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THE PARLIAMENTARY INQUIRY INTO THE STATE OF LAND RECLAMATION WORKS IN ROMANIA, 2009

AUREL LUP¹

Abstract: *Between June 24 and September 13, 2009 the Agriculture Commission of the Romanian Parliament conducted an inquiry into the state of land reclamation works in Romania. The main objectives were: rehabilitation and maintenance works, the exploitation of the works, the way in which the financial resources were used for their maintenance and exploitation, the measures taken to urge irrigations, the losses and costs of watering delays, other problems. From the conclusions of the inquiry we notice: the state of the works is generally unsatisfactory in all aspects. Maintenance works are incomplete either due to the lack of financial resources, or due to a low interest on the part of the user, or pure and simple some irrigation works in some areas have proven to be technically and economically unviable. Among the causes of not realizing the irrigation programs we tackle: the disappearance of large-scale agricultural holdings corresponding to the irrigation systems' constructive schemes, the lack of watering equipment, increasing water fees, the discrepancy between the rehabilitated areas and the establishment of beneficiary irrigation organizations and even the non-observance of the contracts between the water supplier (the state) and the agricultural users. There has been much criticism of the frequent reorganizations and especially of the 138/2004 Law, which separated the administration from the part that had as its object the maintenance and rehabilitation and construction works. In addition, the paper also contains some data on previous analyses and research results of this paper's author.*

Key words: *inquiry, land reclamation, irrigations, laws.*

JEL Classification: *Q 15, Q 25, Q 38*

1. INTRODUCTION

The inquiry that represents the object of this paper is important first and foremost for its pattern of work and duration. The inquiry has covered satisfactorily territorial and thematic issues encompassing all categories of land reclamation works: irrigations, drainage, soil erosion control. This was possible due to the duration of the inquiry (24 June-13 September 2009), but also due to the provision of means of transport which allowed the on-site ascertainment of the state of land reclamation works. The 2009 parliamentary commission's inquiry is also important in aspects such as:

- I. The appropriate composition - 15 deputies representing the entire political spectrum of the Romanian Parliament and four experts from outside the organizational system of the Department of land reclamation, including this paper's author.
- II. Simultaneously with the field trips, the commission asked the branches of the "*National Administration for Land Reclamation - ANIF*" and its management a series of statistical data on:
 - the area and infrastructure of hydro-amelioration facilities, and the economically viable area at the time of the inquiry;
 - the irrigation infrastructure area handed over to the Users of Water for Irrigations Organizations - AUAI;
 - the area contracted for watering works in 2009;
 - the actual irrigated area over the last three years 2007, 2008 and 2009;
 - the financial situation of ANIF and each of its branches, respectively the cost of irrigations and the degree of coverage from the revenue received from users;
 - the necessary investments for the rehabilitation of land reclamation works: irrigations, drainage, soil erosion control;
 - any other issues related to the land reclamation activity.
- III. The Commission also requested:
 - data on electricity, its cost and the possibility of reducing it;

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- data on production growth possible through irrigations and their efficiency;
- data on the available water sources, the degree of water coverage for irrigations, and the possibility of using groundwater for irrigations.

Simultaneously, at the Commission hearings of stakeholders involved in land reclamation activities at all levels, including ministers and even heads of state in connection with ANIF's collateral activities, took place. Finally, the commission raised the issue of the legislative system on land reclamation by making proposals to improve it.

At the end of this introduction, we mention that its final report contains over 170 pages, and that this paper will only be a partial summary of the conclusions of this report.

2. MATERIAL AND METHODS

Information from various sources was used as a research base, including bibliographic information (especially on the history of reclamation), but the main source was the written information from ANIF's branches, as well as that obtained verbally during the meetings at the agriculture commission headquarters in the Romanian Parliament, as well as those belonging to the representatives of ANIF's branches during field visits.

For the geographical coverage of the country's territory, the commission was divided into four subcommittees composed of 3-5 deputies and 1-2 experts, as follows:

- a) Subcommittee no.1, with the ANIF branches: Someș-Criș, Tisa-Someș and Timiș-Mureșul Inferior comprising 9 counties from the center of Transylvania and the north-western part of the country;
- b) Subcommittee no.2, with the ANIF branches: Mureș-Olt mijlociu, Mureș-Olt superior and Danube-Olt, comprising 12 counties from Transylvania and the Southern Subcarpathians;
- c) Subcommittee no.3 with the ANIF branches: Olt-Argeș, Argeș-Buzău and Argeș-Ialomița-Siret, comprising 7 counties from the Wallachian Plain, the Subcarpathians and Bărăgan;
- d) Subcommittee no.4, with the ANIF branches: Dobrudja, Moldova-South and Moldova-North, comprising 10 counties from Dobrudja and Moldova.

The 4 subcommittees actually visited the land reclamation works, and outside the statistical statements provided by the branches, they had discussions with the members of the branches. The reports of the subcommittees were typified, each one of these included the area of activity, the history of the works, the source of the works, the set up areas included into the three categories of works, watering in the years 2007-2008-2009, the financial situation, the investments needed for rehabilitation, other aspects. Simultaneously with the field visits, weekly at the Agriculture Commission headquarters hearings were held with stakeholders, institutions or organizations such as:

- ANIF - National Administration for Land Reclamation;
- SNIF - National Society for Land Reclamation;
- ADS - State Property Agency Syndicates;
- LUAI - The Water for Irrigations Users League.

Apart from the reports of the four subcommittees, the report of the Parliamentary Commission contains its own conclusions and proposals.

3. RESULTS AND DISCUSSIONS

3.1. Short history

The need for land reclamation works in Romania has been known since ancient times, we could say. History mentions the need to cultivate land on high terraces, as well as for irrigations in times of distress (2). The chroniclers of the Middle Ages cite grim droughts and catastrophic floods (7). In Banat and Câmpia de Vest (the Western Plain), ever since the eighteenth century, the former

Habsburg Empire began the drainage of over one million hectares in order to make them cultivable and to allow the development of human communities (2).

In Wallachia, ever since the end of the 19th century, some projects have been discussed and have even been carried out concerning large-scale irrigations, such as the paper of eng. Chiru *River Sewerage and Irrigations*. The studies and projects continued throughout the first half of the 20th century, but practically in 1950 only 42 thousands ha were being irrigated, 368.1 thousands ha were drained and soil erosion control work was being carried out on just 2 thousands ha (7).

The pro-communist government installed on March 6, 1945 however, was determined to put an end to this lag, and in 1950, through the *Electrification Plan* (the construction of the hydroelectric power station Biczaz was also considered) it identified a drought-affected area of 2.78 mil. ha out of which 1.2 mil. ha were to be set up in the first stage, out of which the water source for 500000 ha was to be the Danube, the reservoirs for another 500000 ha and for the remaining 200000 ha the internal rivers Jiu, Olt, Argeş, Ialomiţa and Siret (9). However, in 1965 (after 15 years) only 230 thousand ha were being irrigated, 587 thousand hectares drained and 197.5 thousand ha of soil erosion control works, so that the second program *The National program for the extension of land reclamation works during 1966-1970* was launched and followed by a 3rd program. In July 1970, *the National Program on Water Resource Management, the Extension of Irrigation Works, Embankments, Drainage and Soil Erosion Control in RSR in 1971-1975 and General and Prospective Provisions until 1985* was launched.

In 1983 – *The National Program for ensuring safe and stable agricultural productions by increasing the productive potential of the land, better organizing and unitary use of agricultural land, of the entire area of the country, performing irrigations on approx. 55-60% of the arable land, drainage and soil erosion control works* (10).

At the end of 1989, at the fall of the communist-totalitarian regime 3109 thousand ha of irrigations (56.5% of the program), 3085 thousand ha of drainage (55.8% of the program) and 2222 thousand ha (41.9% of the program) of soil erosion control works were set up.

After 1989, the emphasis was not on the extension of the works according to the program, but on the rehabilitation of the areas set up before 1990, taking into account the inadequate quality and the unfinished systems built up to that date. From then until the present, countless analyses have been done, with the emphasis on irrigations. Of these, we will deal mainly with two: the one from the beginning of 1990, conducted by a governmental commission and the one organized by the *Parliamentary commission of inquiry on the state of the irrigation systems, as well as other land reclamation sectors* (18). (The author participated as an expert in both commissions). This latter investigation is the subject of this paper. In particular, the commission set for itself the following objectives:

- a) the verification of the way in which the specialized bodies followed the observance of the measures for rehabilitation and maintenance of the irrigation facilities in the affected areas;
- b) the analysis of the structures regarding the use of the allocated funds for the irrigation systems;
- c) the analysis of the measures put in place to speed up irrigations in 2009;
- d) the analysis of the measures (including the legislation) that can be taken urgently;
- e) losses and costs of delaying the application of watering;
- f) the checking of any incidental issues to this event.

3.2. Informing ANIF about the patrimony

The first document provided to the commission was the report of the National Administration for Land Reclamation - ANIF about the inventory of the facilities it manages, as well as some data on the exploitation of the land reclamation works, including the difficulties encountered in their proper exploitation.

Irrigation facilities. The area equipped for irrigation works - 2 998 255 ha, out of which: sprinkler watering 2,660,353 ha (88.7%), furrow irrigation 281,982 ha (9.4%) and 55,920 ha watering by flooding (1.9%). The main source of water is the Danube for 2,017,420 ha (67.3%) and the inland rivers 980.835 ha (32.7%).

- transportation, supply and distribution canals of irrigation water 10,975 km, out of which 6,015 km lined;
- buried pipe networks 28,773 km;
- irrigation pumping stations 2.908 units, out of which:
 - fixed and floating base stations 227 pcs;
 - refueling stations 352 pcs;
 - pressure stations 2,329 pcs;
- hydrotechnical constructions 13.923 pcs;
- the installed power of the pumping stations is 4.134 MW;
- Average installed power 1.38 kW / h.

Drainage facilities. The area equipped - 3.085.295 ha

- Excess water evacuation methods:
 - water evacuation through pumping 1,463,807 ha;
 - water evacuation through gravitation 1,621,488 ha.
- Number of drainage facilities 443.
- Water collection and evacuation canals 56,584 km:
 - main collectors 25,705 km;
 - secondary and tertiary 30,879 km.
- Evacuation pumping stations 740 pieces, out of which
 - electrical stations 698 pcs.
 - thermal stations 42 pcs.
- Hydrotechnical constructions 42,228 units.
- Drainpipes 40,410 km.

Soil erosion control facilities. The area equipped - 2,222,287 ha. in 650 facilities:

- canals and outlets, out of which 13,255 km coastal evacuation canals and 6.681 km outlets.
- anti-erosion roads 28,125 km.
- ravines and torrents 7,926 km.
- hydrotechnical constructions 188,482 pcs.
- collecting and absorbing roads 19,828 km.

Flood protection works:

- flood-protected area 1.378.119 ha, out of which:
 - with defense dams in ANIF's administration 643,870 ha.
 - with defense dams in ANAR's administration 734,249 ha.
- dams in ANIF's administration 2,270.3 km, out of which:
 - at the Danube River 1,181,1 km.
 - at lower rivers 1,089.2 km.
- flood-protected area through dams 189,694 ha.
- dams and accumulations for floods mitigation 114 pcs.

3.3. Exploitation of land reclamation works

Irrigations. According to the data available in ANIF branches's accounts, during 2006-2009, compared to 1989, irrigation was done less and with great variations from one year to the next. A significant reduction in irrigation rules and areas can also be noticed, compared to 1989. Even in particularly dry years -1993, 2003, 2007- there was less irrigation done.

The most important causes that have led to a significant reduction of the irrigated areas are as follows:

- the dissolution of large-scale exploitation structures, starting with the agricultural cooperatives following Law no. 18/1993, the Land Fund and then Law no.1/ 2000;
- the degradation of hydro-amelioration equipment infrastructure by destruction, theft, physical and moral wear, abandonment, disinterest of new landowners and those in repossession of their land. Everything has been assisted by the inability of decision makers and in power players to manage and organize the exploitation of a significant heritage of agriculture and at the same time of the national economy;
- the transition to market economy, whose engine is considered to be the profit obtained exclusively at the level of the economic operator and not of the national economy;
- the progressive increase of irrigation water fees and, in particular, pumping differentiation has also contributed to the reduction of the interest in irrigation;
- the destruction of the power transmission network, accompanied by power supply disconnection and decompletion (extraction of transformers) motivated by its non-use;
- the lack of equipment for water management in plants;
- the lack of correlation between the rehabilitation of the irrigation infrastructure activities and the real water demand at a hydrotechnical level.

Over the 2006-2009 period, the area contracted by the beneficiaries increased in all branches. By contrast, the actual irrigated area was much smaller than the contracted area and variable from one year to another, approximately 15% of the set up surface.

In 2007, an area over two times larger than in 2006 was contracted, and an almost four times larger area was irrigated, which is due to the drought in that year. In 2008, although a larger area was contacted than in 2007, a smaller area was actually irrigated than in the previous year, with rainfall assuring plant water requirements. The actual irrigation situation in 2009 is dated at the beginning of July, so the irrigation season was not complete.

