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LAND RECLAMATION POLICIES AND STRATEGIES. HISTORICAL REVIEW AND PROSPECTS

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Abstract: *This paper describes the evolution of land reclamation works in Romania, from the second half of the twentieth century and until today. Given that over two thirds of the farmland was affected by unfavorable phenomena, such as frequent drought, waterlogging and soil erosion, the totalitarian political power instituted after the Second World War decided to improve the situation. Priority was given to irrigation facilities because they were expected to substantially increase the agricultural production and yield per hectare, which were among the lowest in Europe. Between 1950 and 1989, by successive programs developed by specialists under political order, over 3 million hectares were equipped for irrigation (ranking the second or the third in Europe); on similar surfaces, there were performed works to combat waterlogging, and over 2.2 million hectares were equipped with facilities for soil erosion control. Given that, in 1950, only 42 thousand hectares were equipped for irrigation, 368 thousand hectares were equipped against waterlogging, and only 2 thousand ha for soil erosion, in the next four decades (1950-1989) there were performed land reclamation works and improvements on more than 8 million hectares. The financial effort, the rush, but also the lack of some measure in some works, such as irrigation, damaged the quality of works, many of them with important missing parts. The faulty operation for which there were insufficient financial resources yielded to unsatisfactory results compared to what was expected. After 1989, the arrangements have been degraded, and the land was irrigated increasingly less, while working endlessly to rehabilitation and modernization studies and projects, this time in accordance with the principles of market economy.*

Keywords: *land reclamation, strategies, rehabilitations.*

JEL Classification: *Q 15*

INTRODUCTION

Without getting lost in the mists of the ages, land reclamations in Romania have a long history, written by renowned specialists, i.e. professors and researchers in the field. Many of them, such as Ion Ionescu de la Brad, P. S. Aurelian, Gh. Ionescu Sisesti and others, had administrative responsibilities, for longer or shorter periods (1). The purpose of this paper is to present only the period after the Second World War, when almost all land reclamation works were implemented. In 1950, there were equipped 1,432 thousand ha, of which only 42 thousand ha for irrigation and 2 thousand ha against soil erosion; the remaining 1,388 thousand ha were embankment and drainage works carried out mainly in the Western Plain, for over two centuries (3). In the next four decades, there were equipped no less than 8,000 thousand hectares, of which 3,000 thousand ha for irrigation, more than 2,700 thousand ha against waterlogging and 2,220 thousand ha for soil erosion control (1). Specifically, until the end of 1989, there were equipped 8,416 thousand ha, of which 3,100 thousand ha for irrigation, 3,085 thousand hectares against waterlogging and 2,222 thousand ha for soil erosion control, which envisioned an area of 16,330 thousand ha, of which 5,500 thousand ha for irrigation, 5,300 thousand ha for drainage and 5,530 thousand ha for soil erosion control. This area was equipped during the period covered by this paper. In its turn, the land reclamation strategy was the result of a series of political decisions whose final objectives aimed not only at combating these three natural phenomena, i.e. drought, waterlogging and soil erosion but also at increasing the agricultural yield per ha, Romania ranking among the last places in Europe in this regard.

MATERIAL AND METHOD

Like any other economic study, our paper is based on figures from various sources, such as statistics, strategies, operational records from entities operating land reclamation works, figures revealed by balance sheets, and similar documents from farms benefitting from land reclamation

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works. This material was selected, analyzed and processed by economic research methods and techniques.

RESULTS AND DISCUSSIONS

3.1. The development strategy of land reclamation works in planned economy (1950-1989)

The studies and research dating back to the nineteenth century were demonstrating the need for land reclamation works on more than half of the country. Not only the drought but also the floods, waterlogging and landslides severely affected the agricultural yield, food security and the safety of settlements. However, at the end of the Second World War, the only more significant works in size were 622 thousand ha of impounded lands and 358 thousand ha of drained lands, mainly in the west of the country. In addition, in 1950, there were irrigated only 42 thousand ha, mainly with vegetables and rice, and soil erosion prevention works amounted to only 2 thousand ha.

In the spring of 1945, the totalitarian political power decided to combat the country's backwardness in terms of land reclamation; thus, in 1950, there was developed the first large-scale land reclamation draft, covering a period of 10 years.

