

MANAGEMENT OF THE IRRIGATION SYSTEMS IN ROMANIA BETWEEN 1990-2014. STUDIES, PROJECTS, STRATEGIES

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Abstract

At the end of 1989, over 3 of 5.5 million ha were fitted with irrigation systems, namely more than 1/3 of the Romanian cropland. At that date, Romania was third in Europe after Spain (3.3 million ha) and Italy (3.14 million ha), countries with larger croplands, over 2.2 times and 20% more, respectively, but with less precipitation. At international level, Romania was on twelve place in terms of irrigated surface per capita. Annually, over 100 thousand ha were upgraded for irrigation, but many systems were left unfinished, the water transport canals unlined, lacking water measurement devices or drainage and water recirculation systems. The exploitation of the irrigation systems was also deficient, both in hydrotechnical and agrophytotechnical terms. Thus, the technical and economical parameters were not accomplished. Given these conditions, studies were initiated starting with 1990 to rehabilitate and also continue such projects of land reclamation left at various stages of execution. According to the report of a governmental commission, at the end of 1989, over 750 investment works valued at approximately 25 billion lei were in progress. In the field of irrigation, the first systems studied starting with 1990 were: Carasu, Galatui and Pietroiu with a total surface of over 300 thousand ha. Between 1992 and 1994, a joint Romanian-British team studied 100 irrigation systems and reached the conclusion that 1200-1500 thousand ha can be irrigated in Romania in conditions of economical efficiency. Also in 1994, a Japanese company studied the irrigable perimeter in south Moldavia and an American company explored the market for high-productivity irrigation equipment. (The author of this article collaborated as consultant in all these studies.) In time, there were other commissions that analyzed the irrigation situation in Romania. A greater project was finalized in 2011 by a Dutch company, found economically viable irrigation systems or parts of irrigation systems summed up to a total surface of over 800 thousand ha, a surface recommended to be included in the investment plan for the next period.

Key words: analysis, irrigations, projects, strategies, 1990-2014

INTRODUCTION

In the middle of the 1960s (the 20th century), irrigated agriculture represented only 2.2% (approx. 230 thousand ha) of the arable surface and of the surfaces covered by plantations of grapevine and fruit trees. During the same time period, the irrigation improvements covered 9.9% of the cropland at global level; 6.6% in Europe; 22.1% in Italy; 11.2 in Spain; 2.8% in France. Beginning with the second half of the 1960s, the trend in Romania was to fit for irrigation larger and larger surfaces, so that in 1990 Romania not only recovered the gap, but the country had 3,100 thousand irrigated hectares, occupying third place in Europe after Spain (3,300 thousand ha) and Italy (3,140 thousand ha). The speed at which the irrigation equipment

was built prejudiced its quality, and numerous parts of this equipment were not finalized. Among these the following: the permeability of the water canals, the lack of water measurement devices, the lack of automation elements etc.

During the exploitation period, there were also numerous disfunctions: lack of electrical power to activate water pumping; insufficient fertilizers and pesticides or faulty management. The result: low yields and economic inefficiency. However, at the end of 1989, over 750 investment objectives were at various stages of implementation in the domain of land improvements. In terms of irrigation, the surface that should have been upgraded was 5,500 thousand ha until 1989. After 1989, nothing was developed. However, rehabilitation studies were initiated for the existing irrigation systems. This article synthesizes the most important studies of this

kind, to which the first author collaborated as co-author or consultant.

MATERIALS AND METHODS

The material used represents the synthesis of the rehabilitation studies for the irrigation systems in Romania, as well as the conclusions of various commissions that analyzed the situation of the land improvement works, namely, the irrigation systems.

The method is chronological, starting with 1990 until 2014, and using the reports and conclusions of different teams and commissions that studied and analyzed the irrigation issue in Romania, given the conditions of market economy. The first author contributed extensively to these materials.

RESULTS AND DISCUSSIONS

In a short period of time – 25 years – over 3 million ha were improved with irrigations, Romania being third in Europe, after Spain and Italy in this regard.