Embankment and drainage. Flood protection is provided by 1,181 km Danube dams and 1,089 km of inland rivers, belonging both to the National Administration for Land Reclamation (ANIF) and to the Romanian National Water Agency (ANAR). The protected area totals 1,378 thousand ha.

According to the situations presented by the branches, the maintenance and reparation works needed to ensure the functioning at the parameters required by the exploitations regulations are totally inadequate. The management of the branches estimates that the drainage systems are only 50% prepared for natural disaster interventions, which is extremely grave.

Not realizing work on the drainage canal network is mainly due to the faulty way of organizing the maintenance and reparation activity required by Law 138/2004 due to the lack of its own working personnel needed to carry out these works and to dealing with the maintenance and reparation works as construction and assembly works in third-party relationships. Also, the chronic lack of funds has led the present canal network to be invaded by vegetation (aquatic, grassy, woody) which in many areas makes it impossible to drain water from agricultural land and not only. Both of the above-mentioned causes have led to the execution of some specific works to the detriment of works that ensure the functioning of the entire system.

Regarding the maintenance of the stations and the reparation of the pumping stations, we notice the following aspects:

- at present, there is no necessary equipment and specialized personnel to perform the reparation works;
- the maintenance and reparation system currently in use is not the proper one, as a pumping unit works until failure, only at the time the reparation is being done;
- it is necessary to apply the maintenance and revisions program according to the technical book prepared by the manufacturer.

Soil erosion control. The application of the land fund laws with the retrocession on the old sites, and hillside downsizing, led to the destruction of soil erosion control works, with an increase in erosion phenomena. This phenomenon was also favored by deforestation and the destruction of protective curtains.

The plotting of the land also resulted in a random placement of the crops, which makes it impossible to exploit economically and anti-erosionally the areas equipped for this purpose.

The shortcomings created by the application of the land fund laws, correlated with the chronic lack of funds for the maintenance and reparation works, led to the degradation of the works and implicitly of the agricultural lands.

A harsh analysis of the works within each hydro-ameliorative system is required and the scrapping of the destroyed works or, where appropriate, their restoration if this is expressly requested by the beneficiaries.

An analysis of the amounts allocated for works and average costs per hectare shows that the budgetary allocations received in 2001-2009 did not ensure the exploitation, maintenance and reparation of the works according to the norms in force, allowing only for interventions in the critical points.

Institutional and legislative evolution in 1990-2009. After 1990, during the transition to the market economy period, a new series of specific reorganizations began, in order to adapt to the new structures.

By *Government Decision* no. 292, in 1991 the Commercial Company for the Exploitation of Land Reclamation Works - S.C.E.L.I.F. S.A., with branches in each county, in which a variable number of hydro-ameliorative systems and Pumping and Automation Stations Maintenance Societies - S.I.S.P.A. functioned. The scope of activity: maintenance, reparation and exploitation of canals, pipelines, hydrotechnical constructions, irrigation installations and equipment, drainage; maintenance and reparation of soil erosion control facilities; agricultural activities; design and technological upgrade of works, installations and land reclamation equipment; import-export trade activities; consulting and public relations, investments.

Law no. 50/1994, on some measures for the organization of the land reclamation activity, which establishes the *Autonomous Land Reclamation Authority* (RAIF) with the same activity objectives.

Law 138/2004 provides for the reorganization of the National Society for Land Reclamation - S.N.I.F. - by the separation from the National Administration for Land Reclamation - A.N.I.F., the former would be privatized according to the provisions of the Government Decision for the approval of the global reorganization plan of S.N.I.F. This law was severely criticized because the ANIF was left without specific services: maintenance, design, construction, etc.

The repeated legislative changes in the land reclamation field have not made progress, but have led to a number of system failures. It is necessary the revision of the legislation aimed at new institutional reorganization measures of the two organizations (ANIF and SNIF).

3.4. The findings and conclusions of Subcommittee no.1 on the management of irrigation facilities and other land reclamation sectors

From the data presented in the table below, it is clear that the predominant activity in the Timiș, Mureș Inferior and Someș Criș branches is drainage, while for the Tisa-Someș branch it is soil erosion control in the counties: Cluj, Sălaj, Maramureș and Bistrița-Năsăud. The irrigation activity in this area is low, the irrigation facilities occupying only an area of 50.122 ha.

Table 1
Capacities of land reclamation under the management
of the ANIF RA branches in the analyzed area

No. char.	Branch	Capacities (ha)				Observations
		Flood protection	Irrigations	Drainage	Soil erosion control	
1.	Someș - Criș	251.410	10.128	404.863	102.966	
2.	Tisa - Someș	-	5.880	48.971	312.281	
3.	Timiș - Mureș Inferior	-	34.114	693.520	95.141	
	<i>Total</i>	<i>251.410</i>	<i>50.122</i>	<i>1.147.354</i>	<i>510.388</i>	

The large drained areas are due to the restoration works for draining the area started by the former Habsburg Empire, ever since the beginning of the 18th century.

As far as the sources of financing the land reclamation activities are concerned, they come from income - fees for water and other services, as well as from the state budget.

a) For irrigations:

- annual fees for the maintenance and exploitation of the irrigation works from the ANIF-RA administration received from beneficiaries of lands with irrigation systems supplemented by subsidies from the state budget granted under Law 138/2004;
- water supply fees from the source of the water to the point of takeover from the beneficiaries, fees partially covered by subsidies from the state budget;
- water delivery fees by organizations to members of the organization or other beneficiaries who have lands served by facilities owned by a water users' organization.

b) For the defense, drainage and CES (soil erosion control) activities, the exploitation, maintenance and reparation costs are fully covered by the state budget. They were never used, but even if this was the case they would not have been sufficient. Sub-financing of these works has led to numerous degradations, broken dams, clogging and even destruction of crops. In fact, the phenomenon of degradation was present everywhere.

Regarding the economic situation of the branches visited by subcommittee no. 1, it is presented overall as follows:

- revenues from water and maintenance fees.... 1,181 thousand lei
- total expenses on all branches2,603 thousand lei
- financial results (losses) 1,422 thousand lei

The losses of the current year are added to the previous year's losses (2008) for Maramureș branch, and those of 2007, amounting to 5,121 thousand lei. Also, it is noteworthy that about half of the expenses are living expenses.

3.5. Subcommittee no. 2's findings about the management of irrigation facilities and other land reclamation sectors

Geographically, subcommittee no. 2 has been active in the central and southeastern areas of Romania, in the Alba, Hunedoara, Sibiu, Brașov, Mureș, Covasna, Harghita, Gorj, Mehedinți, Dolj, Vâlcea and partially Olt counties.

From an administrative point of view, the exploitation, maintenance and reparation of the land reclamation works in the above mentioned perimeter is organized in three territorial branches of ANIF RA, namely:

- *Mureș - Olt Mijlociu branch* for land reclamation works in the Alba, Hunedoara and Sibiu counties, based in Alba Iulia city
- *Mureș - Olt Superior Branch* for land reclamation works in Brașov, Mureș, Harghita and Covasna counties, based in Brașov city
- *the Danube-Olt branch* for land reclamation works in Gorj, Mehedinți, Dolj, Vâlcea and partially Olt counties, based in Craiova city.

Table 2

Land reclamation works situation in the Subcommittee no. 2's analyzed area

No. char.	Branch	Capacities (ha)				Observations
		Flood protection	Irrigations	Drainage	Soil erosion control	
1.	Mureş Olt Mijlociu		8.194	50.646	152.236	
2.	Mureş Olt Superior	54.458	6.744	149.642	165.772	
3.	Dunăre Olt	112.322	562.709	248.439	248.940	
	<i>Total</i>	<i>166.780</i>	<i>577.647</i>	<i>448.727</i>	<i>566.838</i>	

Source: 16

From the data presented in Table 2, the prevailing activity in the Dolj branch is that of irrigation and flood protection on the Danube, and for the Mureş-Olt Mijlociu and Mureş-Olt Superior branches the basic activity is soil erosion control and, to a lesser extent, drainage. Within the activity range of Mureş-Olt Mijlociu and Mureş-Olt Superior branches the irrigation activity is reduced, occupying only an area of 14.938 ha. The irrigation activity in the entire area is low, with irrigation facilities occupying an area of only 50.122 ha. The subcommittee also points out that there are no water requests in the first two branches and proposes scrapping (The author believes that irrigations were not even economically justified in these Transylvanian counties).

In connection with the drainage works the degradation or even the decommissioning of some exhaust stations is signaled. The lack of funding for maintenance is addressed. However, it is considered that about 50% of the works are functional.

Regarding soil erosion control works, they have been degraded or even destroyed due primarily to Law 18/1991 of the Land Fund which favored the fragmentation of the facilities. It is appreciated that for this type of works there is a need for a new strategy in line with the market economy.

3.6. Subcommittee no. 3's findings concerning the management of irrigations facilities and other land reclamation sectors

The scope of activity of subcommittee no. 3 was aimed at the analysis of the land reclamation facilities from the ***Olt-Danube-Siret*** geographical area and their administration in three territorial branches of ANIF-SA:

- ***Olt-Argeş*** branch, based in Giurgiu, divided into four Management Units (Teleorman, Giurgiu Vest, Giurgiu Est and Ilfov);

- ***Argeş-Buzău*** branch, based in Ploieşti, divided into four Management Units (Argeş, Dâmboviţa, Prahova and Buzău);

- ***Argeş-Ialomiţa-Siret*** branch, based in Brăila, divided into five Administration Units (North Brăila, Brăila Sud, Great Brăila Island, Ialomiţa and Călărăşi).

The areas equipped with land reclamation works analyzed by Subcommittee no. 3 are as follows (Table 3).

Table 3
Land reclamation facilities in Olt-Dunăre-Siret area
- ha -

Territorial branch ANIF	Irrigations (107 systems) net area	Drainage (153 systems) net area	Soil erosion control (79 works)	Flood protection >850 km
Olt-Argeş	679.939 (45%)	330.761 (31%)	11.365 (6,5%)	116.965 (34%)
Argeş-Buzău	126.017 (9%)	250.292 (23%)	163.157 (93,3%)	1.812 (0,5%)
Argeş-Ialomiţa-Siret	690.899 (46%)	488.773 (46%)	339 (0,3%)	224.360 (65,5%)
<i>TOTAL</i>	<i>1.496.855 (100%)</i>	<i>1.069.826 (100 %)</i>	<i>174.861 (100%)</i>	<i>343.137 (100%)</i>

The subcommittee no. 3's speaker, researcher, designer at the time of the inquiry, university professor, happens to be an old acquaintance of the author and collaborator in some

studies on the cost of water at different pumping stages (heights) in one of the largest irrigation systems in the country "Carasu" from Constanța County. In the introduction of the analysis, the subcommittee mentions the rapid evolution of the facilities in this area, including, in particular, the Danube Floodplain and the lower course of the river where over 418 thousand hectares have been drained in order to extend the irrigated arable area (5).

Table 3 shows that there were about 33,000 ha in the area in 1977, and in 2004 an area of 1456700 ha was set up (46% of the total irrigated area in Romania), out of which 14,448,8 ha were placed in gravitationally fed hydrotechnical systems. These are located in the counties of Buzău, Dâmbovița, Ilfov, Argeș and Prahova. Therefore, only 10% of the area is gravitationally fed, for the remaining 90% (water is pumped against any economic concept from the Danube at great distances on three terraces with three pumping stages that can exceed the height of 270 m (3).) Subcommittee 3's report appreciates as a performance of that time the fact that in a relatively short time about one and a half million hectares have been equipped for irrigation.

In fact, the speed at which the so-called national irrigation system has been built has increased rapidly since 1965, when N. Ceaușescu practically led the state. In 1965, only 230,000 ha were set up in Romania, accounting for just over 2% of the country's arable land area, which means that in only 24 years 3 million hectares have been set up for irrigation, with over 120 thousand hectares per year on average (7).

According to the operative records of the builders, in some years the setting up of over 200 thousand ha was being reported. The price of this performance was reflected during the exploitation period when the technical and economic design parameters were not reached even by 50% (7).

The Danube was targeted as a safe source of water for more than $\frac{3}{4}$ of the irrigation systems in Romania, invoking the dry character of the area, the purpose for which the entire string of lakes and ponds on the left bank of the Danube was previously drained, including the two main premises Balta Brăilei and Balta Borcei, amounting together about 1300 thousand hectares. This is shown in Table 3, in the Argeș-Ialomița-Siret area, where over 70% of the irrigation facilities were built on previously drained land (in fact the two categories of works were carried out simultaneously).

In the irrigation field, the subcommittee lists the main causes for which systems are only used to a limited extent, namely at a utilization rate of 9.5%, compared to a minimum of 70%, the proportion that would make the irrigation systems become cost-effective. These causes could be:

- lack of necessary watering equipment;
- lack of sprinklers required to move 18-22 hours / day watering facilities;
- lack of self-propelled watering installations (of linear, pivot-center, drum and hose type);
- failure to complete delivery / receipt protocols on unidentified owner (non-eligible) areas;
- the high value of the annual fees for maintenance and reparation;
- the high value of water delivery fees depending on the pumping stage, the source, etc.