3.1.1. The electrification plan. Launched in 1950, the plan bore this name because it also included the construction of the hydroelectric plant from Bicaz, on Bistrita. In terms of land reclamation, the irrigation works started on the driest areas estimated at 2.7 million hectares. In the first phase, 1.2 million ha would be equipped, using the following water sources: the Danube for 500 thousand ha, reservoirs for another 500 thousand ha, and inland rivers for the remaining area of 200 thousand ha. The water from Bicaz lake would irrigate 300 thousand ha (no ha was irrigated from this water source). However, ten years later, in 1960, the irrigation facilities totaled only 200 thousand ha, 506 thousand ha had been drained and 100 thousand ha were equipped against soil erosion (3).

3.1.2. The national program for the extension of land reclamation works during 1960-1970. During this period, 530 thousand ha were equipped, mostly after 1965, when the construction of the major irrigation systems began: Carasu - 200 thousand ha, Galati Calarasi - 82 thousand ha, Braila Terrace - 71 thousand ha.

3.1.3. The national program on water resources management, the extension of irrigation works, dams and soil erosion control works in the SRR (the Socialist Republic of Romania), in 1971-1975, and the general and prospective provisions until 1985 was released in July 1970. This program also derives from a political decision, i.e. the objectives set by the tenth Congress of the RCP – Romanian Communist Party (august 1969): *The objectives that we have set in irrigation must be performed consistently, so that about two and a half million hectares be irrigated in 1975...* In reality, the figure achieved in 1975 was 1,474.2 thousand ha, by more than one million ha compared to the Congress provisions.

3.1.4. The national program for ensuring secure and stable agricultural yields by increasing the productive potential of the land, by a better organization and consistent use of the agricultural land, in the whole country, by performing irrigations on 55-60% of the arable land, by drainage and soil erosion control works. It was launched in 1983 with indicators personally set by Nicolae Ceausescu (4). In terms of figures, the program revealed the following (Table 1):

Table 1

Objectives to be achieved by the end of 1989
in terms of land reclamation, compared to the situation at the end of 1982

No.	Action	The surface to be equipped (potential)	Equipped surface on the 31st December 1982	Remaining surface to be equipped
1	Irrigation equipment	5500	2380	3120
2	Drainage	5530	2576	2954
3	Soil erosion control	5300	1718	3582

Source: (4)

3.2. The market planned economy era

It is characterized by a series of analyzes, surveys, strategies, studies and projects for the rehabilitation of irrigation systems, parts thereof, or even of all land reclamation works. Due to the lack of financial resources, most of the areas proposed for rehabilitation remained only on paper, and the actually irrigated areas have been reduced to one tenth or less of the equipped area existing at the end of 1989.

3.2.1. The analysis of the planned economy period. At the end of 1989, over 700 investment objectives were carried out, representing the remainder of the last land reclamation program: 3,120 thousand ha of hydro-facilities (irrigation), 2,954 thousand ha of drained land – actually waterlogging control works, because the actual draining works, performed mostly in the Danube Floodplain, were virtually completed – and 3,582 thousand ha of soil erosion control works. After all works had been stopped, the Prime Minister Petre Roman established a commission to analyze the situation in this sector and make proposals on the cessation, maintenance and full completion of the ongoing objectives⁴. The Commission's report describes, in the first part, the inadequate condition of the works performed: high water loss on non-waterproof channels (at a rate of 40%); water leaks upon irrigation; the poor quality of pumping aggregates (low yield); lack of flow meters and of water recirculation systems. Finally, the commission proposes:

- the definitive shut-down of 207 investment objectives, including primarily drainage and soil erosion control works;
- the partial suspension of 139 irrigation objectives, where drainage and soil erosion control works remained unfinished;
- completion of 136 investment objectives (5).

One task of this commission was to propose some modernization (rehabilitation) systems. In line with this last task, since 1990, a number of studies with different rehabilitation priorities (studies that continue even today) have been performed. Even in 1990, a Romanian-French joint team, i.e. ISPIF Bucharest and GERSAR BRL, began a study for the rehabilitation of the irrigation systems from Carasu, Constanta County, Galati-Calarasi and Pietrosu-Stefan cel Mare, Ialomita and Calarasi counties (Reh).

