

## **Economic benefits of the infrastructure projects implemented in the Reservation of the Danube Delta Biosphere**

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**Abstract.** *The objective of the research is the identification of the benefits related to infrastructure projects implemented in the Danube Delta Reservation Biosphere. The type of the research refers to a study that aims at the identification of economic benefits related to the systems for potable water supply and sewage/disposal of waste water. The result of the research shows the reduction of expenses with medical assistance and treatments for diseases affecting the digestive apparatus, hepatitis, TBC and also for skin diseases, whose occurrence is favored by the lack of proper hygiene conditions. Also, a series of social benefits will be recorded, such as the development of tourism, reduction of unemployment, facilitation of intervention in case of fire.*

**Keywords:** economic benefits, social benefits, infrastructure projects, Danube Delta Reservation Biosphere.

**JEL Classification:** Q56.

**REL Classification:** 15C.

## 1. Considerations regarding the Danube Delta Reservation Biosphere – RBDD

Form the geographical viewpoint, the Danube Delta Biosphere Reservation is bordered by the following coordinates: 28°10'50" (*Cotul Pisicii*) and 29°42'45" (*Sulina*) East longitude; 45°27' (*Chilia* Arm, km. 43) and 44°20'40" (*Midia* Cape) North latitude.

The reservation is placed in South-Eastern Romania, including the Danube Delta, the Razim-Sinoie Lake Complex, maritime Danube until Cat's bend (*Cotul Pisicii*), and also the floodable area of *Somova-Parcheș*, the *Sărături-Murighiol* lake and the marine area between the Black Sea shore and the 20 m. isobaths.

As the Danube Delta Biosphere Reservation is delimited, of its total surface, more than half (312.440 ha) is represented by the natural aquatic and terrestrial ecosystems included in the list of areas with universal patrimony value (UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage) and also the ones destined for ecological reconstruction, areas that form the public domain of national interest.

The difference until the 580.000 ha of the whole reservation is represented by areas that are dammed for fisheries, agriculture and forestry (some 80.000 ha), areas including terrain surfaces in private property or public property of local interest inside or outside villages (some 29.000 ha, that is 5% of the RBDD surface) and also a marine buffer area measuring some 103.000 hectares.

Inside the perimeter of RBDD are 25 villages, organized in seven communes integrally situated within the reservation: Ceatalchioi, Pardina, Maliuc, Crișan, C.A. Rosetti, Sfântu Gheorghe, Chilia Veche and the town of Sulina. Along with these villages, there are also some communes whose territory, in part, is placed inside the RBDD perimeter: Nufăru, Beștepe, Murighiol, and the Tudor Vladimirescu suburb of the Municipality of Tulcea.

In the last five years, the population of the Danube Delta Biosphere Reservation decreased from 13.694 inhabitants in 2009 to 12.038 people in 2013, due to economic and social considerations. Only in 2013 there can be observed a decrease of the population with approximately 600 inhabitants.

The implementation of the infrastructure projects in the Danube Delta Biosphere Reservation has into view the improvement of negative social, economic, and environmental effects existing in the present.

Keeping the population inside the Danube Delta Biosphere Reservation directly depends on the existence of adequate economic and social conditions. It is true that these conditions are tightly interlinked, and many times, the economic development of an area is strongly correlated with the social side.

We must take into account the fact that the social ecologic systems dominated by human population were always involved in a process of regional, macro-regional or global integration. In the case of the Danube Delta Biosphere Reservation, the social subsystem is influenced by the spatial, even regional isolation, with a non-uniform territorial distribution, which makes it hard to govern.

The socio-economic environment is strongly affected by the regional and local physical infrastructure (electricity, communications, water, drainage etc.), by telecommunications and transportation, which are essential for the production and distribution process, and also for the access of the labor force (employees) to the workplace (Manole et al., 2008). Labor force imposes the existence of decent living conditions.

## **2. Present situation regarding the potable water distribution and sewage for waste water systems**

Inside the Danube Delta Biosphere Reservation, according to the *Report on the Environment Status in RBDD*, there are no fixed sources with determinant role in water pollution. In fact, the major sources of water pollution on the territory of the reservation are represented by economic entities situated in the area bordering the RBDD and by the naval transport activity developed on the navigable ways.

