RESEARCH ON INVESTMENTS IN THE DEVELOPMENT OF GRAIN AND INDUSTRIAL CROP STORAGE CAPACITIES THROUGH NON-REIMBURSABLE FUNDS, IN ROMANIA

Cătălin Petrișor MATEI[1], Daniel Valeriu ULIU[2] Marius VLADU[3]

*[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest Blvd. Marasti no. 59, Sector 1, Bucharest; University of Craiova, Faculty of Agronomy, Department of Agricultural and Forestry Technology, 19 "Libertăţii" Street, Craiova e-mail:*catamateip@yahoo.it
[2]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, 011464, Bucharest, Romania, Phone: +40766287579, E-mail: daniel_uliu@icloud.com
[3]University of Craiova, Faculty of Agronomy, Department of Agricultural and Forestry Technology, 19 "Libertăţii" Street, Craiova 200583, Phone: +40744870085 Dolj County, Romania, e-mail: mariusvladu@yahoo.fr

Corresponding author e-mail: catamateip@yahoo.it

Abstract

This study evaluates the efficiency of public investments directed toward the development of cereal and industrial crop storage capacities in Romania under Sub-measure 4.2 of the National Rural Development Programme (2014–2020) and Directive DR-22 of the CAP Strategic Plan (2023–2027). The analysis covers the period 2015–2025 and is based on two performance indicators: (i) storage capacity relative to the area cultivated with cereals and industrial crops, and (ii) public investment per hectare of cultivated land. These indicators provide insights into both the adequacy of storage infrastructure and the intensity of non-reimbursable financial support, enabling regional and national comparisons over time. The results highlight a fluctuating but overall upward trend in investments. Initial allocations were modest in 2015 (€8.4 million), followed by substantial increases in 2016–2018, with a first peak in 2018 (€150.6 million). After a sharp decline in 2019 and the absence of allocations in 2020 and 2023, funding reached its highest level in 2024 (€286.8 million). Regionally, the largest total investments were recorded in South-East and North-West, reflecting their strong agricultural potential, while the smallest allocations occurred in Bucharest-Ilfov.The cultivated area with cereals and industrial crops remained relatively stable, averaging 6.9 million hectares annually, with South-Muntenia and South-East together accounting for nearly half of the national total. Authorized storage capacity increased from 22.6 million tons in 2015 to 32.3 million tons in 2024, with the highest values concentrated in South-East, South-Muntenia, and West. The storage capacity per hectare rose nationally from 3.3 t/ha in 2015 to 4.7 t/ha in 2024 (+43%), though marked regional disparities persist. Public investment intensity followed a cyclical pattern, culminating in 2024 with a record €41.9/ha. Overall, findings confirm significant improvements in storage infrastructure but also underline uneven regional development and reliance on funding cycles.

Keywords: *programme, regional, public investment, storage capacity*

INTRODUCTION

The development of modern and efficient agricultural infrastructure has become one of the central challenges of rural development policies in Romania during the past decade. Among the structural weaknesses that have historically limited the competitiveness of Romanian agriculture, insufficient storage capacity for cereals and industrial crops has been particularly problematic. This deficiency has generated multiple negative effects, ranging from high post-harvest losses and degradation of product quality to increased volatility of market prices and reduced negotiating power for farmers and cooperatives. In many rural areas, the lack of adequate storage facilities forced producers to sell their harvest immediately after collection, often at significantly lower prices, thus reducing farm income and discouraging further investment in agricultural modernization. In response to these challenges, Romania has had access to significant European funds designed to stimulate investments in agricultural infrastructure and value chain integration. The National Rural Development Programme (NRDP) 2014–2020, financed under the Common Agricultural Policy (CAP), represented the main instrument for channeling resources into rural areas. Within this program, Sub-measure 4.2 – Investments in processing, marketing, and/or development of agricultural products was specifically dedicated to improving processing and storage facilities. Later, with the adoption of the CAP Strategic Plan 2023–2027, additional support was introduced through Directive DR-22, continuing and expanding the focus on storage capacities, modernization, and the integration of primary production with downstream markets.

The study presented here aims to evaluate the efficiency and impact of these financial interventions over the period 2015–2025. By combining statistical data with comparative and econometric analyses, the research provides a comprehensive picture of the dynamics of public investment in this domain. The methodological framework relies on two performance indicators: (i) storage capacity relative to the area cultivated with cereals and industrial crops, which reflects the adequacy of infrastructure in relation to regional agricultural potential, and (ii) public investment per hectare of cultivated land, which measures the intensity of non-reimbursable support in different regions. These indicators allow for both longitudinal comparisons across time and cross-sectional evaluations among Romania's eight development regions. The relevance of this approach lies in its capacity to capture not only the direct financial effort made through European and national programs but also the structural transformations in agricultural storage systems. For instance, an increase in the ratio of storage capacity to cultivated area suggests an improvement in farmers' ability to preserve products until more favorable market conditions arise, thereby stabilizing income and reducing vulnerability to price shocks.

