MANAGEMENT ISSUES AND STRATEGIES IN THE EXPLOITATION OF IRRIGATION SYSTEMS

PROBLEME DE MANAGEMENT ŞI STRATEGII ÎN EXPLOATAREA SISTEMELOR DE IRIGAȚII

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Abstract. *The improvement of the quality of the management of water, soil and other natural resources constitutes an important direction in the specialised organisations in the field. International Water Management Institute – IWMI has developed a number of guiding marks on the means to improve it, in the sense of an increased involvement of local communities in decision-making. In this paper, we shall present a number of management issues and strategies in the exploitation of irrigations system, with a study case in the N. Balcescu irrigation system of Carasu Complex, Constanta County.*
Key words: management, strategies, irrigation system

Rezumat. *Îmbunătățirea calității managementului resurselor de apă, de sol şi a altor resurse naturale constituie o direcție importantă în activitatea organizațiilor specializate din domeniu. International Water Management Institute – IWMI a dezvoltat câteva repere asupra modalităților de îmbunătățire a acestuia, în sensul unei mai mari implicări a comunităților locale în luarea deciziilor. In aceasta lucrare se vor prezenta câteva dintre problemele de management şi strategii in exploatarea sistemelor de irigații,, cu un studiu de caz în sistemul NicolaeBălcescu din Complexul Carasu, județul Constanța.*
Cuvinte cheie: management, strategii, sisteme de irigatii

INTRODUCTION

If in developed countries, over several decades, it have created structures and institutions which enabled the implementation of gradual changes in the resources management, in the other countries where resources management was conducted centrally, it must rediscover the local institutions and to transfer the making decision to them. It is also the case of the irrigation organizational process that, in these states, was super centralized in government hands. In recent years, these governments seek to reduce the pressure exerted on the budget expenditure for the administration of irrigation systems, transferring, in part, some obligations on local organizations, specialized, such as the Users Organizations of Water for Irrigation (OUAI). In this paper has been approached issues of optimizing the economic and technical indicators of irrigation systems to implement them in Dobrogea area, on the Nicolae Balcescu irrigation system of Carasu Complex, with application in the management of irrigation systems.

MATERIAL AND METHODS

Global approach

It is known that irrigation systems have a primordial role for food production safety. A major challenge is to adapt the old systems for future food needs („irrigation systems adaptation of yesterday to the tomorrow needs").

Financing the water infrastructure for agriculture requires institutional reforms and strong involvement of associations of water users, the investment at lower or higher level in irrigation systems.

After a peak funding at the end of the '80, it followed a reduction in irrigation financing by international financial agencies. This happened simultaneously with the decrease of the food prices (fig. 1). Lately, due the fact that the food prices increased, have become interesting investment in infrastructure and management of irrigation systems.

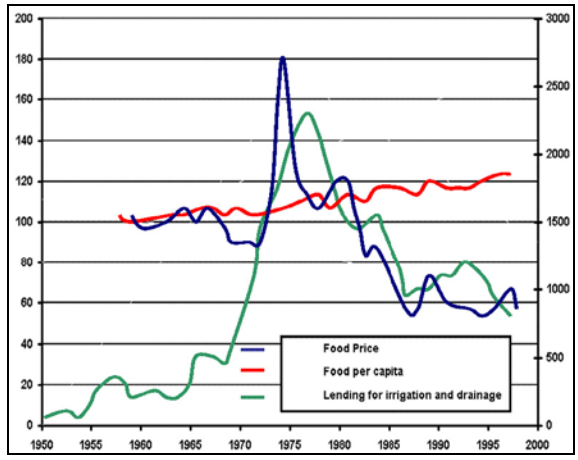


Fig. 1 – Food price developments (—),food per capita (—) and lending for irrigation and drainage (—), after Robert L. Thomson WB, ICID (Seul, 2001)

It is known that water funding for food involves complex issues that depend on a variety of sectoral political interests, operational and disturbances factors of different markets. Future investments will be considerably different from those preceding them by type, size, donors and funding models adopted. Therefore, you must know the actual situation on the need and targeting investment, on the financing mechanisms and funding category. Adopting the principle of „recovering costs" is essential: in many cases, users will realize that they will pay for services they need but that they will recover the money invested.

Hector M. Malano and Paul van Hofwegen in *Management of Irrigation and Drainage Systems* monograph presents an overview of the principles required for the management of irrigation and drainage. The dominant note of the paper is given by emphasing the fact that the irrigation and drainage system should be considered as business services that meet varying needs and demands of consumers and that the approach of management of irrigation and drainage system is a key element of the *strategy to improve performance of many systems in the worldwide*. Hence, the requirement for clear performance in irrigation, if we need to do face to the huge change in production of increasingly large food served to growth of world population.