For all potable water supply systems existing in the Danube Delta, there was adopted the solution to collect water from surface sources in order to make it potable. These systems aim at the collection of water, water filtration station, transportation, storage and distribution of potable water. This system was used because in the Danube Delta, the groundwater is characterized by the existence of a layer of water at depths above 2 meters (that is 1.05–1.35 m) on the lower rises and less than 1.67 m on the lower dunes being influenced by the causal reports between the hydrostatic level and the fluctuations of the levels of Danube.

The lack of potable water supply systems is a major risk for the health of the population, because of the quality, sometimes improper, of the water from fountains. There must be emphasized the danger represented by the lack of units that can prepare potable water in most villages, making that, subsequently, a

significant number of inhabitants, some 25%, do not benefit from optimal conditions of potable water supply. Using water for house consumption directly from the Danube is a major risk for the population of the Danube Delta, when considering the quality of the water, which deteriorated greatly from the reference period in 1950-1960.

Decrease of water quality is due, among others, to:

- Industrial waste waters.
- House waste waters.
- Various substances used in agriculture.

And there's the quality of water issue directly depends on the existence of waste waters, and the lack of sewage and purge system is another problem in the Danube Delta Biosphere Reservation.

Most of villages on the territory of the Danube Delta Biosphere Reservation do not have centralized sewage systems that could collect residual water in the whole village. Only the purge station in Băltanii de Jos is in compliance with the current environmental normative. All other existing purge stations were designed to process only the mechanical pre-purge of house waste waters. In fact, of the four villages that have their own sewer systems two have stations for mechanical pre-purge of waste waters: Maliuc and Sulina. The villages of Sf. Gheorghe and Chilia Veche have each one station for pumping house waters, designed to serve only the blocks of flats, and do not have pre-purge systems.

There can be observed that the existing purge stations are insufficient, because the purge of waste waters, both house and industrial, is realized only by a mechanical step. Mechanical purge assumes the use of grids, de-sanders, septic tanks, grease separators and decantation bacteria. The mode of exploitation is improper, because the emptying tanks emplaced on the path of sewage networks are hard to maintain, and in most cases are manually cleaned, due to the lack of eductor-basin cleaners, which are to be found only in Chilia Veche and Sulina.

The further persistence of this situation leads to the deterioration of environment through uncontrolled infiltrations from the existing tanks. The lack of sewage systems for waste waters will not allow a proper future development of the villages in the Danube Delta Biosphere Reservation. In most villages, the comfort of the population and the environmental conditions are not favorable for a community so close the tourism area.

The uncontrollable spill of waste waters has negative influences on vegetation and animals. The increase of water acidity leads to the death of subaquatic fauna. Many species of amphibians depend on water, and the fall of water quality has direct correspondence in mortality increase, or indirectly, determining even the occurrence of some diseases. All these have repercussions on the health of the population living in these areas.

By implementing environmental problems in the Danube Delta Biosphere Reservation, it is aimed the improvement of negative social, economic and environmental effects existing in the present. The environment projects refer to the development of systems for sewers and waste water purge, systems for waste management and also projects aimed at preventing human disasters (Anica-Popa, Manole, 2008).

### **3. Identification of economic and social benefits related to potable water supply and sewage systems**

The main economic and social benefits related to infrastructure projects referring potable water and sewage systems are:

#### **Reduction of social costs related to hospitalization and treatment**

Taking into account the fact that, in the Danube Delta area, there are medical facilities only in the main villages of the communes (human medical facility), stringent problems arise regarding the possibility to promptly answer to the medical necessities of the population. It can be observed the fact that the nearest hospital with treatment facilities for digestive system diseases is located at a distance of at least 25 km (Municipality of Tulcea). The starting value is the cost of treatments for various diseases related to breath, digestion, urinary systems and also skin, which, at the level of the year 2013 reach the approximate level of 144,522 euro/year per 1000 inhabitants (see the calculations presented in the table below). The decrease that can be taken into consideration is 60%, as medical cases cannot be eliminated (also due to the negligence of the population). Under these conditions, it can be considered that the cost economy could reach an amount of approximately 51,559 euro/year per 1000 inhabitants. This value adds with the similar costs for persons who transit the area (they are likely exposed to risk of getting sick, not being adapted to the conditions in the area).