Due to these and other unspecified causes, not even the area for which water user organizations have been set up is being irrigated, and even these are constituted only for an area representing 34% of what could be irrigated. Specifically, the water delivery fee for irrigations depends on:

- Source water pumping height at the point of delivery for the OUA organization;
- Running capacity of the pumping stations, which is below 60%, due to wear;
- Reduced efficiency of water transport in the supply network, which can reach below 30% due to reduced water demand;
- The utilization rate of the set up area is very low (below 20%) according to the tables;
- Irrigation rules reduced below the required average size (1,800-2,055 m³ / ha).

The dependence of the water supply fee on the stage of pumping, respectively the pumping height makes the fee between the pumping at the first stage of 38 lei / 1,000 cubic meters to increase to 267 lei / 1,000 cm per second stage and to 1,000 lei / cm per the third stage, that is over

26 times (Pietreni system, Galați County); in other irrigation systems it reached 1,800 lei / 1,000 cm.

Regarding the state of land reclamation facilities it differs from one system to another and from one type of facility to another. For example, for drainage facilities, if 77% of the area is maintenance-friendly, on the rest of the surface, the drainage canals are not properly maintained due to both the lack of money and of the staff.

In the anti-erosion facilities, a degradation of the administrative works is noted, claiming the lack of money, of the human resource, but also of the specific equipment. In the flood protection facilities, respectively the dams, which measure 1.158 km on the Danube, maintaining under control the infiltrations through these bodies is being endeavoured. The floods in 2006 were a test of their effectiveness. In some areas, the dams gave in and the respective sites were flooded, in other cases artificially breaking the dams and flooding of the respective enclosures were necessary.

Returning to the subject of irrigations, subcommittee no. 3 considers that the drainage of the Danube Floodplain and the equipment for agriculture within an irrigated system are justified by the superior fertility of the lands and by the results of the research units in the area. In fact, the harvests obtained during the exploitation phase of the works were far lower than the design and research data (7).

Regarding the legislative and institutional evolution of the land reclamation sector, the report draws a comparison between the situation prior to 1990 and post-1990, finding the former much more complete and rational, and, as was the case for the other three subcommittees, it blames Law 138/2004, whose provisions greatly damaged the sector. The report ends with a detailed analysis of the staff, considering that the ratio between the indirectly productive administrative staff and the directly productive staff, in a smaller number, is a mistake.

3.7. Subcommittee No. 4's findings from the Parliamentary Commission of Inquiry on the irrigation systems situation, as well as other land reclamation sectors

The Report of Subcommittee no.4 of inquiry differs from the previous ones since its expert and rapporteur had participated starting with 1990 in commissions of inquiry to many analyses of land reclamation works. As a researcher at the Institute of Agrarian Economy of the Agricultural and Forestry Academy, he had done his own studies and analyses regarding the evolution of land reclamation works, as well as their behavior in the exploitation phase in all aspects, including their technical and economic performance. In addition, since 1991 he participated in joint teams, on the part of Romania, with foreign firms that carried out rehabilitation studies of land reclamation works in Romania. We consider that all of these can contribute to understanding the findings and proposals of the 2009 parliamentary inquiry.

The area of inquiry of Subcommittee no. 4 includes the ANIF branches:

- Dobrudja, with Constanța and Tulcea counties and three administration units: Tulcea, Constanța North and Constanța South.
- Moldova South, with Galați, Vrancea, Vaslui and Bacău counties and five administrative units: Galați South, Vrancea, Bacău, Vaslui and Galați North.
- Moldova North, with Iași, Botoșani, Suceava and Neamț counties and four administrative units: Iași, Botoșani, Suceava, Neamț.

Table 4

Areas set up with land reclamation works
in the branches of ANIF Moldova South, Moldova North and Dobrudja

Branch	Irrigations	Drainage	Soil erosion control	Embankments
Moldova South	222.098	168.151	638.009	31.206
Moldova North	76.438	107.555	310.810	7.613
Dobrudja	582.508	52.127	91.651	45.756
Total	881.044	327.833	1.040.470	84.575

Source:

According to the reports submitted by the three branches, they manage the following facilities capacities, expressed in terms of areas (Table 4). The data source for the irrigation facilities (agricultural area) are Romania's statistical yearbooks, and for the drainage and CES facilities - the departmental statistics, as for these categories of works there are not even to this day data approved by the official statistical system.

The facilities for the maintenance and exploitation of the areas mentioned in Table 4 are represented by infrastructure works, equipment installations and works of art, specific to each category of works. In terms of the share of the four categories of facilities, the branches differ significantly :

- irrigation facilities are dominant in Dobrudja, where hydro-ameliorative facilities twice exceed the set up areas in the other two branches;
- drainage facilities are dominant in Moldova North and Moldova South branches;
- anti-erosion facilities in Moldova North branch occupy a larger set up area than the other two branches together;
- embankments have the highest share in Dobrudja and Moldova South.

Table 5
Areas equipped for land reclamation works on counties in Moldova and Dobrudja

County	Irrigations ha	Drainage ha	Soil erosion control ha
Bacău	24042	3623	108786
Botoșani	23684	10541	9514
Constanța	430247	15491	35889
Galați	145116	59218	161220
Iași	52950	47512	127671
Neamț	9496	11131	36397
Suceava	3864	48698	83192
Tulcea	159881	32790	56612
Vaslui	30401	41186	177120
Vrancea	37384	54174	51898
<i>Total</i>	<i>917065</i>	<i>324364</i>	<i>933896</i>

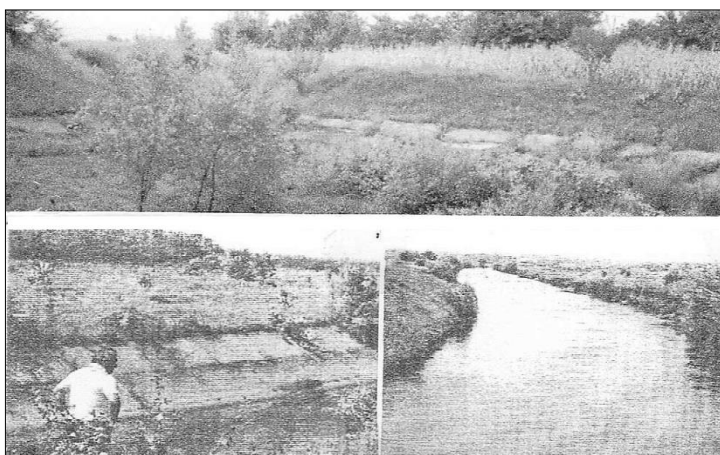
Source: ISPIF Bulletin, year II/1992

We note that the figures included in the table differ, with some exceptions (in the case of irrigations - from Romania's statistical yearbook for the end of 1989, and in the case of drainage and erosion control - from data published by the Land Reclamation Department. In fact, the parliamentary inquiry takes place almost 20 years after the data considered official at the end of 1989.

We find interesting the fact that the two Dobrudja counties of Constanța and Tulcea hold about 2/3 of the area set up for irrigation for the entire eight counties analyzed by subcommittee no.3. This happens although at least the southern part of Moldova has the same degree of aridity as Dobrudja.

3.8. The state of land reclamation works in Dobrudja and Moldova

The 2009 parliamentary inquiry is willy-nilly a *photograph taken* of the situation during the period in which it was made, but what has been noticed is the consequence of a past period that



Source: Author's archive

Figure 1. The main penstock for the irrigation system Carasu-South Constanța county (100 thousand ha) in 2009 (up) and in 1991 (down)

influenced in many ways the state seen and recorded in 2009. This past period is variable from one work to another, which does not result from the findings of the inquiry.

At the beginning of subcommittee no.4's report we mentioned that its rapporteur, A. Lup, is an old researcher in the field of land reclamation at a national level and some of the information and data he possesses can explain many of the findings made by the parliamentary commission in 2009, not only regarding the status of the land reclamation works, but also the mode of exploitation, including technical and economic results obtained on lands

equipped for reclamation works.

Subcommittee no. 4 finds, similarly to the previous three committees, a state of degradation of the works' infrastructure. In most cases, degradation is due to exploitation and maintenance, but also in most cases some deficiencies arise from their construction or set up.

As an example, we present the case of the main penstock and irrigation system Carasu in



Source: Author's archive

Figure 2. Base pumping station of the Caras-South irrigation system in conservation

Constanța county. The parliamentary commission of inquiry finds it in 2009 dry and abandoned (up), but in 1991 it was full and provided water for an area of over 100 thousand hectares, only it was not lined since its construction and it operated in this manner for 20 years with a water loss of 30-60% (1990 Report). Or the base pumping station of the same system, one of the most powerful in Europe (fig. 2). In 2009, it was (and still is) preserved, it can be turned on, only that the yield does not correspond to the figures in the catalog (11).

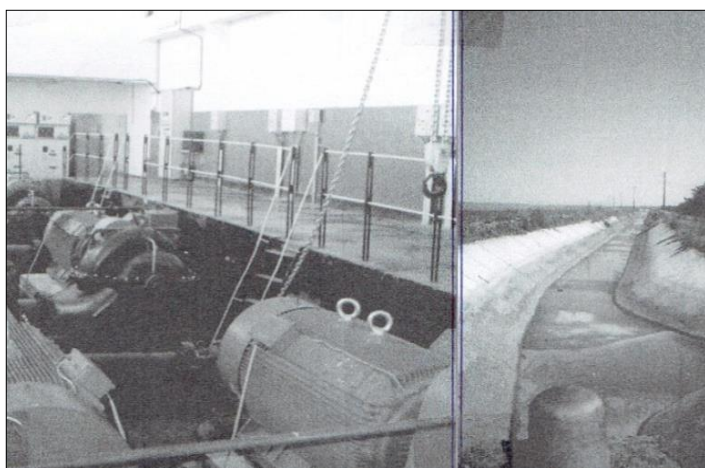
In the Moldova South branch, out of the 259 irrigation pumping stations 64% are functional, 28% are not and 8% require

rehabilitation. In the North Moldova branch, out of the 175 irrigation pumping stations 10.4% are functional, 64.8% are non-functional and 24.8% require rehabilitation.

rehabilitation. In the Moldova North branch, out of 175 pumping stations 10.4% are functional, 64.8% not, and 24.8% require

In Dobrudja, only 5.8% of the irrigation pumping stations are functional, 52.4% are not, and

41.8% require rehabilitation. In all cases, that is in all three branches of Dobrudja, Moldova South and Moldova North, comprising an area of 860 thousand hectares equipped for irrigation, the distribution network requires rehabilitation in proportion of over 90%. As a consequence, the inquiry reveals some works for the rehabilitation of the pumping stations and irrigation water distribution network (Figure 3).



Source: Author's archive

Figure 3. Rehabilitation works of a pumping station and a water distribution channel in the Carasu system Constanța county

Before 1990, when major reclamation systems were built, a special attention was given to irrigations compared to combating excess moisture or erosion, unless the latter two were constituent parts of the irrigation facilities,

or even overtook them, as was the case in the Danube Floodplain, where the lands to be set up for irrigation were first drained. The report of the 1990 governmental commission expressly mentioned the priority given to irrigations: *The works have been carried out since 1966, at unreasonable rhythms, in the last 15 years, in particular the extension of the irrigated areas has been pursued.* The priority given to irrigations was also reflected in the volume of expenditures incurred for their exploitation. In 1992, for example, for the 461.4 thousand ha irrigated, 12470 thousand lei were spent, returning 27025 lei / ha, for 3058 ha drainage 3455 thousand lei were spent, returning 1130 lei / ha (almost 24 times less), and for 1795 thousand ha of anti-erosion facilities, 297.5 thousand lei

were spent, returning only 166 lei / ha, that is over 162 times less than for irrigations, which did not prevent the managers of the RAIF subsidiaries (Autonomous Land Reclamation Authority at that time) to complain about the lack of funds. It is no surprise, thus, that in 2009 the parliamentary commission of inquiry would come across drainage stations as shown in Figure 4 or drainage channels as those in Figure 5.

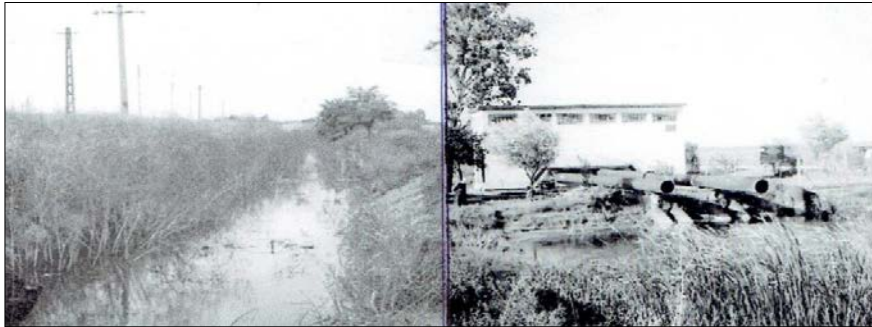


Figure 4. Drainage channel in the Carasu complex of Constanța county and the Hârșova drainage station in Constanța county (Author's archive)



Figure 5. Drainage channel in Iași county, non-lined (2009) (Author's archive)

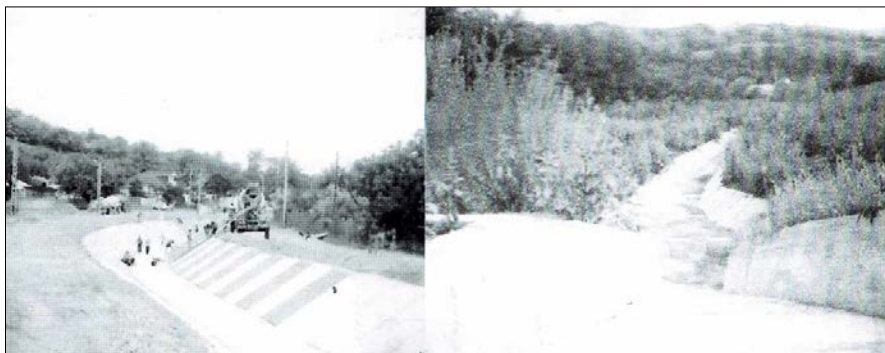


Figure 6. Drainage channel in the course of lining (left) and rehabilitated coastal channel (right) in Iași county (2009) (Author's archive)

In 2009, members of the commission of inquiry noted an intense activity of rehabilitation of land reclamation works. In the images of Figure 6, on the left side a drainage channel is being lined, and on the right a coastal channel was just lined in order to collect rainwater and prevent soil erosion.