Approaches at national level

Performance of many irrigation systems in Romania are below potential, due to causes related to the stages of design, execution and their management:

-deficiencies in the initial project, in the work performed, improper use or design assumptions that were never fulfilled in execution;

- the distribution system is not suitable to land management system (the farms size, their location in the plan, etc.);

- poor management of irrigation systems.

In Romania, after 1989, technical condition of irrigation systems became worse due to deterioration of the basic components and due to the reduce costs of maintenance and repairs. On the other hand, demand for water has been reduced due to the division of land ownership (a farmer owning 2.5 ha on average), the irrigation existing facilities were inadequate and, assuming the irrigation rotation on large areas, have come to be insufficient or totally unusable technically. Thus, it was in a situation that in many large irrigation systems, irrigation to be applied only by a few beneficiaries, owners of large areas. This reduction of use has a negative impact on economic efficiency of irrigation, leading to increasing water costs, cost to be borne by the beneficiary.

In terms of emphasis the competition between water use, irrigation are forced to reduce water losses and increase its efficiency.

Criteria for analysis of the economic efficiency of irrigation systems

An analysis of the economic efficiency of irrigation systems, which translates into the fact of the economy of resources (water, energy, labor), particularly in reducing the current level of use of the existing irrigation systems, involving a detailed analysis of the technical and economic indicators that constitute the major criteria that influence the effective functioning of an irrigation system:

- *technical indicators*: arranged area served by pumping stations, the net volume of water needed to plant over a period of time, the volume of water pumped from the pumping station, pumping station efficiency, efficiency of water use, energy needs for pumping stations operation, the specific energy consumption at a pumping station;

- *economic Indicators*: *global economic indicators* (tariff systems for irrigation, economic profitability); *specific economic indicators* (energy cost, the value of water, work expenses, direct costs, indirect costs, subsidized expenses, non-subsidized expenses, profits and income).

Using of the decision methods and techniques induce an increase of the degree of rigor and, implicitly, the effectiveness of decisions, but differentiated, depending on the type of decision-making situations involved. Each method or management technique involves specific methodology scenarios, structured in stages and phases, which with rigorous compliance facilitates selection of the best versions of several possible.

In the paper is used *ELECTRE method* (Eliminasion et Choix Traduisant la Realité), a method of ranking and choice in the presence of multiple viewpoints, allowing policy makers to adopt the most favorable solutions for the management of economic units and irrigation systems.

Services irrigation are provided by the National Administration of Land Improvements in terms of the Art. 55, 56, 57 and 64 from Law of land improvements No.138/2004 in accordance with seasonal or multi annual contracts concluded at the request of beneficiaries.

In accordance with *the multiannual-contract*, the beneficiaries pay the following rates:

- an annual rate, expressed in euro/ha, of which it is cover maintenance and repair of main irrigation infrastructure and it may be added, by case, the costs of maintenance and repair of interior irrigation system infrastructure when the irrigation water supply for irrigation is to hydrant;

- a rate of irrigation water delivery, expressed in lei/1000 cubic meters of which it is cover sampling, pumping, transmission and distribution of water through the main irrigation infrastructure, and, after case, it is added the operation cost of private infrastructure of the state where the water supply for irrigation is to hydrant.

Rates for services irrigation have in the general structure of the expenditure:

- *the direct cost* of the National Administration of Land Improvements;

- *indirect costs*, consisting of overhead from the administration units and, by case, overhead from the regional branches and headquarters of the National Administration of Land Improvements: the profit of National Administration of Land Improvements; the costs of operation works of the interior infrastructure of irrigation, and the cost of maintenance and repair contracts with third party suppliers.

RESULTS AND DISCUSSIONS

Results obtained for the rate system *„Rate on a water delivery"* has two components:

T_a - *annual rate* per unit area, which includes expenses for maintenance of irrigation planning;

T_l - *rate for water delivery* per unit volume, having in it the following costs and expenses: water cost, expenses for electricity, labor costs necessary for collection and distribution; indirect costs, profit (limited by law at a rate of 3%).

The amount of annual rate (thousands lei / ha) is calculated *for each point of water delivery* for irrigation, resulting in unit costs summation, for each point of irrigation water delivery provided in multiannual-contract:

$$T_{Aijk} = t_{Priza} + t_{SPA} + \sum_{i=0}^{i=n} t_{CAi} + \sum_{i=1}^{i=n} t_{SRPi-1} + t_{Cdij}$$

where:

T_{Aijk} (lei/ha) – annual rate for the point of the irrigation water delivery *k* located on the step of pumping *i* and distribution channel *j*;

t_{Priza} (lei/ha) – share expenses related to maintenance and repair of the gripping water;

t_{SPA} (lei/ha)– share expenses related to maintenance and repair of the pumping power;

$\sum_{i=0}^{i=n} t_{CAi}$ (lei/ha) – share expenses related to maintenance and repair a section of supply channel located on the step of pumping *i*.