**Table 1.** *Estimation of cost reduction for 1000 inhabitants*

Type of disease	Cases per 1000 inhabitants	Average cost of treatment per case (with/without hospitalization)	Annual value euro
Respiratory	73	180	13,140
Skin (mycoses)	42	180	7,560
Digestive and urinary	98	120	11,760
TBC	3	400	1,200
Chronic hepatitis	9	600	5,400
Frequency of occurrence of diseases per inhabitant		2,2	85,932
<b>Cost reduction - %</b>		<b>60</b>	<b>51,559</b>

The global frequency of diseases for kids below one year is over 580‰, for young people (1 to 14 years) is 3.117‰, and for old people (over 65 years) is approximately 1.132 ‰. It is known that the health status of the human population is determined by a series of factors, some of them were mentioned and have deep demographical implications, influencing both the nativity and mortality statuses. At the level of villages in the Danube Delta Biosphere Reservation, there is a high potential risk for occurrence and expansion of diseases due to lack of hygiene (hepatitis or other contagious diseases of the digestive system). In the analyzed area, there are children of school and pre-school age who present a high degree of disease exposure risk.

The great number of retired people living in the Danube Delta Biosphere Reservation, the disabled people and the persons with serious health issues present a high risk of mortality (considering the average life expectancy at regional level for the period 2009-2011 that is 70.1 years for men and 77.5 years for women (INS, 2013)).

For the entire population of the Danube Delta Biosphere Reservation, which accounts for 12.038 persons, the existence of centralized potable water supply and sewage systems, can lead in a first instance to an economy of costs with hospitalization and treatments of over 30%, which would mean the equivalent of 375.000 euro per year.

### **Development of tourism – development of the local economy**

At the level of the year 2013, in the Danube Delta Biosphere Reservation there are 169 economic agents who were authorized to run tourism activities. They have offered a number of approximately 5000 places, 11 hotels, 104 pensions, 51 housing pontoons, 2 hydro-buses, 1 passenger ship, 4 camping areas, 1 youth camp; the tourism season 2013 had a period of maximum during the months May, June, August and September, in the other months, the number of tourists is reduced. We must take into account the fact that there is also tourism that is not

organized by authorized economic agents; this phenomenon knew in 2013 a slight increase from the previous years, especially in the localities with high tourism potential: Sf. Gheorghe, Sulina, Crișan, Mila 23. In 2013, a total of 58,212 tourists were recorded, of which 21,856 Romanians and 36,356 foreigners. There can be observed a slow development of housing structures and of recreational activities. The existence of minimum hygiene conditions, fresh water and sewers, can contribute to the stronger development of tourism.

Increase of comfort conditions (house water and sewage) can generate a plus of tourists by at least 10%, if taking into account the trend of the previous years. The increase of tourists' number, correlated with the average housing fee for a person and the minimum number of housing days in the Danube Delta Reservation Biosphere area, can generate in the first operation year in which the integrated systems of water supply and sewers operate, some 582 thousand euros.

In compliance with the development of tourism in the villages, the social and economic effects would be the increase of the occupation degree of the labor force (statistical data for the analyzed area show the existence of more than 18.5% unemployed) and the decrease of the weight of social categories with low income.

The development of tourism can increase the degree of labor force occupation implicitly contribute to the reduction of unemployment. The benefits generated by the existence of integrated water and sewage systems results in the decrease of the effort to support persons without jobs by the state and implicitly the assurance of a certain level at a family level. The decrease of the number of unemployed people by eight percentage points can be transposed, in the actual conditions of the unemployment subsidies, in an economy of some 1,040 thousand euro.

Around the reservation, there is a number of urban and rural activities, such as Isaccea, Babadag and the Municipality of Tulcea, which totalize a population of over 150,000 inhabitants. Inside the perimeter of RBDD, there are no urban conglomerates, as a single city exists, Sulina with a number of 4,156 inhabitants. The total number of inhabitants in the Danube Delta Biosphere Reservation at the end of the year 2013 is 12.038.