This was followed by an extensive study conducted by a Romanian-English consortium, i.e. of BINNIE-PARTNERS AND HUNTING TECHNICAL SERVICES LTD, which conducted the study *Irrigation and Drainage in Romania*, for 2 years (1992-1994). Taking into account the high electricity costs, this study proposed to stop the rehabilitation of those systems or parts of the systems where the pumping height exceeded 70 m. Specifically, only 45 systems, fully or partly summing up an area of 1,361 thousand ha, were situated below this height. In the Danube Floodplain, 203 thousand ha could be maintained, depending on irrigation efficiency and, according to a detailed study, another 172 thousand ha could be rehabilitated; therefore, in total, there were maximum 1,736 thousand ha or 54.5% of the equipped area that existed in 1990 (7).

During 1993-1995, two rehabilitation studies were carried out, the first one by an American company, i.e. MORRISON KNUDSEEN CORPORATION, for the irrigation systems GIURGIU-RĂZMIREȘTI, IALOMIȚA-CĂLMĂȚUI and GALEȘU-CONSTANȚA (8) and another one by a Japanese company, i.e. JAPAN INTERNATIONAL COOPERATION AGENCY, for an area of 22,360 ha of *Siret-Baragan Canal* project, whose completion would allow the gravity fed irrigation of about 700 thousand ha⁵. Since the mid 90s and up to the present, the issues raised by land reclamation – irrigation, in particular – have been addressed at different levels and in

⁴ The governmental commission was composed of: Prof. Hâncu Simion, PhD from "N.Bălcescu" Agronomic Institute of Bucharest, President; Engineer Găzdaru Adrian, PhD - advisor to the Minister; Engineer Răuță Cornel, PhD - director of the Soil and Agrochemical Research Institute; Assoc. Prof. Izbășoiu Eugen, PhD from the Polytechnic Institute of Bucharest - secretary; Engineer Levițchi Crișan, PhD - director of the State Agriculture Department; Engineer Berbeci Vasile from the Department of Land Reclamation and Engineer Aurel Lup, PhD - scientific secretary at the Research Station for Irrigated Crops, Valu Traian, Constanta county.

⁵ By the ISPIF company, Bucharest, the author has worked as a consultant on irrigation economic issues, in the beneficiary agricultural units. With all these four companies, he drafted and proposed structures of crops and income and expenditure budgets comparable to the system under irrigated agriculture.

different contexts: government strategy, surveys, national debates. We are going to present some of them.

*The National Strategy to Combat Drought, Prevent and Combat Land Degradation and Desertification - 2007*⁶. It was actually an update of the strategy developed in 2000, structured on six priorities: 1. Improving legislation; 2. Developing the institutional capacity; 3. Ensuring human resources; 4. Developing the technical-scientific base; 5. Rural development in areas at risk of drought and desertification; 6. Rural development in areas at risk of land degradation. There was resumed the discussion on the derivation works Siret-Baragan and Olt-Vedea-Neajlov (discontinued after 1990) that would ensure irrigation with low energy consumption. This triggered criticism related to the political decision taken before 1989 to use the Danube as a water source; this required pumping water on terraces at considerable heights and on long runs, with heavy losses on non-waterproof channels, triggering thus high energy consumption and, finally, negative economic effects.

National Debate Danube River and Danube Floodplain and Delta - Agriculture and Environment - Present Situation and Future Projections. (2). The debate was held on 8th-9th May 2008 and it was sponsored by AAFS (The Academy of Agricultural and Forestry Sciences; the Romanian abbreviation is ASAS). The topic was important; it manifested itself critically, precisely with regard to the hydro-facilities in the Danube Floodplain, highlighting their weaknesses, including their costs and inefficiencies.

The discussions were dominated by the representatives of the Institute for Studies and Projects on Land Reclamation – ISPLR (the Romanian abbreviation is ISPIF) – which was the also the organizer of the debate. Although some speakers drew the attention to unresolved environmental issues (waterlogging, in particular) or to issues that could be solved with huge costs, or to the danger of soil degradation (salinization, compaction, erosion, decreased fertility by the rapid depletion of the organic matter), it was appreciated that, this time, through rational exploitation (which did not happen in 20 years of operation), the irrigation systems should be rehabilitated and that the uncontrolled destruction of dams and a *chaotic* flooding would be harmful (though no one proposed it). The attention was drawn to the danger posed by the deforestation of an area of nearly 89,000 ha. The final resolution recommended *the maximum use of facilities and of the works performed*, after their modernization, and the completion of some works, such as waterproofing the irrigation channels.