$\sum_{i=1}^{i=n} t_{SRPi-1}$ (lei/ha)–share expenses related to maintenance and repair of the repumping station which supply the channel section located on the pumping step *i*;

t_{Cdij} (lei/ha)– share expenses related to maintenance and repair of the distribution channel *j* located on the pumping step *i*, where is located the delivery point of water for irrigation;

n – number of pumping steps from the irrigation planning.

The “Nicolae Balcescu” administrative irrigation system which operating the “Mircea Voda” land improvement subsystem, is one of the systems were kept in service after 1989, while areas that have concluded contracts for delivery of irrigation water were reduced significantly.

The “Mircea Voda” irrigation system, in total area of 28 125 ha, is available in four energy steps and the energy draught is represented in fig. 2.

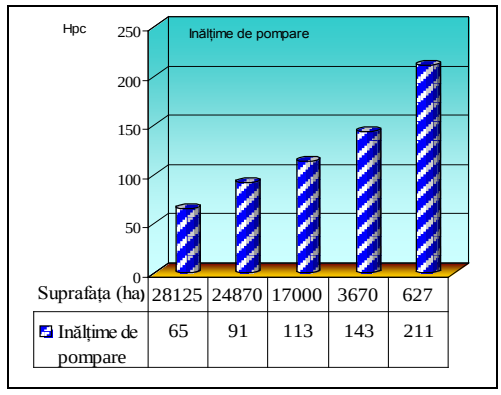


Fig. 2. The energy draught of “Mircea Vodă” irrigation system

Analysis of the main economical and technical indicators in relation to "The hydraulic chart of the operating system Mircea Voda" for different use degrees of 13%, 32%, 55%, 72%, 88% and 100% (chosen in relation with the energy steps of the system) is found that there is a maximum which corresponds to the use degree of 30% (fig. 3), the irrigated area was only willing to step IV (the most unfavorable). On these graphs (fig. 3 and fig. 4) it is a relative minimum corresponding to the full use of the system.

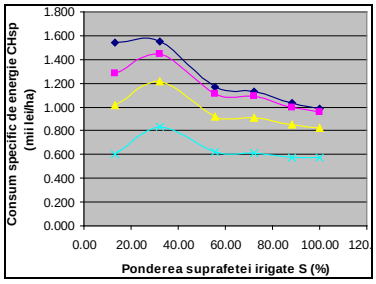


Fig. 3. Variation of the specific energy cost

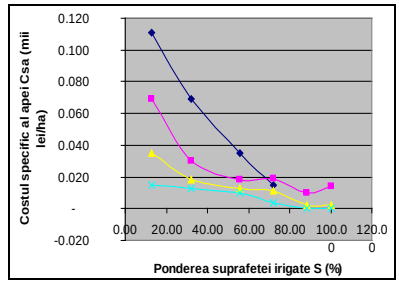
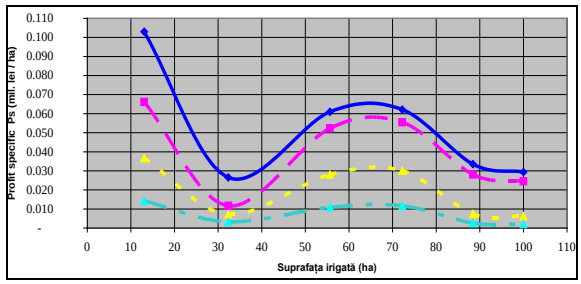


Fig. 4. Variation of the specific water cost

The variation curves of the economic indicators that are interested in the unit providing the service of water delivery in the irrigation system (ANIF), the profits and income (fig. 5, 6), showing a minimum for a degree of use about 30% and a maximum degree of use of 72%.



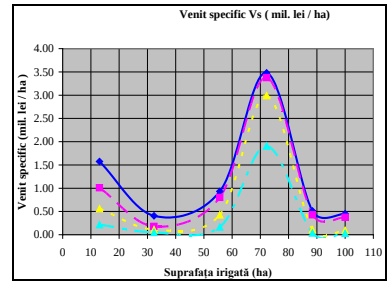


Fig. 5. Variation of the specific profit

Fig. 6. Variation of the specific income

To decide on the profitability of irrigation, according to the pumping steps with the specific energy consumption over 1 kwh/m^3 are needed deep analysis of all categories of costs, both those incurred in budget allocations as well as those incurred by the beneficiaries. Choosing the best variant, using the ELECTRE method, based on relationships between upgrading variants show that the optimal variant is that which corresponds to a degree of the irrigation system use of **72%**.

CONCLUSIONS

The economic analysis based on diagnostic criteria of the irrigation system efficiency, can highlight the performance areas from the economic point of view, helping to improve the management of the operating system unit.

The study case presented shows that, from the design stage, the irrigation system was over dimensioned as area (almost 30%), fact that is common in the country and well known by experts in the field but ignored by the policy makers in that period.

Utility of such analysis will be in the rehabilitation and modernization of the irrigation systems, and the investments can be targeted to areas that are economically justify.

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