### **Firefighting**

The execution of the water supply systems has incidence over fire events, because the projects' design on one hand, provides hydrants, and on the other hand, the population gains access to an uninterrupted water source. Facilitation of intervention in case of fire refers to the limitation of the possibility of

death/damage for persons affected by the event, the respective area is characterized by a „HIGH” degree of fire occurrence risk (if considering the existence of dwelling with warehouses and food supplies for animals, of houses made of wood and other easy flammable materials). The fires can be started or ignited because of negligence manifested by fishermen, animal breeders or tourists. The fires also are a factor of menace for the integrity of forestry fund. Many fires were stopped at the limit of the forest due to the fireproof strips created and maintained annually, through plowing and disk-processing, at the Tulcea and Rusca Forestry Offices.

### **Animal breeding**

Also, the realization of the potable water supply systems will allow the development, under better conditions, of the animal breeding activity. Both the quality of the food and the quality of conditions in which livestock is raised have a direct influence on the products realized (milk, meat, eggs etc.) and on the final consumers (the population).

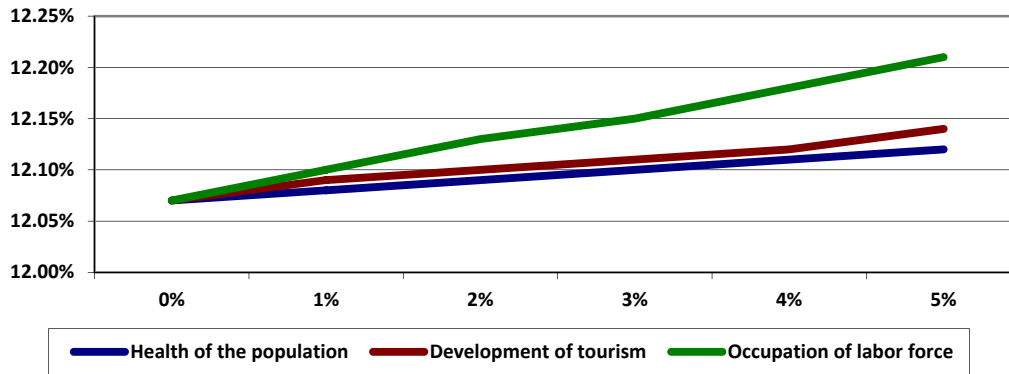
Starting from the previously measured benefits, related to the health of the population, development of tourism and occupation of the labor force, there can be tested the effect of the amplification of those benefits as time passes and the awareness of the population about the advantages of using potable water from safe sources, and also the elimination of uncontrolled release of waste waters.

**Table 2.** *Modification of economic internal profitability ratio at the modification, by 1-5% of the benefits generated by the project*

<b>Indicator</b>	<b>1%</b>	<b>2%</b>	<b>3%</b>	<b>4%</b>	<b>5%</b>
Health of the population	12.08%	12.09%	12.10%	12.11%	12.12%
Development of tourism	12.09%	12.10%	12.11%	12.12%	12.14%
Occupation of the labor force	12.10%	12.13%	12.15%	12.18%	12.21%

Normally, the economic internal profitability ratio for such projects is a value around 12.07%.



**Figure 1.** Modification of economic internal profitability ratio at the modification, by 1%-5% of the benefits generated by the project

The result of the simulation shows that, simultaneously with the increase of usage of a secure water source and controlled release of waste waters, a continuous increase of the economic internal profitability ratio will be recorded, compared to the initial situation.

**Table 3.** Percent ratio between NPV (net present value) and the value of the investment

Elements	1%	2%	3%	4%	5%
Health of the population	74.99%	75.09%	75.19%	75.29%	75.39%
Development of tourism	75.05%	75.20%	75.36%	75.51%	75.66%
Occupation of the labor force	75.23%	75.57%	75.91%	76.25%	76.60%

The net present values associated to the integrated systems for water supply and sewage, determined by the update of net incomes for a time horizon of 30 years, represent some 76% of the present value of projects, if we take into account economic, social and environmental benefits translated as much as possible in monetary units.

#### 4. Conclusions

It can be appreciated that the existence and execution of the potable water supply and sewers systems in the villages of the Danube Delta Biosphere Reservation generates a multitude of advantages, both for local administration and for the population and economic agents inside the area, the advantages presented, especially the economic ones, will have a significant impact on the life standard of the population, considering that more than 50% inhabitants have a low, even very low living standard.

In time, the use of integrated systems for water supply and sewers will lead to the increase of economic internal profitability ratio.

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