The works of debate were published in a volume that lacked concrete data on the yields and results obtained in more than 20 years of irrigated agricultural operation, on its economic efficiency, on the costs triggered by the water drainage process of drained premises; the negative effects were minimized, although the respective designers and builders knew well their magnitude. The evolution of soils and the agricultural yield would be studied further.

*The investigation of the Parliamentary Commission on the situation of irrigation systems and of other land reclamation sectors*⁷. The Commission would verify how the specialized bodies pursued the compliance with the rehabilitation and maintenance measures, including the irrigation facilities, the functionality of drainage systems and the maintenance of soil erosion control works.

For over two months, the commission divided, into four sub-commissions, traveled throughout the country, drawn up a set of forms previously prepared with the updated situation of each branch (12 in total), including the areas irrigated in the last three years, i.e. 320 thousand ha in 2007; 258 thousand ha in 2008 and 288 thousand ha in 2009. The main findings of this parliamentary commission in the three land reclamation categories (irrigation, drainage and soil erosion control works) were:

Hydro-facilities - Irrigation:

- Decay, abandonment, lack of user interest;

⁶ It was approached in 2007, based on Government Decision no. 474/2004.

⁷ It was established by the Chamber of Deputies Decision no.31/24 June 2009, comprising a total of 15 deputies from all political formations and four specialists - experts in the field, including first author of this paper.

- Lack of funds for rehabilitation, maintenance and operation;
- Disappearance of the Forecasting and Warning Compartment from the organizational structure of subsidiaries;
- Disproportion between the area equipped for irrigation, the area organized in IWUOs – Irrigation Water Users’ Organizations (the Romanian abbreviation is OUA) and the effectively irrigated area;
- Lack of watering equipment; the inadequate condition of pumping aggregates.

Drainage facilities:

- Decay; clogged channels, flooded by vegetation;
- Abandonment and neglect;
- Broken up and degraded pumping stations;
- Lack of financial resources for rehabilitation and proper operation;
- In some areas, such as Olt-Arges, Arges-Buzau, Arges-Ialomita-Siret branches, 70% of the hydro-facilities were on drained land, cumulating the deficiencies of both categories, i.e. irrigation and drainage works.
- In the same area, there was the Siret-Baragan bypass, designed for the gravity fed irrigation of an area of 500 thousand ha, thus with minimum energy consumption; this project was abandoned.

Soil erosion control works:

- Affected by land laws that led to their destruction and abandonment;
- Fragmentation and almost total neglect by the new landowners.

The Commission also noted that Law 138/2004, which separated the former NCLR (the National Company of Land Reclamation; the Romanian abbreviation is SNIF) in NALR (the National Agency for Land Reclamation; the Romanian abbreviation is ANIF) – a non-lucrative/ non-profit administrative unit – and NCLR SA (the Romanian abbreviation is SNIF SA) – a lucrative/ profit-making unit - was a mistake and that the priority allocation of funds to NALR was also harmful. The Commission also found that the personnel plans of the branches included specialists with little specialized training or that there were no specialists, the personnel being appointed by political criteria.

Regarding the users’ involvement in the management of equipped areas (land reclamation works), under Law no.138/2004 for the establishment of IWUOs (Irrigation Water Users’ Organizations), the commission found that, in 2009, 400 units were established, covering an area of 1,000 thousand ha – i.e. more than 30% of the area equipped at the national level –, while the actually irrigated area was 288 thousand ha, at national level, in 2009– i.e. 9.3% of the equipped potential existing in 1990, or 35% of the area declared viable in 2009.