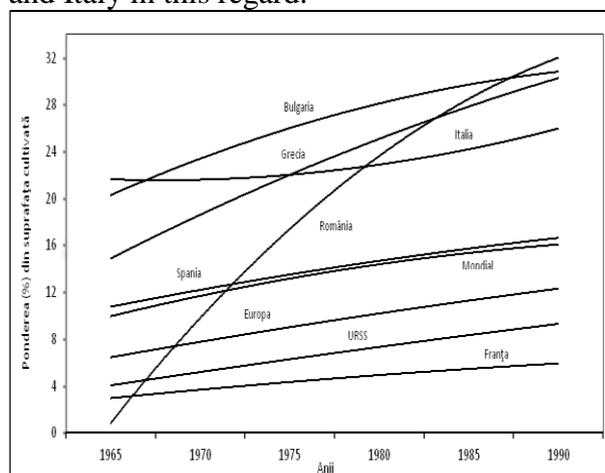


Fig. 1. The evolution of irrigation development in Romania compared to the main European countries and the international trend between 1965-1990 (% of the cultivated surface)

At the same time, the irrigation ratio per cultivated surface evolved as follows: from 8.9% to 16.1% at global level; from 4.4% to 7.3% in Africa; from 32.6% to 33.3% in Asia; from 8.9% to 11.3% in Central and North America; from 3.7% to 4.9% in South America; from 8.0% to 9.9% in SUA and from 2.2% to 31.0% in Romania.

Table 1. The evolution of the surfaces improved for irrigation between 1965-1990, globally, on continents, and in some European countries and the USA

Specification	U/M	1965	1970	1980	1990
GLOBALLY	mill. ha	140.0	167.4	211.0	237.4
Africa	„	6.2	7.6	10.0	11.3
N-C America	„	20.7	21.0	27.7	26.6
South America	„	5.6	5.7	7.4	8.8
Asia	„	104.4	109.7	132.2	150.3
EUROPE	„	9.4	10.7	14.5	17.1
- Bulgaria	„	945	1,001	1197	1,263
- France	„	520	750	900	1,170
- Greece	„	576	730	961	1,200
- Italy	„	2,715	2,561	2,870	3,120
- Romania	„	230	665	2,222	3,100
- Spain	„	2,379	2,379	3,029	3,370
- Former USSR	„	2,900	11,100	17,487	21,215
USA	„	15,200	16,000	20,582	18,771

Source: The FAO Yearbooks and the Statistical Yearbooks of Romania.

At the end of 1989, over 750 land improvement works were in development in various stages of execution. However, the existing irrigation systems had numerous unfinished parts.

Table 2. The harvest estimated and harvest obtained in the main crops in 1989 in counties with an improved cropland of over 90% (kg/ha)

Crop	Estimation	Constanta county	Calarasi county	Braila county
Wheat	5,500	3,773	3,944	4,004
Maize	10,000	2,307	3,080	4,458
Sunflower	3,500	1,474	1,632	1,488
Soy	3,200	600	583	676
Sugar beet	65,000	25,938	22,054	25,129
Potatoes	38,000	11,078	7,542	12,347

Source: The Statistical Yearbook of Romania, 1990.

The precarious state of the irrigation systems and the lack of the main production factors (fertilizers, pesticides, water) led to much smaller yields than estimated (Table 2). Eventually, these results influenced negatively the economic situation of the agricultural exploitations.

Given this situation, urgent decisions were necessary regarding the continuation, cessation, conservation or rehabilitation of certain irrigation systems, which actually meant the addition of the missing parts or components. For this purpose, by an order of the Prime Minister issued on 19.12.1990, a commission of specialists was constituted in

order to analyze the situation of all the land improvement works and to make proposals regarding their future.

Among the recommendations of this commission was to rehabilitate, which in fact meant to add the unfinished parts in order to use the improvements at the estimated parameters.

The rehabilitation of the irrigated perimeters Carasu, Galatui and Pietroiu (Fig.2). The first evaluated irrigation systems were: Carasu located in the Dobrogea Plateau (200 thousand ha), Galatui (83 thousand ha) and Pietroiu (55 thousand ha), located in the Danube Floodplain.

