union

7. Increased competition on the domestic market; this will motivate and stimulate Macedonian companies to improve their competitiveness through

development of new products and services, utilisation of modern technologies and continual reductions in production costs

8. Greater access to the capital, equipment, know-how, technologies, and policies of the EU compared with our agricultural policy, as well as the trace for joining the Common Agricultural Policy (CAP) of the EU

The mid-term development opportunities of the agricultural sector are presented in the report as material to be further developed by different authors within the framework of the project Strategy of the Macedonian Agriculture through year 2005. It is obvious that the development strategy has to rely on its own strengths, mobilising its resources and exploiting its natural resources and economic conditions. Agriculture has to be a part of the open national market economy, where domestic and foreign capital with modern technology will compete in fair conditions, as well as the domestic and foreign products of all agriculture-related products. The analysis of our rural problems increasingly points to the need to pay more attention to problems in the countryside that affect individual farmers and their families. In that context, it should be expected that our agricultural policy will come closer to that of the EU and that, subsequently, agriculture and farmers will be more invigorated and the countryside will be better taken care of.

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**RAZVOJ VODNIH RESURSA U MAKEDONIJI NA PUTU PREMA
PUNOM ČLANSTVU U EVROPSKOJ UNIJI**

Što se tiče identifikacije i razvoja vodnih resursa analiziran je obim i evolucija vodoprivrednog planiranja, aspekti upravljanja vodnim resursima, vladine aktivnosti kod planiranja upravljanja vodnim resursima, regionalno i sektorsko planiranje, kapaciteti u okviru tematske oblasti degradacije zemljišta i dezertifikacije, kao i modeli i baze podataka u planiranju vodnim resursima. Postoji posebno interesovanje kod planiranja modernizacije poljoprivredne proizvodnje u odnosu na vodne resurse i razvojne planove za dvije makedonske doline, odnosno sliva. U radu su prikazana pitanja koja se odnose na radove unutar okvira razvojnog plana, poljoprivrede, osnovne karakteristike vode za navodnjavanje ekonomije i mogućnostima navodnjavanja. Naglašava se tehnička osnova vodoprivrednih struktura prema programu Vardarska dolina kod zaštite od poplava i erozije, zaštite i unapređenje okoliša, vode i najboljih praksi upravljanja.

Ključne riječi: Vodni resursi, poljoprivredna modernizacija, hrana, vodoprivreda, Vardarska dolina, ekološka svijest, upravljanje otpadom, Evropska unija