The most important causes that led to significant reductions in irrigated areas are:

- Dissolution of large operating structures, of agricultural cooperatives in the beginning, under Law no. 18/1991 of the land, and then under Law no. 1/2000;
- Degradation of the infrastructure of hydro-facilities by destruction, theft, disrepair, abandonment, the new landowners’ lack of interest. This was accompanied by the policy makers’ inability to manage and organize the operation of an important national agricultural and economic heritage;
- The transition to a market economy, whose engine was represented by the profit obtained exclusively by the economic entity and not by the national economy;
- The progressive increase in irrigation water costs and, in particular, the differentiation on pumping steps reduced the interest in irrigation;
- Destruction of the electricity transmission network, together with switching off the power supply network and removing parts of it (such as the extraction of processors), motivated by non-use;
- Many landowners were not convinced of the economic benefits of agriculture under irrigation, associated with the delayed establishment of IWUAs/ IWUOs – Irrigation Water Users’ Associations/ Irrigation Water Users’ Organizations (the Romanian abbreviation is AUAI/ OUA);

- Shortage in terms of water management equipment;
- Mismatch between the activities carried out in order to rehabilitate the irrigation infrastructure and the actual water demand at the level of the hydro-technical system;
- Uncertainty regarding the sale of yields for the breeds responding best to irrigation, such as corn or vegetables, under very permissive policies on imports.

At the end of the Report (160 pages), the Parliamentary Commission makes a number of proposals, such as:

- Conducting an inventory of the systems and subsystems that can be functional without investment;
- Finalizing the economically viable systems or parts thereof (when the ratio between benefit and cost is greater than 1);
- Awarding the public utility status to gravity fed irrigation systems, in order to make them eligible for grants, after their inclusion in IWUOs at a rate of more than 50%.
- Completing the priority list of schemes for rehabilitation and modernization investments (modern watering infrastructure and facilities) based on economic viability and inclusion in IWUOs and/ or Federations;
- Resuming the work on Siret-Baragan and Olt-See-Neajlov bypasses and identifying other areas that can be equipped with gravity fed irrigation systems;
- The areas subject to an obvious degree of aridity and desertification and whose irrigation systems have no economic viability (e.g. Dobrogea) should be treated as *disadvantaged areas*;
- As far as functional irrigation systems are concerned, the payment of compensation under drought should not be accepted, and lease contracts should provide for the mandatory irrigation of these areas;
- Establishing land reclamation organizations – LROs (the Romanian abbreviation is OIF) (LRO-Draining (the Romanian abbreviation is OIF-Desecare); LRO-SRC (Soil Erosion Control; the Romanian abbreviation is OIF- CES); OIF-Irrigations (the Romanian abbreviation is OIF-IA)) in collaboration with local committees, and the association in federations organized at the level of systems, polders and micro-watersheds;
- Acquisition of machines and equipment for rapid intervention in emergency cases;
- Reviewing the project on the Economic and ecological resize of the Danube Floodplain, drafted and approved by the Ministry of the Environment;
- Promoting and remunerating the staff involved in the operation, maintenance and repair activities solely under performance indicators.

The strategy on the investment in the irrigation sector (7). This study was conducted by a Dutch company, i.e. *Fidman Merk at*, within the Project for the Rehabilitation and Reform of the Irrigation Sector – PRRIS (the Romanian abbreviation is PRRSI) – in order to provide the Ministry of Agriculture and Rural Development – MARD (the Romanian abbreviation is MADR) – solutions regarding the conduct of the investment in hydro-facilities.

This study is based on Romanian realities and considers that irrigation is a business component and, hence, the value of the additional yield must cover additional costs and make profit. Thus, farmers need to introduce a structure of specific crops and have a sufficient level of economic development in order to manage irrigation. Without these conditions (mentioned in the preamble of the study), *we can speak only of enthusiasm without any foundation, and the case of those who propose irrigation at any cost during dry periods* (although the aridity index is just one of the seven criteria for prioritizing investments) *is just a demagogical manifestation*. Another need is represented by the recognition of the fact that *irrigation does not fall into the state's responsibilities, money cannot be spent on irrigation just in order to respond to the false perceptions of the public opinion and the media. They should not be introduced by force or announced as election topics; they should be designed as business components*.

Based on these considerations, the objectives of the strategy were the following:

- a) *Investing in those irrigation facilities where farmers have a high potential in terms of*

the use and maintenance of systems, and also in terms of the contribution to the investments in irrigation equipments;

b) Modernizing the irrigation infrastructure by reducing water loss and energy consumption.