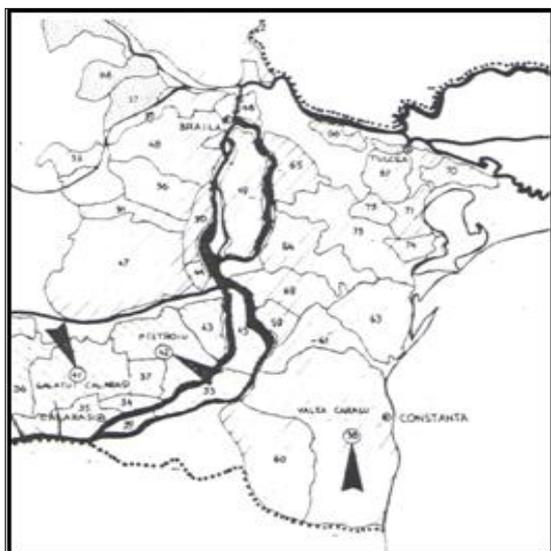


Fig. 2. Location of the irrigated perimeters Carasu, Galatui and Pietroiu

The study was accomplished by a joint Romanian-French team. The Romanian side was represented by the National Institute of Research and Development for Land Improvements (ISPIF) and the Dobrogea Research Station for Irrigated Crops (SCCI), and the French side was represented by the co-ordinator team from BAS-RHONE-LANUEDOC GERSAR-NIMES.

The study took place between 1991 and 1992, and among its conclusions were the following:

-After the complete rehabilitation of the improved perimeters, the occupancy degree of the irrigated surface would be between 105-115% (while the harvest growth would be 50% in wheat, barley and sunflower; 75% in grain maize; over 100% in vegetables, sugar

beet or alfalfa⁵).

-The ratio of the surface actually irrigated of the total improved area was evaluated at 80%;
-The economic profitability rate calculated for a period of 45 years was 12-8% for Pietroiu, 10-7% Galatui and 7.5-6.5% for Carasu (3).

In parallel with the rehabilitation of the irrigation infrastructure, a study was executed regarding the control of water excess originating primarily from canal infiltrations. The cost of these works was evaluated at approximately USD 51/ha for Pietroiu, USD 64/ha for Galatui and USD/ha for Carasu (5). When the irrigation systems were commissioned, the water transport canals were not lined (Fig. 3), so the water losses from seepage were evaluated at 23-27% of the volume of water transported during one irrigation season (4). In time, the water losses from canals had other negative consequences as well. In the Pietroiu-Stefan cel Mare system, for example, after 20 years of exploitation, the level of the ground water had risen from a depth of 10-15 m to near the surface, so that some areas turned into marshes and ponds (4).

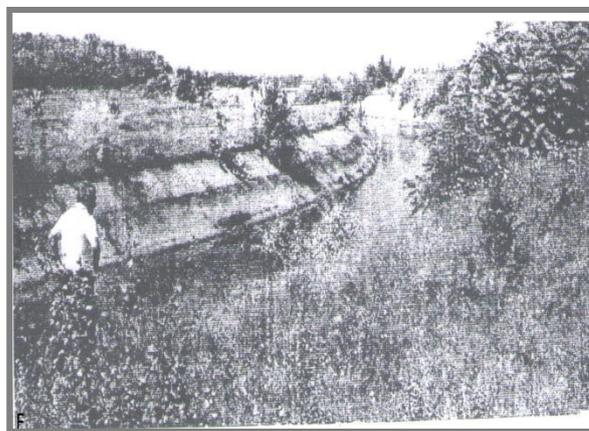


Fig. 3. A large transport canal without water proof

During the first years of the great irrigation projects – the end of the 1960s and beginning of the 1970s (the 20th century) – these problems were neglected even though a large part of the irrigation systems in the Danube Floodplain were built on drained fields, over

⁵ Data regarding the production growth, crop structure, as well as the economic parameters that are possible to obtain on the rehabilitated surface were provided by the author of the present material.

400 thousand ha (2). At this time, the financial resources were used primarily for fitting new surfaces with irrigation systems.

After 1990, given the conditions of market economy, the state no longer found the resources needed to rehabilitate the irrigation systems so that only few surfaces were rehabilitated and the negative events disappeared because the lands were irrigated less and less. However, the irrigation problem have continued to concern the national decision factors so the analyses and studies regarding the rehabilitation and irrigation of large surfaces have continued and are still available.

The study on Irrigations and Drainage in Romania (10). It was accomplished by a joint Romanian-British team between 1992-1994. The Romanian party was represented by the National Institute of Research and Development for Land Improvements (ISPIF)⁶, while the British side was represented by the companies BINNIE-PARTNER and HUTING TECHNICAL SERVICES LTD.

It was the most extensive study meant to analyze the technical and economical criteria of the irrigation systems built by the end of 1989, to select the most economically efficient systems and, finally, to establish a rehabilitation program for them over a period of 5-10 years.