3.9. Exploitation of the irrigation systems during the analyzed period

Table 6

Set up areas, functioning areas, and areas on which OUAI was established (2009)

Branch	Functioning areas - ha	Functioning areas total - ha	Share of functioning areas %
Moldova South	93.250	207.136	45,0
Moldova North	12.026	76.439	15,7
Dobrudja	162.391	582.508	27,9
Total	267.667	866.083	30,9

Source: 16

The data centralized in Table 6 show that the share of functional areas, meaning irrigable, of the total surface area is 45.0% in Moldova South branch, 15.78% in the Moldova North branch and 27.9% in Dobrudja, the average of subcommittee no.4 being 30.9%. On the other hand, OUAI were established on areas that differ from the areas assessed as functional, as follows:

- 71,302 ha: 75.6% in

Moldova South branch

- 1,395 ha: 11,6% in Moldova North branch

- 24,597 ha: 15,5% in Dobrudja branch

The areas on which the OUAI were established were not fully surrendered to the latter, but only in a proportion of:

- 82.6% in Moldova South branch

- 15.7% in Moldova North branch

- 27.8% in Dobrudja branch

- 66.2% average of subcommittee 4

Areas irrigated during 2006-2009. In the 2006-2009 period, the area contracted by the beneficiaries increased in all three branches: 186.4% in Moldova South branch, 8.7 times in Moldova North branch, 163.8% in Dobrudja, the average of the three branches being 185.0%. In contrast, the actual irrigated area was much lower than the contracted area and variable from one year to the next (Tables 7-9).

Table 7

Areas contracted during 2006-2009

Branch	2006	2007	2008	2009
Moldova South	42.425	81.525	108.800	121.521
Moldova North	420	3.608	3.546	3.660
Dobrudja	14.202	41.260	36.364	37.470
Total	57.047	126.393	148.710	162.651

Source:16

Table 8

Irrigated areas (watering I) during 2006-2009

Branch	2006	2007	2008	2009
Moldova South	16.570	49.055	32.642	40.661
Moldova North	106	2.444	1.295	1.814
Dobrudja	4.281	27.012	13.819	18.415
Total	20.957	78.511	47.756	60.890

Source:16

Table 9

Share of areas actually irrigated, compared to those contracted during 2006-2009

Branch	2006	2007	2008	2009
Moldova South	39,1	60,2	30,0	33,5
Moldova North	25,2	67,7	36,5	49,6
Dobrudja	30,1	65,5	38,0	49,1
Total	36,7	62,1	32,1	37,4

Source: 16

In 2006, 39.1% of the contracted area in Moldova South branch was actually irrigated; 25.2% - Moldova North; 30.1% - Dobrudja, with an average of 36.7% on the entire analyzed area. In 2007, an area over two times larger than in 2006 was contracted, and an almost four times larger area was irrigated, which is explainable by the severe drought that year. In 2008, although an area

almost 18% larger than in 2007 was contracted, a 40% smaller area was actually irrigated than in the previous year. In 2009, both contracted and actually irrigated areas increased, but the difference compared to the functional areas, thus, irrigable, is huge. On the entire analyzed area, only slightly more than a fifth of the irrigable areas were irrigated in 2009.

We note that although the actual watering situation in 2009 is dated at the beginning of July, it is conclusive, because for the 2007-2008 agricultural year, even if new areas appeared after this date, they are insignificant in the assessment of the phenomenon. Comparing the actual irrigated areas with those for which watering equipment is available shows that there was less irrigation actually done than it would have been possible with the existing equipment, with 4,164 ha in Moldova South branch, 501 ha in Moldova North branch, and 25,450 ha in Dobrudja. On the entire area, the actual irrigated area in 2009 was 30.115 ha more than what could have been irrigated with the existing equipment. However, this area is still much smaller than the contracted area, resulting in a significant shortage of watering equipment.

It is estimated that one of the reasons for which irrigation is reduced is the shortage of watering equipment. For the patrimony area on the entire analyzed area, the share covered by irrigation equipment is 11.2%, and for the subsidiaries - 3.0% for Moldova South, 20.1% for Moldova North and 8.8% for Dobrudja. In contrast, for the OUA established areas, the situation is somewhat better, 32.7% for the entire area, 21.7% for Moldova South, 27.2% for Moldova North and 42.3% for Dobrudja.

3.10. The extention of land reclamation works in the the second half of the 20th century

Table 10
The evolution of irrigation facilities,
compared to the works of embankment-drainage
and soil erosion control

- thousand ha -

Years	Irrigations	Embankments	Drainage	Soil erosion control
1944	-	622,2	358,0	-
1950	42,0	642,0	368,1	2,0
1955	93,1	668,8	404,4	9,4
1960	199,6	827,1	505,7	100,0
1965	229,9	856,7	587,0	197,5
1970	731,3	1331,9	1111,4	435,3
1975	1474,2	1455,2	1965,5	983,1
1980	2301,0	1545,0	2462,5	1609,7
1985	2956,3	-	2948,8	2095,5
1990	3187,8	-	2959,3	2134,5
1995	3211,0	-	3199,5	2208,2

Source: DGEIFCA, Romania's Statistical Yearbooks

Throughout the paper, we have stated that the 2009 parliamentary inquiry was one of the most extensive both in terms of duration, and due to field trips and the actual view of the status of different categories of works across the entire country.

We have also stated that subcommittee no.4's report would be much broader, including a series of additional data prior to the inquiry, but contributing to a better understanding of the state of the facilities in 2009. However, in 2009 the inquiry repeats - in an extensive form, regardless - numerous analyses, discussions, symposiums, conferences on land reclamation, and especially on irrigations,

considered one of the main problems of Romania's agriculture. And, also as in previous analyses, the inquiry has as its subject the legacy left by the totalitarian communist regime at the end of 1989.

How did the pro-communist regime, installed on March 6, 1945, have the necessary resources, this is another story that will have to be written in an economic history of the Romanian agriculture of this period. We note that in the first 20 years of governance, 1945-1965, the achievements in this field are modest: 230 thousand ha of irrigations, 587 thousand ha - drainage and only 197,5 thousand ha - soil erosion control. Although at least in the case of irrigations following the model of the Soviet Union, the first program launched in 1950 (8) would be called the "*Electrification Plan*", as about 300 thousand ha of agricultural land would be irrigated from the reservoir of the hydro-electric plant to be built. (The hydro-electric plant was built, but no hectare has ever been irrigated from the Bicaz reservoir. A change would happen in 1965, when N. Ceausescu would lead the Communist Party and Romania.

The creation of facilities would continue, at a cracking pace we could say, in some years more than 250 thousand ha being reported to be operational. Unhappy even with this rhythm, in 1983 the Great National Assembly (the Parliament of Romania of that time) elaborated and approved the most ambitious program of land reclamation that would largely solve the requirements in the field assessed by the experts of that time.

The provisions of this program had to reach the following figures at the end of 1989: 5500 thousand ha of irrigations; 5530 thousand ha of drainage (including combating excess humidity) and 5300 thousand ha of soil erosion control works (Table 11) and it was called "*The National Program for ensuring safe and stable agricultural productions by increasing the productive potential of the land, better organizing and unitary use of agricultural land, of the entire area of the country, performing irrigations on approx. 55-60% of the arable land, drainage and soil erosion control works*" (9).

The 1983 program's provisions

- thousand ha -			
Action	Area to be set up (potential)	Set up area at 31 dec. 1982	Area left to be set up
Facilities for irrigations	5500	2380	3120
Drainage	5530	2576	2954
Soil erosion control	5300	1718	3582

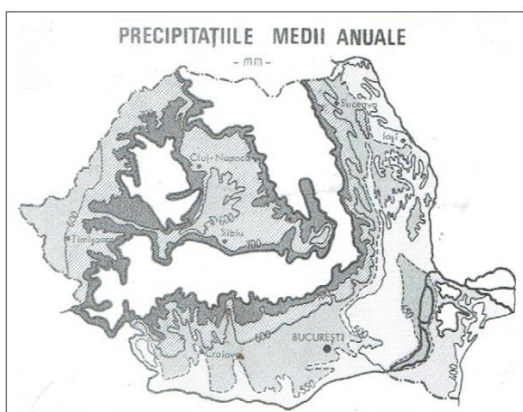
Source: DGEIFCA data and Romania's statistical yearbooks

Table 11

The text of the program explicitly states that it was elaborated *according to the guidelines and instructions of comrade Nicolae Ceaușescu*. As at the end of 1982, 2380 thousand ha were equipped for irrigations, 2576 thousand ha for drainage and 1718 thousand ha for anti-erosion works, what would be set up in the next 6-7 years surpassed everything that had been set up throughout the

entire history of land reclamation in Romania. Moreover, the program stipulated that by the end of 1985, the counties of Constanța, Tulcea and the Ilfov agricultural sector would be fully equipped for irrigations, and in the counties Maramureș, Satu Mare, Sălaj, Bihor, Arad, Timiș, Caraș-Severin and Brașov the entire area with excess moisture would be drained.

A special case would be Dobruđja which, unlike the plain on the left bank of the Danube, consists of a sum of plateaux. Without achieving the program's provisions, the arable land was set



Source: 4

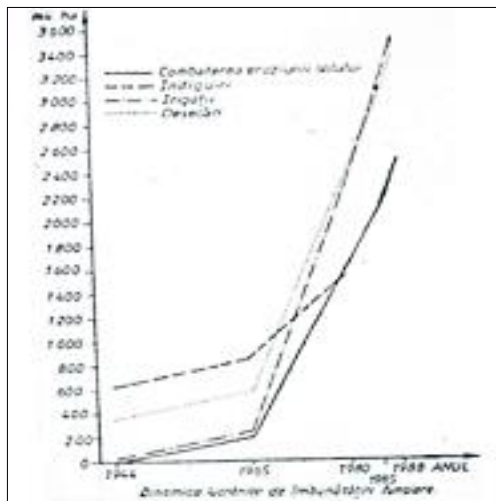
Figure 7. Territorial distribution of annual average rainfall in Romania

up in 82.4% of Constanța county and 54.8% of Tulcea county (7). And the water pumping heights, respectively the energy consumption for this pumping 916 kWh / 1000 cm of water in Constanța county and 1207.3 kWh / 1000 cm in Tulcea county exceeded more than 2 times the country average of 484 kWh / 1000 cm.

The explanation lies in the aridity of the most severe area, as results from the line linking the lowest rainfall points 400 mm annually (fig.7), but also the insistence of a local chief of state agriculture and deputy minister of agriculture at that time.

The program launched in 1983 was not implemented, at the end of the year 3109 thousand ha were equipped for irrigations (56.5% of the program), 3085 thousand ha for drainage (55.8% of the program) and 2222 thousand ha for anti-erosion works (41.9% % of the program). After 1989, state policy on land reclamation focused on the rehabilitation of areas set up till that date, both due to wear and degradation of the works' infrastructure, and especially due to the low level of completion of the works even during the period in which they were done.

The governmental commission for the analysis and solving of problems related to land reclamation works (the author of the present paper was a member of this commission) explains thus the quality of the hydro-ameliorative facilities and especially the speed with which they were carried out (fig.8).



Source: IGEFCOT

Figure 8. The extension of land reclamation works (1944-1988)

The works have been carried out since 1966 at unreasonable rhythms, in the last 15 years in particular the expansion of irrigated surfaces was pursued, in some cases abandoning technical requirements in design and execution and environmental protection requirements. About 40% of the irrigation channels are not lined, water losses reaching 30-60%, the pumping aggregate yield is below the catalog values, the watering equipment has a low reliability, others are technically outdated (11).

After 1983 little was set up, only 729 thousand ha of irrigations instead of 2380 thousand ha, 509 thousand ha of drainage instead of 2954 thousand ha and 504 thousand hectares instead of 3582 thousand hectares of anti-erosion works, on the whole 1742 thousand ha instead of 8916 thousand ha, that is over five times less. In fact, in 1981 Romania would become insolvent, and N. Ceaușescu's ambition to liquidate external debts would put agriculture to the test and the population of Romania would suffer deprivations of all kinds.