In addition, the principles of the irrigation investment strategy were the following:

a) The technical and economic viability of irrigation systems, which translates in recovering the operating costs and making profit, subsequent to irrigation;

b) The user's interest. Investments are made only at the request of potential beneficiaries. Without the users' active involvement, investments are not sustainable and such principle must be excluded;

c) Contribution. The farmers who will benefit from investments must bring their own contribution to the rehabilitation / modernization or creation of new facilities;

d) The economic capacity of water users;

e) Crops adequate to irrigation;

f) Adjustment to request. Modernization should meet the users' requirements in terms of the irrigation methods adopted by users;

g) Support, development and modernization of local irrigation facilities.

From more than three million ha equipped for irrigation, existing in the NALR records (the National Agency of Land Reclamation; the Romanian abbreviation is ANIF), a total of 56 systems were selected – most in the Danube Floodplain, i.e. about 570 thousand ha –, with a total area of 1,412 thousand ha, wherefrom an area of 823 thousand ha was deemed viable and recommended for the inclusion in investment programs, in the next period. The selection criteria included:

1) Crop structure (as recorded at APIA – the Agency of Intervention and Payment for Agriculture) in the year before the financing documentation;

2) Utilization degree (the Romanian abbreviation is G_u); it indicates a part of the efficiency of the system; the higher the G_u , the lower the users' costs per volume unit (1000 m³);

3) The delivery charge of the water provider (the Romanian abbreviation is TL);

4) Inclusion rate within IWUOs (the Romanian abbreviation is G_w);

5) Integrated projects that rehabilitate both the main section of the system and the interior fittings;

6) The existence of windbreaks;

7) Aridity index (AI; the Romanian abbreviation is IA).

Each of these criteria were assessed and taken into account in the selection. For example, for the crop structure, there were taken into account the percentage of those elements that are suitable for irrigation (that trigger great additional value bonuses, such as corn, wheat, sugar beet, fodder, seeds), usability (what surface from the entire system was irrigated in 2008-2009) etc. Moreover, priority was given to those systems that have a high coverage rate of water user organizations and, obviously, this included the farmers with areas of tens of thousands of ha (some of them were unique associates). Drought is lost among these strictly commercial criteria, although the Danube Floodplain is not the driest (the poem *The Deer's Death* (in Romanian, *Moartea Caprioarei*) was not written at Bailesti and *Papura-Voda* was not "ban" of Craiova).

When establishing the investment program, three scenarios were drawn up:

- The entire area found viable: 823 thousand ha;

- The maximum area irrigated in 2008-2009, on each system, but not less than 51% of the system: 433,723 ha;

- The maximum area irrigated in 2008-2009: 25, 759 ha.

The specific investment needed in order to rehabilitate those areas was assessed at about 1,130 euro/ha.

CONCLUSIONS

1. The totalitarian regime installed after the Second World War tried to eliminate Romania's backwardness in the field of land reclamation and irrigation, in particular, drought being considered the main cause of some of the lowest yields in Europe.

2. By particularly large financial efforts, including foreign loans, in four decades, almost eight million ha were equipped by land reclamation works, including more than three million ha equipped for irrigation, about 2,700 thousand ha were equipped against waterlogging and 2.2 million ha benefitted from soil erosion control works.

3. The financial effort was enormous – i.e. over 10 billion dollars, modestly assessed at 10-12 billion dollars; however, according to the World Bank's assessment, there were invested about 50 billion dollars. Haste, lack of action, especially in irrigation – the 2nd place in Europe and the 1st place in the world, in terms of equipped areas per capita – damaged the quality of works; this was associated with the inappropriate operation triggered by the lack of money, leading to unsatisfactory results.

4. There were registered modest yield increases, assessed at less than half of the projected level; there were registered losses instead of additional revenue, in the intensive crops, such as corn, sugar beet, soybeans and potatoes.

5. After 1989, a real campaign was declared for the elaboration of rehabilitation studies and projects, both by Romanian specialists and by specialized foreign companies: French, English, American, Japanese and Dutch. They aimed at rehabilitating and completing the construction deficiencies of these systems.

6. The last Dutch study recommends prioritizing the rehabilitation of the systems located in the Danube Floodplain, not on grounds of drought, but on profit maximization, but also having in view that large agricultural producers installed themselves in this Floodplain.

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