The study was programmed for a span of 22 months between 1992-1994. The most important 97 irrigation systems were studied and analyzed, especially those from the Danube Floodplain, Dobrudja, and Moldavia (Fig. 4). The power demand for pumping water was set as a selection criterion for the most economical ones (the most important cost element), a factor that depends in turn on the average height for water pumping. For this purpose, the most important 28 irrigation systems were divided into four groups depending on the average electric energy consumption per ha per irrigation season, thus:

I: 6 systems with reduced demand <700 kWh/ha = 196 thousand ha

II: 6 systems with medium demand 700-1400 kWh/ha = 250 thousand ha

III: 8 systems with medium-high demand 1,400-2,100 kWh/ha = 471 thousand ha

IV: 8 systems with high demand >2,100 kWh/ha = 405 thousand ha.

Total 1,322 thousand ha

The percentage distribution of these surfaces is: 14.9% of the surface with low demand; 18.9% of the surface with medium demand; 35.6% of the surface with medium-high demand and 30.6% of the surface with high demand.

The relationship between the power demand, pumping height and economic viability of the irrigation systems is given in Table 3.

The pumping height of 70 meters was considered the limit at which extra irrigation costs equated with the extra income obtained by the farmers from the irrigated fields, given appropriate technologies were applied (Fig.5).



Fig. 4. The distribution in the territory of the studied irrigation systems

Knowledge of the study accomplished by the team BINNIE-PARTNER & HUNTING TECHNICAL SERVICES LTD is important as it is the best documented one. This is why parts of the study were used subsequently, namely various strategies for the rehabilitation of the irrigation systems, including in the legislation in the field (the Law of Land Improvements).

⁶ The ISPIF Team provided for this study the data regarding the technical and economic parameters in the agricultural exploitation phase of the rehabilitated irrigation systems.



Fig. 5. Irrigation system with water pumping height under and over 70 m

The Government Emergency Ordinance no. 147/1999 regarding the organization of the water users association). The limitation of rehabilitation to a surface of 1.2-1.5 million ha has the same origin.

Table 3. The economic viability of the surface fitted for irrigation depending on the geodesic height (Hg) compared to the level of the source water*)

Hg(m)	Improved surface (thousand ha)	Economic viability	Cumulated surface (thousand ha)
0-10	0.50	Exceptional	0.50
10-30	0.25	Very good	0.75
30-45	0.25	Good	1.00
45-55	0.25	Satisfactory	1.25
55-65	0.25	Satisfactory/unsatisfactory	1.50
65-90	0.60	unsatisfactory	2.10
>90	1.00	Disaster	3.10

*) In conformity to the study BINNIE & Partners Ltd. In association with Hunting Technical Services Ltd.UK and ISPIF SA (1992-1994). The viable surface = 1,361,000 ha will be rehabilitated through an investment program for the period 1995-2004.

The study had the following objectives: increase of agricultural production, promotion of market economy and limitation of state's role in the sector's administration.

The main conclusions of the study were:

- A maximum economic viability will be achieved by systems in which high maize productivity will be obtained;
- Within the cost of systems exploitation, the cost for water pumping energy will have a significant impact in their economic viability. In most systems, the cost of energy would be covered by USD 75/ha, but in some, energy + exploitation adds up to USD 100-200/ha.
- The partial retechnologization costs were evaluated differently, between USD 80-150

/ha, while the total retechnologization costs were between USD 334 and 2,500/ha.

-The farmers' capacity to bear the cost of irrigations would be regulated by differentiated tariffs, higher for state companies and the great private exploitations that would be willing to pay three times more for water than the small farmers.

-The systems in which the ratio Benefits/Costs is higher than 1.5 are appreciated as viable.

-It is believed that the beneficiaries can reduce their water demands below the limit at which its cost is equal to the value growth, but that they would be willing to pay for water 50% of this growth.

-For a production growth of 4 t/ha of maize (evaluated in 1994 at USD 120/t) all the categories of farmers could pay USD 75/ha for water).

-The state could bear a subsidy of USD 25 /ha.

The report regarding the technical, economic and financial viability contains the data necessary for the justification of the investment strategy for the following 10 years (1994-2004), for the following surfaces:

- over 1.3 million ha, of the three million fields improved for irrigation can be included justifiably in a long-term rehabilitation program;
- the surfaces covering approximately 200 thousand ha located in the Danube Floodplain that are well administered (but which yield small harvests) and located near water bodies that have a well maintained infrastructure can prove to be viable, at least in the medium term.