Not only due to speed, but also to lack of financial resources parts or essential components such as automation, water volume measurement, drainage, water recirculation system were abandoned. All this would negatively impact on the technical and economic performance during the exploitation phase.

The fall of the communist-totalitarian regime at the end of 1989 stopped the program from 1983, the level reached as we have shown before being 3109 thousand ha of irrigations, 3085 thousand ha - drainage and 2222 thousand ha - anti-erosion works, figures that would constitute after 1990 subjects of studies, inquiries, rehabilitation projects. The program of 1983 also contains figures spread out on counties, and the achievements are also known (table 12).

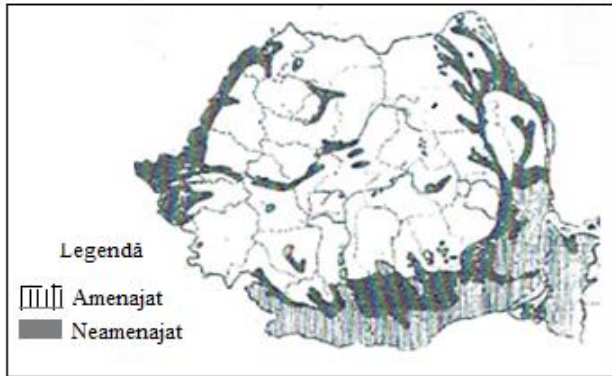
Table 12

Irrigated areas in the years 2007, 2008 and 2009, compared to the surface set up in 1989

County	Set up in 1989	Irrigated			County	Set up in 1989	Irrigated		
		2007	2008	2009			2007	2008	2009
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>
Total country	3167262	319998	257666	287999	Harghita	305	0	0	0
Alba	4676	0	0	0	Hunedoara	9652	0	0	0
Arad	29130	1721	2625	3539	Ialomița	203238	26699	22192	33199
Argeș	35083	641	0	20	Iași	52950	2241	1259	1463
Bacău	24042	1296	420	709	Maramureș	330	0	0	0
Bihor	12851	0	0	0	Mehedinți	79878	0	0	0
Bistrița-Năsăud	23684	300	36	575	Mureș	3466	0	0	0
Botoșani	2653	0	0	0	Neamț	9496	0	0	0
Brașov	379579	111776	90307	109670	Olt	178161	8908	9286	8727
Brăila	31500	2113	1541	1172	Prahova	17782	238	111	16
Buzău	445	0	0	0	Satu Mare	7180	0	0	0
Caraș-Severin	371961	48025	19648	23918	Sălaj	1160	0	0	0
Călărași	10721	0	0	0	Sibiu	2700	0	0	0
Cluj	430247	9306	6382	6281	Suceava	3864	0	0	0
Constanța	4789	993	961	1296	Teleorman	241514	11439	6033	9019
Covasna	38272	0	0	0	Timiș	15379	0	64	64
Dâmbovița	316625	29949	56015	21557	Tulcea	159881	17538	7437	16156
Dolj	145116	43266	30518	39352	Vaslui	30401	414	1404	5303
Galați	1336	0	0	3853	Vâlcea	11697	0	0	0
Giurgiu	0	0	0	0	Vrancea	37384	1020	1360	2040
Gorj	0	0	0	0	Mun.București	62490	0	0	0

Source: DGEIFCA

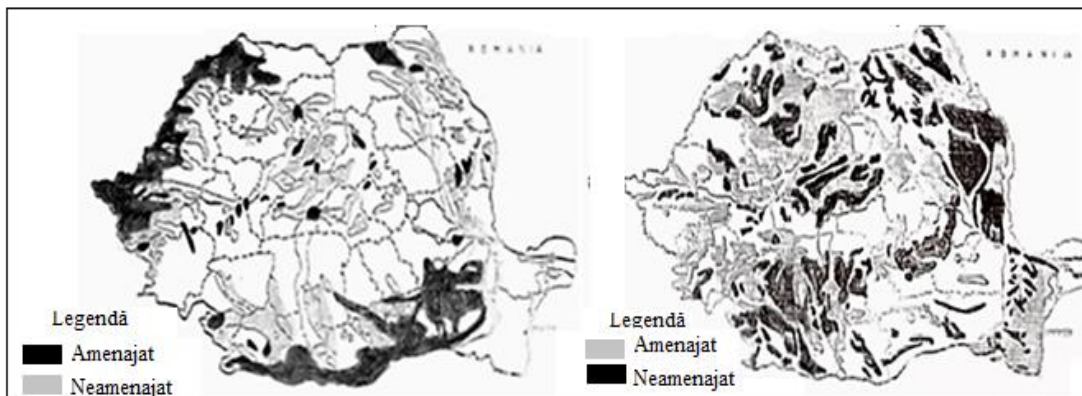
The data presented in Table 12 show that from the ANIF's patrimony area, namely 3167,3 thousand ha, in 2007 320 thousand ha (10,1%) were irrigated, in 2008 258 thousand ha (8,1%) were irrigated, and in 2009 288 thousand ha (9.1%) were irrigated, the average on the three years being 9.1%. On the other hand, the reporting of the irrigated area to the three million hectares inherited from the communist-totalitarian regime in 1989 is purely formal because with all the rehabilitation programs (within one of these, ANIF aimed to rehabilitate 2,2 million hectares by 2007, and even 3 million hectares by 2011), ANIF reports in 2009 an area of 2998 thousand hectares set up in the entire country, out of which only 1535 thousand ha viable (51.2%). In relation to the viable area, the share of the actually irrigated area in the analyzed period would double, that is 18.2%, still being too little. From the same table we can see that in 16 counties, comprising 206814 ha set up during the analyzed period, no hectare was irrigated, and for some of these the respective subcommittees propose scrapping. Figures 9-10 show the territorial location of the three categories of land reclamation: irrigations, drainage and soil erosion control.



Source: DIF-ANIF

Figure 10. Lands affected by drought in Romania and the degree of set up at the end of 1989

The set up and not set up lands mean in figures the provisions of the program of 1883, that is 5500 thousand ha of irrigations, 5350 thousand ha of drainage and 5300 thousand ha of anti-erosion works, and the lands which according



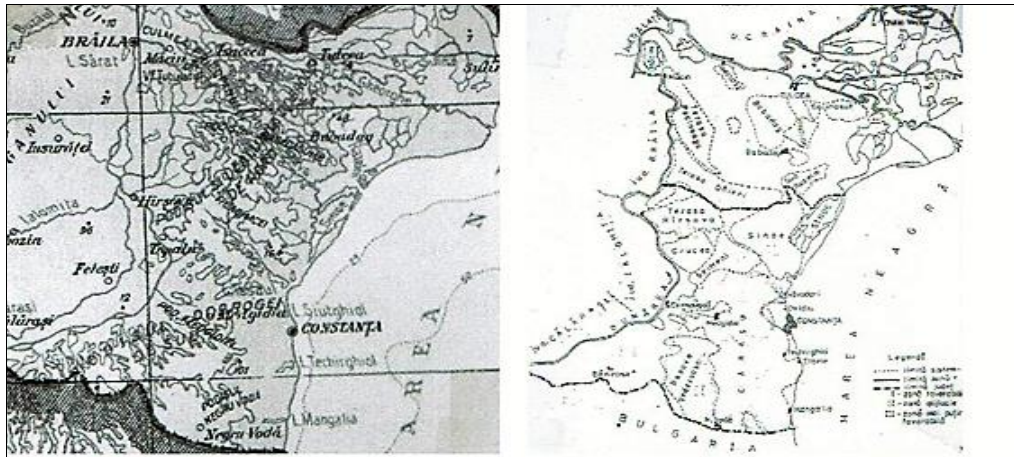
Source: DGEIFCA

Figure 9. Lands with excess moisture (left) and eroded lands (right)

to the legends on

the maps are set up represent the achievements up till the end of 1989, the not set up ones represent the difference from the 1983 program's provisions.

The case of Dobrudja. In the history of anti-drought facilities in Romania, Dobrudja is a special case. The province was equipped for irrigations in a similar large proportion to the plain counties of the Danube Floodplain, although the relief of the province is far from being flat - in fact it is true that the whole province is a sum of low plateaux (fig. 11), but less suitable for large set ups. For example, Constanța county was set up in a proportion of over 82% comparable to the Calarași plain county (86%), and Tulcea county with Măcinului Mountains was set up in a proportion of almost 55% comparable to Ialomița county (54%). The main argument for this economic policy decision was the drought, but also the reference to the recommendation of Romanian agronomist savant Ion Ionescu de la Brad to the sultan of the Ottoman Empire following his trip to Dobrudja in 1850, when Dobrudja was still a part of the empire. Here is the so-called recommendation of Ion Ionescu: *Plants suffer more from lack of water than of nutrition. This country's main flaw lies in the lack of water, so on an environment of plenty, cheap water depends the entire improvement of this country's agriculture.* Even if the Danube had provided plenty of water it would not have been cheaper as we will see in the following pages.



Source: ANIF Constanța

Figure 11. The relief of Dobrudja compared to the plain - also cleared- on the left of the Danube

The solution for a lot of cheap water would have been the forest, only the empire had cleared Dobrudja, a fact confirmed by a resident of Dobrudja of that time: *An old Tartar made a rather fair climate observation: Nowadays, the villages in Dobrudja are only established where there are water springs, but if there are no more villages, that proves that the springs have dried up, and we know that springs do not dry up where large forests stand (6).* And in Dobrudja there are no longer forests. The Ottoman Empire, both prior to the visit of Ion Ionescu de la Brad, but also afterwards, and then the Romanian railway constructors continued taking care to compensate the province.

At present the share of forests within the total area is 5.5% in Constanța county, 11.2% in Tulcea county and 8.6% in Dobrudja. Nor are there forests in the Danube Floodplain: Dolj county 10.9%, Olt county 10.9%; Teleorman county 5.1%; Giurgiu county 10.7%; Călărași county 4.2% and Ialomița 5.8%, knowing that the minimum share of the forest in any territory is 20.0%. In Dobrudja, in order not to disturb the future network of irrigation channels, even the curtains for forest protection were cleared.



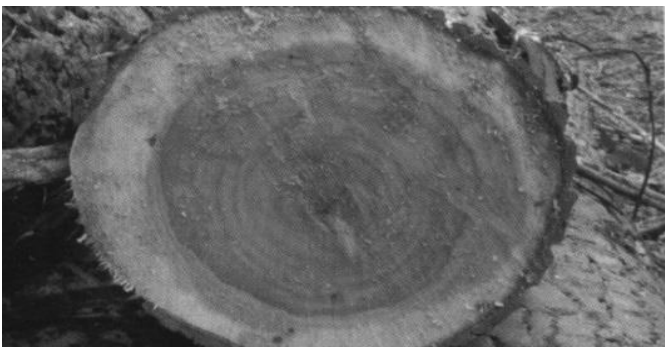
Figure 12. Hill tops with up to date rocks suitable for afforestation in Tulcea county (Author's archive)

In the report of ANIF's Dobrudja branch it is stated that in Dobrudja the main activity is irrigation, although in the province there are still over 100 thousand ha of little productive pastures and hill tops with up to date rocks as in figure 12.

Afforestation of these areas would improve the rainfall regime and we would have *a lot of cheap water* as required by Ion Ionescu de la Brad in 1850. The situation is similar in the Danube Floodplain.

The Danube Floodplain and the Danube Delta.

Unlike Dobrudja, both the floodplain of the Danube and the Danube Delta were relatively well afforested, did not suffer from drought and were also flat. Here, the very forests and excess water were hindering their transformation into high productivity agricultural lands. The fact that the Danube Delta was a public property, and the floodplain of the Danube had long before been owned by the state constituted premises favorable to their transformation into cultivated lands of the



Source:5

Figure 13. The quality of Euramerican poplar trunks from the floodplain area of the Danube, suitable for superior use

state. To this end, by a decision of the Council of Ministers (signed by Prime Minister Ion Gheorghe Maurer at that time) since 1962, about 300,000 hectares were to be drained, in order to be protected by the periodic or annual floods of the river (10). Over a length of more than 1100 km a non-submerged dam was built, and behind it, on the drained lands large state-owned agricultural enterprises were constituted.

The forests were cleared - 43 thousand ha. The ponds were drained, over 50 thousand ha (5). Thus, from a damp environment, the floodplain of the Danube became a dry environment which, in order to be cultivated, had to be imperatively irrigated. More than 100 water pumping stations for irrigation have been built along the Danube, and as many for drainage due to infiltrations through the dam (5). In the Danube Delta, also, nearly half of its area was to be drained - more

than 200 thousand ha. A single enclosure of about 30,000 ha was drained.