-The progressive backdown of governmental involvement in the administration of exploitation activities;

-The implementation of a policy of progressive reduction of subsidies for irrigations and the liberalisation of the water price as a means to balance the demand and offer and to direct the investments towards areas efficient from the economic standpoint.-

-The discouraging of irrigations when they are not viable. This aspect is essential to minimize the subsidy costs.

In the last phase of the study (January 1994-

July 1994), based on the Report regarding the technical, economic and financial viability, a ten-year investment program was prepared and it contained the following main components:

- Pilot-surfaces for demonstration;
- The rehabilitation and modernization of infrastructure, preparation, projection, rehabilitation;
- Institutional development.

In the field of Institutional Development, the study stipulated:

- The introduction of a computerized informational management system;
- The establishment of Water Users Associations;
- The development and extension of consultancy services;
- The establishment of the Program Management Unit.

During the same time period (1992-1994), two other foreign companies were interested in the rehabilitation of the Romanian irrigation systems:

- MORRISON KNUDSEN CORPORATION - USA 1992/1993 for the following areas: Giurgiu-Razmiresti, Ialomita-Calmatui, Baraganu-Basarabi (Constanta), SAI Bucharest;
- JAPAN INTERNATIONAL COOPERATION AGENCY-JICA, for the area Ruginesti-Pufesti-Panciu (Vrancea county), for 1994-1995⁷.

Of the over 700 investment objectives into land improvement works inventoried by the governmental commission constituted in 1990, in the field of irrigation, a surface of 218 thousand ha was in various stages of execution and was proposed for completion. Apart from this, other rehabilitation studies and projects were executed by ISPIF after 1994 for irrigation systems as follows:

- Calafat-Razmiresti (Dolj county)... 49,640 ha
- Giurgiu-Razmiresti (Giurgiu) ... 110,718 ha.
- Galatui-Calarasi (Calarasi county) ... 84,874 ha.
- Pietroiu-Stefan cel Mare (Calarasi county)...

55,400 ha.

-Valea Carasu (Constanta county)...200,000 ha

-Ialomita-Calmatui (Braila county)...140,000 ha

Total 640,638 ha.

As a matter of fact, both ISPIF and the National Administration of Land Improvement pleaded after 1989 for the restoration of the irrigation systems on the surface existing before 1990, namely three million hectares and even more. The argumentation was Prodomo-type for both institutions, which meant work front, the maintaining of organisational structures, jobs etc. This in spite of the fact that no rehabilitation study executed after 1990 recommended the exceeding at national level of irrigable surfaces larger than 1,500 thousand ha.

Other strategies, analyses and rehabilitation projects for the irrigation systems in Romania.

The abolition of the planned economy and the transition to the market economy based on private land property had an important impact on the land capital, the result being the liquidation of large state and cooperative agricultural exploitations and the land retrocession to its previous owners into millions of plots that became as many exploitations.

The process lasted for several years and had a catastrophic impact on the irrigation systems whose water transport and distribution network was projected for large exploitations. Parallel to the creation of the new land exploitation structure, the irrigation systems were destroyed, including through the theft of the metallic, ferrous and non-ferrous parts. On the other hand, given the conditions of the market economy, the state subsidies for water were reduced simultaneously to the price differentiation depending on water pumping height and water transport distance. Consequently, the farmers' interest for irrigations decreased and the systems were mostly abandoned.

Even in this state, the national irrigation system represented a great patrimonial value given that the climatic phenomena became more critical and irrigation represented both

⁷ The author collaborated between 1992-1994, as consultant, with both companies.

the guaranty of food security and an important factor of technological intensification and growth of the performances of Romanian agriculture, one of the most reduced within the European Union and not only.

Given these conditions, the government maintained its concern for the existence of an institutional legislative and economic framework meant to help the restoration, at least partial, of the irrigation systems which could thus contribute to the increase of agricultural performances. The material presents a synthesis of the most important governmental policies regarding the rehabilitation of the national irrigation system.

The project Rehabilitation and Reform in the Irrigation Sector was launched in 2004 by the Law no.4/2004 (7, 8, 11, 12). Valued at USD 103 million, it was financed by BIRD (USD 80 million), the Romanian Government (USD 20,622 million) and AUI (USD 2,325 million). The purpose of the project was:

- To reduce the drought risk;
- To increase the economic efficiency of irrigations;
- To improve the management of irrigations;
- To involve the beneficiaries in the management and rehabilitation of the irrigation systems.

Practically, as a result of the project, 100 thousand ha were going to have their irrigation infrastructure rehabilitated, 40,310 ha of which in the Sadova-Corabia system (Dolj county) and 11,030 ha in the Terasa Nicoresti-Tecuci system (Galati county).

The National Strategy for the Reduction of the Effects of Drought, the Prevention and Control of Land Degradation and Desertification (12) was elaborated in 2007 based on the Government Resolution no.474/2004.

The specialists that collaborated to draft it came from 38 institutions with various backgrounds and degrees, among which seven ministries, two academies, 12 research institutes, six universities and others. The strategy was completed at the end of 2007.

In regards to the rehabilitation of the irrigation systems, the strategy stipulated:

- The elaboration of a *study regarding the evaluation of the working condition of the*

irrigation hydrotechnical systems in the administration of ANIF with the purpose of selecting systems that can enter the rehabilitation and modernization program in a certain priority order;

- The *selection of the irrigation systems and sub-systems for the rehabilitation and modernization program* on a surface of approximately 1.23-1.5 thousand ha considered viable from the economic standpoint in the long run.

- This selection will be done in order of a priority established according to technical, economic, ecological and social criteria. The priority in this selection is held by those regions where irrigators associations are established and where there are demands for irrigations (approx. 700,000 ha according to the ANIF data), where water is available all year-round and it can be obtained with minimal energy and material expenses, where the restoration of the systems does not have great impact on the environment and where the crop structure provides, through irrigations, a considerable harvest growth. The tackling again of the irrigation rehabilitation and modernization issue is also justified by the relatively significant demand of the local communities (approx. 62% of the total questionnaires filled out, with an availability to contribute financially expressed by approx. 10%).

- The elaboration of *projection documents for the rehabilitation and modernization of the irrigation systems*, selected in order of priority. This measure will be accomplished by request of public offer and based on the specifications, and it will have the following components: 1) the infrastructure of the hydro-technical scheme for the adduction of water from the source to the interior equipment; 2) the infrastructure of the interior equipment and rigging with watering installations; 3) plantation of protective forest barriers;

- Execution of the rehabilitation and modernization works in the determined order of priority – approx. 0.75 thousand ha in the short-medium term.

- Resuming of work on the derivations suspended after 1990 (Siret-Baragan and Olt-

Vedea-Neajlov canals) within a national measure to develop gravity fed irrigation systems which would ensure the irrigation of croplands with reduced power demand, as well as providing water to the areas covered;

-Encouraging of the creation of local irrigation improvements, in correlation with the directives for the improvement and management of waters within the sustainable development projects in the rural areas, based on the access to local water sources. This measure is necessary in order to complete the rehabilitation of the irrigation system administered by ANIF, as, unlike this one, the local systems could benefit from financing by EU structural funds. Another argument for this measure is the fact that the national irrigation system cannot respond to all the irrigation needs in agriculture (vegetable growing, sericulture, fruit growing etc).

The Inquiry of the Parliamentary Commission regarding the Situation of the Irrigation Systems 2009⁸. The objectives of the commission were:

- To verify the way in which the specialized institutions observed the conformation to the measures for rehabilitation and keeping the irrigation systems going in the affected areas;
- To analyze the situation regarding the use of the funds allotted to the irrigation systems;
- To analyze the measures taken for expediting irrigations in 2009;
- To analyze measures including legislative ones that can be taken urgently;
- To verify any other aspects incidental to this event.

On this occasion, the National Administration of Land Improvements (ANIF) presented to the commission the patrimony situation within which the irrigation improvements equated 3,001.6 thousand ha made up of 10,996 km of adduction canals, water transport and distribution, 33,550 km of buried duct networks, 3,313 basic pumping stations, repumping stations and pressure stations equipped with 20,336 pumping gear. This patrimony was valued at 6.6 billion lei and then at Lei 5.98 billion, which means less than

Lei 2,000/ha or USD 570/ha, an insignificant value compared to the one at the end of 1989.

The following are among the findings of the commission:

-The considerably reduced degree of use of the irrigation systems reported to the improved surface existing in 1989.