Source: 5

Figure 14. Euramerican poplar logs for rotary cutting, obtained from the floodplain area

3.11. Analysis of the Land Reclamation Works of 1990

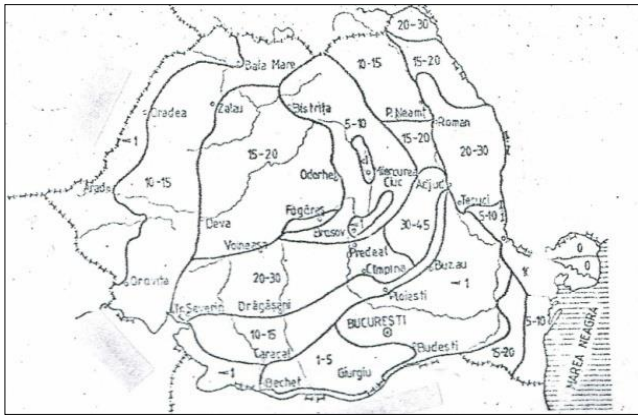
At the end of 1989, when the totalitarian-communist regime fell, the program of 1983 in the field of land reclamation was in full swing, with the known areas (5500 thousand ha -irrigations, 5530 thousand ha - drainage, 5300 thousand hectares - soil erosion control). At that time, more than half of the program's provisions for irrigation and drainage and about 40% of anti-erosion facilities were implemented. The fall of the dictatorial political regime was the beginning of the transition to the market economy in which the financial resources were to be distributed according to the principles of market economy, so investments in land reclamation works that accounted for over 1/3 of the total investments in the country were questioned. However, not only the investments, but also the human resource involved in this field, about 85 thousand people from research, design, constructions. Through the branch syndicate and the leadership of the respective institutions, their representatives addressed the state power institutions: the Government, the Senate, the Chamber of Deputies, asking for clarification regarding their future fate.

In response to these requests, the Prime Minister (Petre Roman, at that time) appointed a *Commission for the analysis and resolution of the problems related to land reclamation works*. Made up of specialists in the field representing the relevant ministry, specialized university education, profile research, state agriculture as the main beneficiary, the commission had two months to draft a report with the proposed solutions (11).

In the first part of the works, the commission composed of seven members, including the author of the present paper, compiled an inventory of the works: 705 objectives (actually, work sites) classified by type of work: irrigation, drainage, soil erosion control, and at the same time by execution phases, as follows:

- works to be finalized in 1991;
- works sealed for preservation;
- works with a minimum volume of works proposed for completion;
- works completely shut down (45 irrigation objectives, 36 drainage works and 1245 soil erosion control facilities).

Also in the first part of the report after the enunciation of the patrimony: 3188 thousand ha - irrigations, 3036 thousand ha - drainage, 2263 thousand ha - anti-erosion works, appraisals are made about the necessity of the works (11). The report furthermore justifies the need for each category of work. The drought is first: *it affects more than 3 million hectares in 7 out of 10 years,*

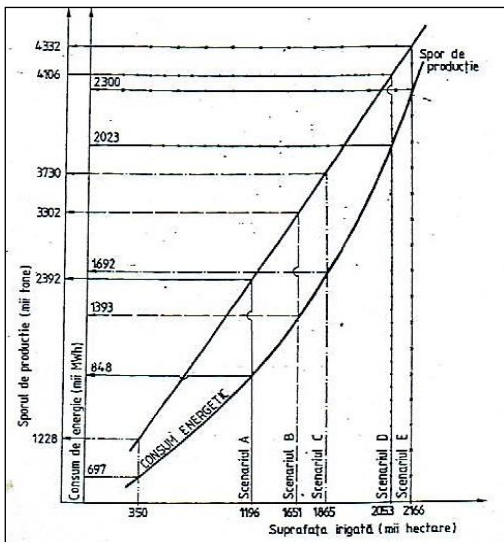


Source: 11

Figure 14. Zoning of annual soil losses due to erosion reaching 50 tonnes / ha / year while the soil recovery capacity is 2- 6 tonnes / ha / year (Figure 15).

The agricultural production is drastically reduced annually, the reservoirs are clogging (on Argeş and Olt some reservoirs have become deltas), highways, roads, bridges are becoming depreciated, landslides happen. These cloggings act alongside the ecological imbalance produced by the anthropic factor. The exaggerated cutting of forests and the abolition of forest curtains have led to an increase in the desertification of entire areas from the south of the country to the Moldova plateau. Erosions in the hillock areas have increased, especially in Vrancea and Buzău counties, and in Dobrudja.

About the land erosion control works, considered the most necessary, the report of the governmental commission states that they have been lagging behind, not being exploited or maintained properly (11). The commission continues to be concerned about the areas that could be irrigated in 1992. This is after recognizing that: *the soil erosion control facilities, the most needed in the land reclamation complex, have been lagging behind...* (11). Then a technical analysis and of efficiency elements in the use of existing facilities is performed. It is considered that *out of the approx. 3.2 million hectares approx. 823 thousand ha cannot be used in 1984 primarily due to the lack of watering installations, as well as due to excessive water loss...* (11).



Source: 11

Figure 15. The graphic of the relationship between production growth, energy consumption and area equipped for irrigations

For an area of 2,380 million hectares the energy consumption and the possible production growth were determined (fig.16). The area of 350 thousand ha from Constanta county is not included (from 4302 thousand ha, that is 81,4%), with specific energy consumption of over 2000 kWh / ha. The production growth considered - 2000 kg / ha of cereal equivalent.

In fact, according to another ISPIF study, from an area of 1332 thousand hectares, comprising the main irrigation systems in Romania, 405 thousand hectares with high energy consumption (over 2,100 kWh / ha), respectively 30% belong exclusively to Constanta county.

An analysis of all irrigation systems in Romania places them among the largest energy consumers. The same government commission report from the beginning of 1990 classifies irrigation systems in Romania according to the energy required for water pumping at 1000 cm and per hectare (tab.13), a classification which shows that 17.4% of the areas belonging to the systems of irrigation in Romania require an energy consumption of more than 700 kWh / 1000 cm of water and 2000 kWh / ha. Energy consumption, in its turn, is determined by two other characteristics of the irrigation systems in Romania, the size and height of water pumping.

According to a scale in which irrigation systems larger than 500 ha are *large systems*, practically everything that has been set up in Romania belongs to the *giant* domain. From a classification on this criterion results the following:

- 4 systems larger than 100000 ha;
- 13 systems with sizes between 50000 and 100000 ha;
- 18 new systems between 25,000 and 50000;
- 29 systems between 10000 - 25000 ha and 39 systems with an average of 5018 ha, the country average being of 28144 ha (7).

As far as the water pumping height is concerned, the irrigation systems in Romania are also among those with the highest heights and distances, especially due to the choice of the Danube as the main source of water and, to a certain extent, to the size of the systems requiring very large transport distances. Almost everywhere in the world irrigations are done from water accumulations from dams on water sources upstream of irrigated surfaces, for example, the dam from the mouth of Rhône in France (fig.17).

Table 13
The need for electric energy for irrigations in 1990, per 1000 cm of water and per hectare, differentiated by pumping steps

Pumping levels kWh		Area -ha-	Share of total area (%)
at 1000 m ³ water	Per hectare		
300	774	719135	23,5
400	1032	0	27,2
500	1290	570703	18,6
600	1548	118399	3,8
700	1806	291414	9,5
800	2064	157186	5,1
900	2322	112199	3,6
1000	2580	66965	2,2
1100	2838	36667	1,2
1200	3096	25362	0,8
1300	3354	36351	1,2
1400	3612	9194	0,3
1500	3878	12525	0,4
> 1500		32797	1,1
40*		45528	1,5
483,9		3062024	

Source: 11

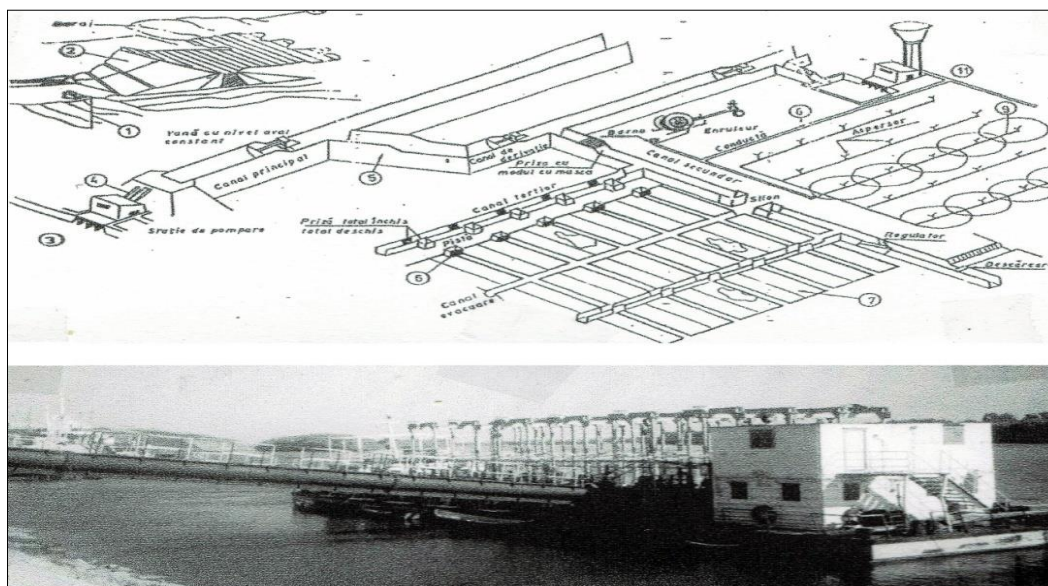


Figure 16 The scheme of the dam on Rhône-France and the downstream irrigated land (up, source 1) and the floating base station of the irrigation system Hârșova, Constanța county pumping water upstream (down, Author's Archive)

The 1990 Governmental Commission hoped that in 1991 an area of 2380 thousand ha would be irrigated, for which all calculations, including energy consumption, were made. In fact, in 1991 only 192 thousand ha were irrigated, that is over 12 times less.

In conclusion, the 1990 governmental commission considers that land reclamation works need to be extended in view of their economic efficiency, but taking into account environmental protection. For irrigations it proposed to continue the works at the Siret-Bărăgan Channel, the Olt-Argeș branch, the Moldavian plateau and the Covurlui Plain.

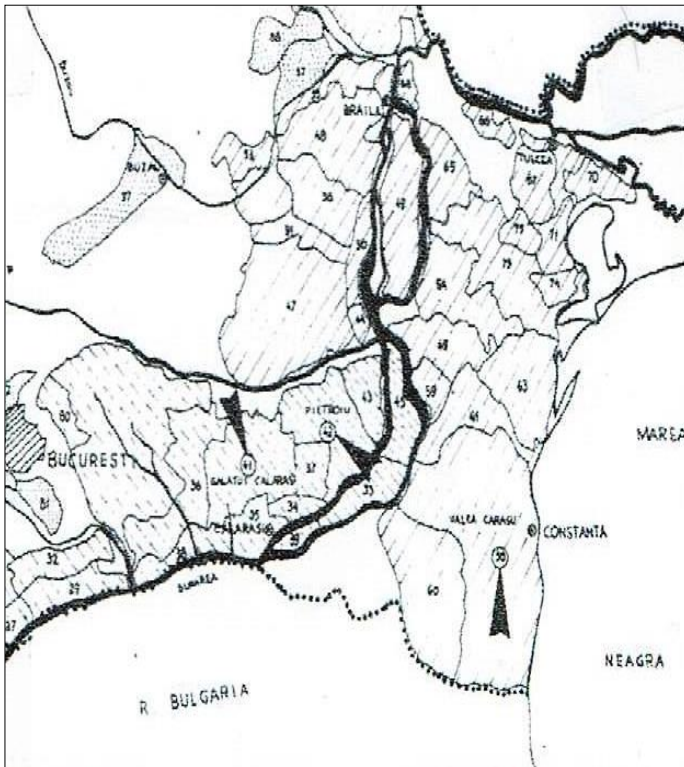
Combating erosion is a priority in the counties of Vrancea, Buzău, Vaslui, Iași, Argeș, Vâlcea, taking into account the fact that soil losses are irrecoverable. The expenditures for the three categories of works were also calculated for 1991: irrigations 3.7-9.9 billion lei; drainage 0.8 billion

billion lei and soil erosion control 0.45 billion lei. Per objectives, totaling over 750, the commission selected 212 objectives worth 0.68 billion lei to be finalized in 1991; the continuation of the works on another 230 objectives amounting to 2.7 billion lei (11).

3.12. Studies and projects for the rehabilitation of land reclamation works after 1990

At the beginning of the previous chapter we stated that only the areas set up at the end of 1989 were taken into consideration, without taking into account a continuation of the program of 1983, which provided 5500 thousand ha for irrigation, 5530 thousand ha - drainage and 5300 thousand ha - anti-erosional facilities, although the figures for the 1983 program were foreseen by certain governments, but for a distant future.

The issue then was the use of existing facilities at the end of 1989, and the governmental commission set up in December 1990 proposed and called on the government to fund the existing works that were considered viable. Still, in 1990, began the collaborations with foreign firms specialized in rehabilitation studies of irrigation systems or complex works such as irrigations, drainage, erosion. The first of these was a collaboration with France (fig.18).