-Between 1991-2009 the actually irrigated surface ranged between 622,510 ha in 1996 and 45,719 ha in 2005, which represented 20 and 1.5%, respectively, of the over 3 million hectares in the ANIF patrimony. In 2003, a particularly droughty year, only 569,073 ha were irrigated and in 2007, the most droughty year of the last 60 (compared to 1945-1946), 319,998 ha were irrigated, namely approx. 10% of the theoretical potential.

Among the major causes that generated this situation are the following:

- The inadequate technical state of the irrigation systems in various stages of degradation;
- The liquidation of large exploitations and the appearance of millions of small exploitations which are not prepared and not interested in intensive irrigation technologies;
- The increasing water prices;
- The reduction of irrigation subsidies;
- The lack of irrigation equipment;

The split of SNIF into ANIF (National Administration for Land Improvements) and SNIF (National Society for Land Improvements), the last institution that provided maintenance for irrigation systems, was unanimously considered the main error of the Law no. 138/2004.

Other aspects were signalled as well:

- Inadequate ratio between the administrative staff and the productive one (favoring the former);
- Hiring personnel that is not trained in the field, including on political grounds;
- The high salary ratio within the expense structure;

Finally, the Parliamentary Inquiry Commission made a number of proposals:

- Inventory of the systems and sub-systems that can work without further investment;
- Completion of the systems or of any part of each system that fits within the domain of economic viability;

⁸ The author of the present material collaborated with this commission as expert.

-Granting the statute of public utility to the gravity fed irrigation systems;

-Completion of the priority list for investments of rehabilitation and modernization;

-Legislation amendments to facilitate the quick development of the Organizations for Water Users in Irrigation (OUAI) and Federations;

-The land subjected to an obvious degree of aridisation and desertification located in irrigation systems without economic viability (e.g. Dobrudja) should be treated as *disadvantaged area*;

-No compensatory payments to be accepted in the functional irrigation systems;

-Introduction of means of measurement and recording of the water volumes delivered to OUAIs;

-After the analysis, addition and completion of these proposals, the *National Irrigation Plan* should be drafted and provided with complete tasks and development span (short, medium and long term), including stipulations regarding the financial sources.

This program is included in the *Strategy of agricultural development for 2020-2030*, when irrigations would be applied on a surface of approx. 1500 thousand ha, recommended by all studies and analyses executed so far on this topic.

CONCLUSIONS

The irrigation problem was approached at governmental level immediately after the abolition of the planned economy system, beginning with 1990. At the end of 1989, hundreds of land improvement projects were at various stages of execution and the land improved for irrigation should have reached 5.5 million ha, according to the last program launched in 1983.

There was an urgent need to decide which works should be continued, preserved or abandoned. The option for market economy required the reexamination of all the investment objectives, including those commissioned before 1990. This because most of them were not finished and functioned at technical and economic

parameters inferior to those estimated.

The irrigation systems had to be adapted to the new types of small agricultural exploitations and in economic terms, these had to function according to the rules of market economy, namely be lucrative (efficient) both for the state and for the users.

The conclusions and recommendations of the first rehabilitation studies and projects were not put into practice due to several causes:

-The lack of financial resources;

-The increase of water prices and their differentiation according to pumping heights;

-Difficulties in the organization of farms capable of practicing irrigated farming;

5.-A study executed between 1992-1994 recommended the reduction of the irrigable surface from over 3,000 thousand ha to a maximum of 1,500 thousand ha, with technologies and crop structure specific to irrigated farming.

The studies and analyses of various commissions, as well as the rehabilitation projects of irrigation systems or parts of systems continued till the present day but none of them recommended the irrigation in Romania of surfaces larger than 1500 thousand ha.

The areas recommended for rehabilitation are those in the Danube Floodplain, with small pumping heights and the systems in which there is no need for water pumping.

There are, however, opinions according to which the national irrigation system should be restored to the size existing in 1989, namely 3100 thousand ha or even more. These opinions belong to the engineers and builders of irrigation systems.

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[11]x x x Reabilitarea și Reforma Sectorului de Irigații 2009. Ministerul Agriculturii, Pădurilor și Dezvoltării Rurale.

[12]x x x Strategia Investițiilor în Sectorul Irigațiilor 2011. Fidman Merkat. București.

[13]x x x Cadrul Național Strategic pentru Dezvoltarea Durabilă a Spațiului Rural Românesc 2014-2020-2030. București. 2014.