Source: 12

Figure 17. Location of the Carasu irrigation systems in Constanța county, Gălățui and Pietroiu, Călărași county

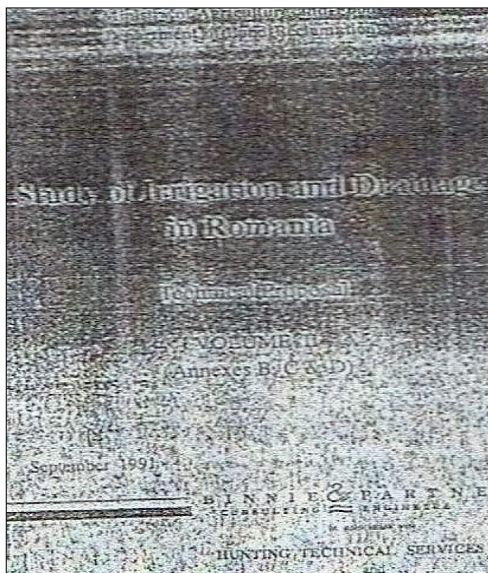
The project Rehabilitation of the Pietroiu and Gălățui in Călărași county and Carasu in Constanța county irrigation perimeters (12). Based on a collaboration protocol between ISPIF-SA Romania and

BRL (Bas Rhône Languedoc company-France), it was agreed to jointly develop a study of *Rehabilitation of Carasu irrigation systems, Constanța county 200,000 ha; Pietroiu-Ștefan cel Mare 55,000 ha and Gălățui 85,000 ha Călărași county* on the basis of a non-reimbursable loan from the French state to cover the expenses incurred by BRL.

The study was carried out between the autumn of 1990 and the summer of 1992 with the investments: 3100 USD / ha for the Carasu system; 2867 USD / ha for the Gălățui system and 2798 USD / ha for the Pietroiu-Ștefan cel Mare system. Finally, an additional net value of 400-455 USD / ha was calculated outside the water price which would be partially subsidized by the state in the coming years. The following percentages of internal profitability for a 45-year period ensued:

Instalment	Pietroiu	Gălățui	Carasu*	Carasu (total)
1	12	10	10	7,5
1+2	10	8,5	8,5	6,5
1+2+3	8	7	6	5,5
1+2+3+4	8,5	7	7	7
1+2+3+4+5	8	7	6	6,5

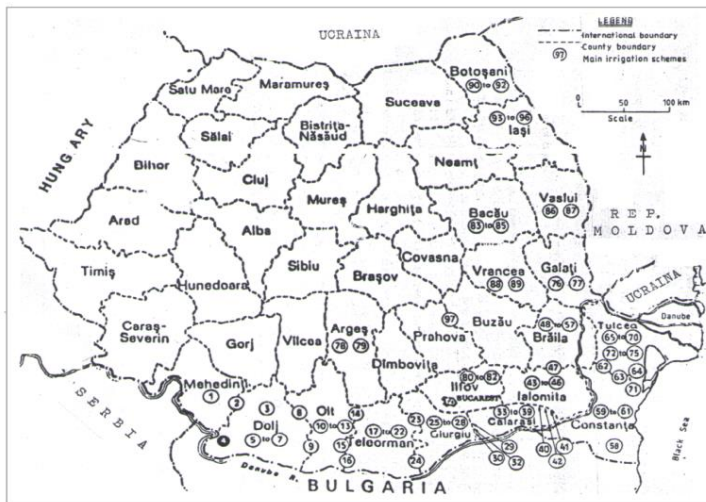
*) Only for the lower parts. (The author of this paper was part of the ISPIF Romania team and contributed to the economic completion of the study)



Source: 13

Figure 19. Cover of the study *Irrigation and Drainage in Romania*

The next one was the Irrigation and Drainage Study in Romania (13). It was developed by a team from BINNIE-PARTNER and HUNTING TECHNICALSERVICES LTD companies in the UK and ISPIF Bucharest. The aim of the study was to provide the Ministry of Agriculture and Food with investment plans for the rehabilitation and modernization of the irrigation and drainage sectors. It took place between September 1992 and July 1994, being the most extensive in this area for the first years since the political decision to adopt the principles of market economy. Unlike the previous study *The rehabilitation of the Pietroi, Gălățui, Carasu irrigation perimeters*, with a total area of 340 thousand ha, the new project would analyze for almost two years (22 months) the entire surface set up with hydro-ameliorative systems, which at this date amounted to more than 3100 thousand ha, out of which a large part is located on drained lands, especially in the Danube Floodplain and with excess moisture (fig.19). A total of 104 hydro-ameliorative



Source: 15

Figure 20. Location of hydro-ameliorative facilities in Romania

systems would be analyzed, out of which an area of 1361 thousand hectares would be selected, for which a rehabilitation program and a 10-year investment plan (1994-2004) had been prepared (fig.20).

One of the constructive features that had great influence on the operating costs was (still is) the water pumping height. The synthesis report would highlight: *A large part of the irrigation systems are located at heights higher than the water source. There are situations in which the systems were executed to irrigate lands located more than two hundred meters above the water source, so that the energy requirements for pumping, repumping and putting under pressure for sprinkler*

irrigation were considerable (13). In fact, the height of water pumping from the source would be one criterion for excluding from irrigations some set up areas. English specialists analyzed all of the 104 irrigation systems in terms of energy consumption. Finally, an area of nearly 3000 thousand ha was grouped by energy consumption per set up hectare into four groups, as follows:

- low energy consumption	0-700 kwh/ha	292838 ha 10,0%
- " " " "	medium	700-1400	" 838180 ha 28,6%
- " " " "	medium-high ...	1400-2100	" 1409927 ha 48,2%
- " " " "	high	over 2100	" 385989 ha ... 13,2%
<i>Total</i>		<i>2926934 ha</i>	<i>... 100,0%</i>

It is worth noting that of the area of 385989 ha with consumption of over 2100 kwh / ha, 379173 ha representing 98.2%, are in Dobrudja, and the rest of 6816 ha (1.8%) are in Moldova. The consumption of electricity for water pumping is directly related to the pumping height, and a classification of the areas where the economic viability is directly related to the water pumping height (tab.14) has also been drafted (tab.14).

Concerning the group of irrigation systems with the highest energy consumption totaling 385989 ha, 379173 (98.2%) are in Dobrudja and 329412 (85.3%) are in Constanța county. For Romanian specialists, however, the selection criterion for hydro-ameliorative set up was not energy consumption, but the degree of aridity of the area, a criterion that at that time also influenced political decision.

The Study *Irrigation and Drainage in Romania* would come to the following conclusion in connection with the technological upgrade of irrigation systems: *The following areas would be maintained or developed for the implementation of irrigations within the ten-year program:*

- the 1361000 ha area with viable irrigation facilities (45 systems or parts thereof) would be rehabilitated);
- depending on the efficiency of the irrigation, an area of 203,000 ha in the Danube Floodplain would be maintained;
- after studying in detail, another 172000 ha, which are currently equipped for irrigations, and which would prove viable, can be rehabilitated (13).

Thus, the maximum area on which irrigations could develop in Romania would be of about 1736 thousand ha. In the field of institutional and political implications, the study recommends:

- correlating rehabilitation works with the evolution of ownership and exploitation structures;
- deterring the application of irrigations if they are not viable. This fact is essential in minimizing subsidy costs;
- the progressive withdrawal of Government's involvement in the management of exploitation activities;
- establishment of commercially-based organizations responsible for the efficient provision of irrigation services and the recovery of exploitation and maintenance costs;
- implementing a policy of progressively reducing irrigation subsidies and liberalizing the price of water as a way of balancing supply and demand, as well as directing investments towards economically efficient areas (13).

We recall that according to this study the maximum area that irrigated agriculture in Romania could be practiced under conditions of economic efficiency would be of about 1700 thousand hectares, and the rest of over 1,300 thousand ha would return to the non-irrigated agriculture system, but with optimal technologies. Though in the view of the Romanian specialists, represented especially by the designers and constructors of the more than 3 million set up hectares, the surface had to be rehabilitated entirely at the end of 1989, that is 3 million hectares and even more.

Subsequently, Romanian specialists reproached to the study that the selection of the 1361 thousand ha proposed for rehabilitation as viable under the conditions of the market economy was made on a single criterion, the specific consumption of electric energy per hectare depending directly on the pumping height. Subsequent studies using several criteria would, however, select approximately the same areas of about 1.5 million hectares and also in locations with low pumping heights.

Feasibility study of the Irrigation Project Ruginești-Pufești-Panciu, Vrancea county. The study was conducted by Japan's *Japan International Cooperation Agency* (14). With a view to reaching 5.5 million hectares of irrigated land by the end of 1989, in 1985 started the works on what

Table 14
Economic viability of the area equipped for irrigations according to the geodetic height (Hg) towards the water level of the source

Hg(m)	Set up area (million ha)	Economic viability
0-10	0,50	Exceptional
10-30	0,25	Very good
30-45	0,25	Good
45-55	0,25	Satisfactory
55-65	0,25	Satisfactory/ unsatisfactory
65-90	0,60	Unsatisfactory
>90	1,00	Disastrous

Source: 13

would be called *the Siret-Bărăgan Channel Project*, which was to unite the accumulation on the Siret River from Călimănești Vrancea county with Dridu lake Ialomița county. The channel, about 200 km long, crossed the driest area in southern Moldova and Bărăgan, and would provide the water source for irrigations for an area between 500 and 700 thousand hectares.

Compared to most irrigation systems in Romania where water was pumped bottom-up with high electricity consumption, in this case the energy consumption would be minimal, most of which only needed for water pressurization in watering equipment. The objectives of the study were as follows:

- increasing production on irrigated crops in order to meet national food requirements;
- increasing the export of agricultural products;
- encouraging the farming system in small, private agricultural units, including individual farmers and family associations;
- developing and / or maintaining irrigated agriculture where it is viable;
- promoting a free market economy in the agricultural sector and reducing the Government's direct role in financing agriculture.

The location of the study in this area - the northern end of the Siret-Bărăgan Channel Project (Figure 21) had the reasoning that, on a length of 5.7 km from the channel's direction itself, the construction works were completed. The project also includes a study on soil conservation, bearing in mind that there were vineyards in the area on sloping land. An area of 22300 ha set up in the Ruginești-Panciu area in Vrancea county was studied, out of which 9700 ha eroded and requiring soil conservation measures.

Results of the study. The choice of location for the study in the area, as well as its location recommends it as a pilot unit for the conditions in Romania, where over 2/3 of the agricultural area is subject to erosion. Apart from the problem of soil erosion, the study also includes other issues: economic and social problems of the rural communities (exploitation and property of the land, livestock, trade, credits and agriculture funding, etc.).

In the second part of the study the project itself is described and quantified: investments, exploitation costs, economic efficiency indicators and, finally, the socio-economic assessment of the multifunctional environment.

Table 15
Financial effects of the study's implementation
- Monetary unit: 10³ \$ SUA -

Article	With project	Without project	Growth	
			value	%
Gross production value	64071	11763	52308	544,7
Production costs	17767	4036	13710	381,6
Net production value	46305	7707	38598	600,8

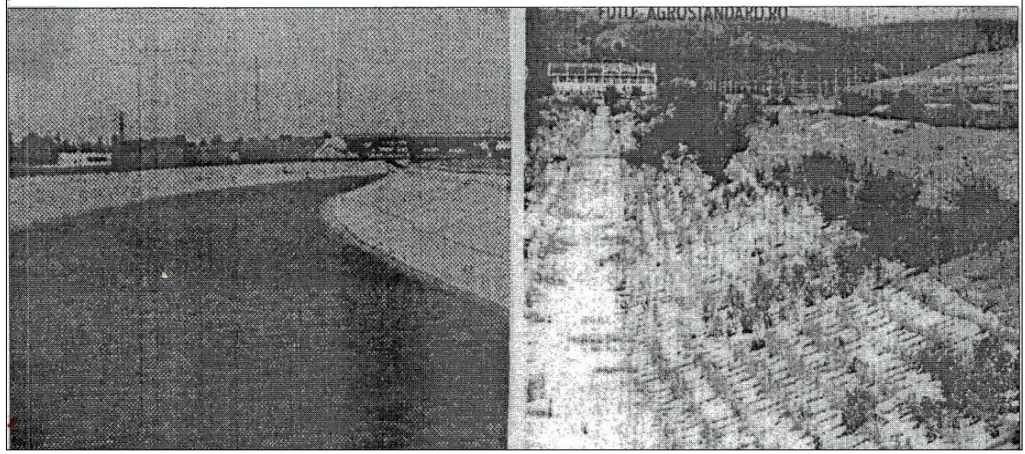
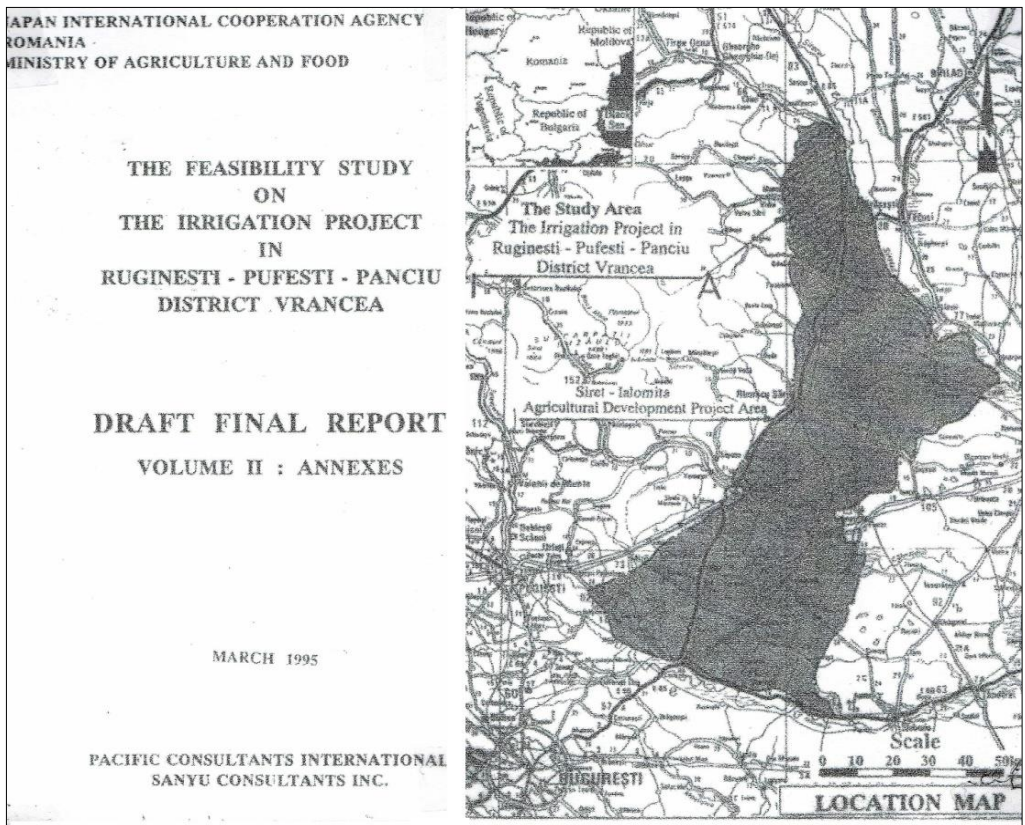
Source: 14

Data presented in Table 15 show that a 5.4 times increase in value production and 3.8 times in costs results in a net production value of more than 6 times. And the last recommendation: *Emergency implementation of the project.*

Ten years after the Japanese study, *Evenimentul Zilei* newspaper (06.01.2012) headlines:

The channel that beats the drought and brings yachts to Bărăgan. The same newspaper also says that by 2012 135 million euros would have been invested in this project.

The Siret-Bărăgan channel project has always been in the attention of the competent authorities without much progress, as shown in the program presented in Table 16.



Source: 14

Figure 18. The JICA study and its location (the shaded part) of the proposed area to be irrigated from the channel (up); The channel built on a length of 5.7 km (left, the newspaper *Evenimentul zilei* of 06.01.2012) and the image of the same channel in 2015 (right, newspaper *Evenimentul zilei* of 15.05.2015)

Table 16

PROGRAM

to make new irrigation installations with the Siret-Bărăgan main channel source stage I (up to 50 km) in order to reduce the exploitation expenses due to the reduction of electricity expenses for the operation of the pumping stations

Set up	The area to be set up ha	Estimated costs - thousands of lei				
		2009	2010	2011	2012	2013
Ruginesti-Pufesti -Panciu, judet Vrancea	22295	100000	100000	100000	0	0

Investment Strategy in the Irrigation Sector (15). It was the last extensive field study - known by the author and adapted to the principles of market economy. During 2007-2008, a DHV Netherlands (Fidman Merk-at) consortium conducted an economic analysis of the irrigation sector, a component of the Irrigation Sector Rehabilitation and Reform Project titled *The Investment Strategy in the Irrigation Sector*, which we continue to outline below.

The total set up area of 2,933 thousand hectares was studied and analyzed in terms of financial viability - financial benefit / cost ratio B/CF and economic benefit / cost ratio B/CE. Following these criteria, the 2933 thousand ha were grouped into two *viable* categories (including the marginally viable ones that became viable after rehabilitation), 1502 thousand ha (50.1%) non-viable and 1,431 thousand ha (49.9%). This is the numerical result of this analysis, accounting for about 550 system positions and parts of irrigation systems *Classification of ANIF systems according to the opportunity of Viable / Non-viable investments*. In this case as well as in the analysis carried out by the BINNIE team from UK - which came 15 years ago to similar results 1300-1700 thousand ha suitable for rehabilitation - the water pumping height was a major criterion in the assessment of viability, as shown by the irrigation systems in Dobrudja, which are non-viable in a proportion of over 90%.

Finally, an area of 1482,060 ha was recommended to be included in the investment plan. As the authors consider that the technological upgrade of an area of nearly 1.5 million hectares is a long-term problem, another selection is made based on a set of criteria, including the areas actually irrigated in 2008 and 2009. Depending on all these criteria three scenarios were proposed, each of these materialized in a certain area for which the rehabilitation investment needed was assessed. For the three scenarios, the total investment is € 425,609 for scenario 1, € 646,301 for scenario 2, and € 1,141,484 for scenario 3, respectively € 1,627/ha, € 1,490/ha and € 1,366/ha for the three scenarios. The largest share belongs to the rehabilitation of the main infrastructure, that is the state.

- scenario 1: Maximum irrigated area in 2008-2009: 250,757 ha
- scenario 2: Maximum irrigated area in 2008-2009 for each system, but not less than 51% of the system: 433.723 ha;
- scenario 3: All viable area: 835,725 ha.

In order to establish the priority order, a number of criteria were selected:

a) *Crop structure* - 25 points for systems in which at least 60% of the area is cultivated with species suitable for irrigations and 0 points below the 30% limit. The list of plants suitable for irrigations would include: seed lots, vegetables, fruits, fodder, soy, sugar beet, maize, rice.

b) *Share of G.U. use* - 20 points for a degree of use of at least 70%, a point for a use rate of less than 20%.

c) *TL water supplier's delivery fee*. A score of 1 to 2 points calculated according to the share of the average fee for viable systems.

d) *Share of OUI and GW coverage* - 10 points for systems in which the main infrastructure serves at least 70% of the surface, and the secondary one is integrated and a point when the main section serves 0% of the interior design.

f) *Aridity Index (IA)* - 8 points for IA below 21 and one point for IA > 28.

g) *Protection curtains* - 7 points when the area is provided with at least 40% protection curtains and one point for a share over 10%.

The author considers this set of criteria in which only the last aridity index is a constant to be questionable. An *eligible* system to be rehabilitated according to this criterion, after a year may no longer meet the required score, but the investment cannot be undone. The system will continue to operate without meeting the financial or economic efficiency parameters.

The issue of crop structure is also questionable. The territorial distribution of different crops or groups of crops is subject to other criteria. In Romania there is such a work that all the research institutes of the Academy of Agricultural and Forestry Sciences have worked on for years, namely *The zoning of agricultural production by counties, 1980, 1985, 1990*.

The comparison with warmer Mediterranean countries and other agricultural structures also seems inappropriate. The privatization of the Danube Floodplain and the former Borcea and Brăila ponds is required by big commercial companies that produce for neither drought control nor for food security, but to maximize their own profits. The strategy only speaks of the rehabilitation of the irrigation infrastructure, however it is known that the entire area proposed for rehabilitation faces serious problems of excess humidity and erosion, reported since the early 1990s both in the French BRL team and the English firm BINNIE studies, in which the Romanian side collaborated through ISPIF.

3.13. Economic efficiency of land reclamation works

Irrigations. Governmental Commission from 1990 calculated a minimum increase of 2000 kg / ha grain equivalent except for Dobrudja and in particular of Constanța county with very high energy consumption.

Drainage. An average increase of 20% was taken into consideration and the works were considered efficient considering that for 50% of the set up areas discharging excess water is gravitational.

Soil erosion control. In standard perimeters, production increase reach up to 100%, but the effects of Law 18/1991 destroyed most of the set up areas.

Overall, the economic efficiency of land reclamation works was minimal or even lacking, with multiple causes ranging from not finalizing projects to inappropriate exploitation. In the case of irrigations, energy was provided at 50% of the necessary, fertilizers, pesticides, watering equipments, as well. The concrete economic efficiency calculations were made for the period before 1990, both by the author and by the Economic Department of the Ministry of Agriculture.

Tables 17-18 show the average yields and expenditures on the main crops in the state agricultural enterprises trust of the in Constanța county. With the exception of wheat, maize, soy and sunflower recorded losses due to small yields per hectare.

Table 17

Cultivated area, average yields on physical ha and STAS and financial results obtained in some cultures by IAS in the Constanta county Trust in 1988

Cultivation	Cultivated area ha	Average production kg / ha		Income million lei	Production costs million lei	Financial results	
		physical	STAS			million lei	Return lei/ha
Wheat	36950	6645	3562	237451	158500	+78951	+2137
Maize	43655	9166	1738	117761	277841	-160080	-3667
Soy	11302	1147	542	23702	50822	-27120	-2400
Sunflower	15814	1324	1002	47145	68681	-21536	-1362

Source: Report of AGR 1 of the IAS Constanta Trust for 1988

Table 18

Economic efficiency of irrigated and non-irrigated crops (1986-1988)

Area	Average production kg/ha	Production value lei/ha	Costs lei/ha	Profit/ losses lei/ha	Average production kg/ha	Production value lei/ha	Costs lei/ha	Profit/ losses lei/ha
1	2	3	4	5	6	7	8	9
	<i>Wheat</i>				<i>Maize</i>			
I Total	2880	5243	4906	337	3656	5583	6520	-937
I Irrigated	3073	5592	5237	355	3816	5827	7005	-1178
Country average	2957	5381	5244	137	3097	4728	5290	-562
	<i>Sunflower</i>				<i>Soy</i>			
I Total	1621	5013	4461	552	764	2491	3894	-1403
I Irrigated	1603	4955	4584	371	765	2493	3982	-1489
Country average	1652	5108	4589	519	983	3203	4271	-1068
	<i>Sugar beet</i>				<i>Potato</i>			
I Total	22901	8683	10399	-1716	9717	9514	16718	-7204
I Irrigated	23909	9097	10852	-1755	10167	9884	17130	-7246
Country average	19341	7761	8707	-946	13178	12391	15137	-2746

Source: Romania's Statistical Yearbook 1990 and the Ministry of Agriculture and the Department of State Agriculture

At a zonal level the results are similar. Even in the area of maximum irrigation concentration – Dobrudja, the Danube Floodplain and the Romanian Plain - differences in yields between irrigated and non-irrigated are insignificant, however on irrigated lands the costs are much higher so that losses happen with the very crops suitable for irrigation: maize, soy, sugar beet, potatoes.

Table 19
The average yield obtained by some state-owned agricultural enterprises located on drained land
kg/ha

Specification	Average 1986-1988	
	Wheat	Maize
Dunăreni Dolj county (Bistreț)	3430	2819
Corabia Olt county (Potelu)	3015	5607
Zimnicele Teleoman county (Suhaia)	4614	2506
Prundu Giurgiu county (Greaca)	3087	3644
Făcăieni Ialomița county (Balta Borcei)	2148	2958
Great Brăila Island Brăila county	3317	3396
<i>IAS Ialomița trust (average)</i>	<i>3154</i>	<i>3637</i>
<i>IAS Brăila trust (average)</i>	<i>3252</i>	<i>3694</i>

Source: 7

Due to poor drainage and in the case of drained lands the yields are small, similar to the average of the agricultural enterprises trusts in the area (Table 19).

Non-submerged embankment for high water floods was inefficient in the case of dams' infiltration and since efficient drainage was provided only on about 5% of the area under cultivation in the Danube Floodplain, excess water from different sources negatively influenced the yields.

CONCLUSIONS

Romanian agricultural lands is affected on more than half of the surface by three factors with a major influence on the technical and economic performances of agriculture. These are: climatic, hydrological factors and orography or land relief. To combat their effect, studies and even concrete actions have been carried out over time: irrigation facilities, drainage and even anti-erosion works on a small scale however, with the exception of the Banat and west of the country of over one million hectares. In the first 20 years of the totalitarian-communist regime, the achievements in this field were modest: in 1965 230 thousand ha of irrigations were set up, 587 thousand ha - drainage and 198,000 ha - anti-erosion facilities. Since 1965, according to two consecutive programs, over 3 million ha of irrigation and drainage have been set up, but only 2,2 million hectares of anti-erosion works, although soil losses of about 150 million tonnes per year are irrecoverable.

After 1989, numerous studies and analyses of land reclamation works were carried out during the transition to market economy, including in collaboration with specialists from France, Great Britain, USA or Japan. In the studies conducted in collaboration with foreign teams, free water is not recommended, on the contrary, the progressive reduction of subsidies and the liberalization of the price of water are suggested in order to direct the investments to areas with low pumping heights, thus more economically efficient.

Contrary to these recommendations, projects such as the Siret-Bărăgan Channel are delayed indefinitely, absolute priority being given to the Danube Floodplain where the drought was artificially created by drainage, without the problem of excess humidity being solved.

Overall conclusion. The communist-totalitarian regime invested heavily in creating production capacities without providing the resources needed for rational exploitation. Hence the differences between the projected and the realized parameters.

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