Similarly, higher levels of public investment per hectare indicate a stronger policy commitment to supporting modernization and bridging territorial disparities in infrastructure.

The empirical results underline both achievements and shortcomings of the policy framework. On the one hand, significant progress has been recorded, with total authorized storage capacity at national level increasing from 22.6 million tons in 2015 to 32.3 million tons in 2024. This growth, representing more than 43% over less than a decade, confirms the substantial role of public financing in reshaping Romania's storage infrastructure. On the other hand, the analysis reveals persistent regional imbalances: the South-East, South-Muntenia, and West regions concentrate the highest storage capacity and attract the largest share of funds, while Centre and Bucharest-Ilfov remain disadvantaged. These disparities reflect differences in agricultural potential, project absorption capacity, and administrative efficiency.

Moreover, the evolution of public investment per hectare shows a cyclical pattern strongly dependent on programming and funding cycles. Years such as 2015 and 2019 witnessed very low allocations, whereas 2018 and 2024 marked historical peaks. This volatility may undermine the predictability of financial support and limit long-term strategic planning for both farmers and investors. Thus, while the overall trajectory is positive, the findings point to the need for greater stability and continuity in funding streams, as well as for policies better tailored to the needs of structurally weaker regions.

By examining the efficiency of investments through quantitative indicators and statistical models, this study contributes to a broader understanding of how rural development policies influence the modernization of agricultural infrastructure. Beyond the technical improvements in storage capacity, the implications extend to food security, market integration, and the competitiveness of Romanian agriculture within the European Union. The results are therefore relevant not only for policymakers and program administrators but also for farmers, cooperatives, and private investors who seek to understand the opportunities and limitations of EU-funded interventions. In sum, the introduction of Sub-measure 4.2 of the NRDP and Directive DR-22 of the CAP Strategic Plan has played a decisive role in transforming Romania's agricultural storage landscape. However, the success of these measures should be evaluated not solely by aggregate increases in capacity, but also by their contribution to balanced regional development, reduction of structural vulnerabilities, and reinforcement of the country's overall agricultural resilience. The present research sets out to provide such an evaluation, combining descriptive statistics, comparative analysis, and econometric modeling to trace the evolution of storage investments over a decade and to assess their effectiveness in meeting

Romania's agricultural development goals.

MATERIALS AND METHODS

For the evaluation of the efficiency of investments implemented through Sub-measure 4.2 of the NRDP and through DR-22 during the period 2015–2025, two performance indicators were calculated at both regional and national level: storage capacity relative to the area cultivated with cereals and industrial crops, and public investment relative to the area cultivated with cereals and industrial crops.The first indicator reflects the degree to which storage infrastructure needs are covered in relation to the agricultural potential of each region, while the second expresses the intensity of non-reimbursable financial support per hectare of arable land.These formulas enable comparisons both between regions and at national level, as well as an analysis of the evolution across the entire 2015–2025 period. The data obtained were statistically processed, and the results were interpreted through comparative analyses and polynomial regression models in order to highlight the correlations between public investments, storage capacities, and agricultural areas.

1. Storage capacity relative to the area cultivated with cereals and industrial crops (Csa):

$C_{sa} = \frac{Cap._{stor}}{Area._{cultivat}}$ Where:

Capstor= total storage capacity (tons).

Area cultivat= agricultural area cultivated with cereals and industrial crops (ha).

2. Public investment relative to the area cultivated with cereals and industrial crops (Isa):

$I_{sa} = \frac{Inv._{pub.}}{Area._{cultivat}}$;Where:

Inv pub = value of non-reimbursable public investment (euro).

Area Cultivat= agricultural area cultivated with cereals and industrial crops (ha).

RESULTS AND DISCUSSIONS

In our study, significantly higher biomass yields were achieved in thesecond year than inthe first year, which is consistentwith the resultsof other studies (Angelini et al., 2009; Danielli et al., 2021). The highest dry biomass yield of 620 $kgha^{-1}$(T2)was obtained on agricultural landin the second year (18.26 t ha^{-1}), while the lowest yieldwas recorded on flotation tailings in the control treatment (C) in the first year (1.16 t ha^{-1}).The plants treated with different doses of mineral fertiliser showed statistically significant differences in biomass yield (table 2). On average for all three substrates in both cultivationyears,the biomass yield increased with increasing mineral fertiliser doses. The lowest yields were achieved in the control treatment (C) and the highest in treatment 2 (T2).The substrate also had a statistically significant influence on the biomass yield (table 2). The highest yields were obtained on agricultural land (average 11.33), then on the ash and slag dump (average 3.89), while the lowest yieldswere measured on the flotation tailings(average 2.65).

Table 1. Eligible value invested in the development of storage capacities for cereals and industrial crops (euro) (Source: Own calculations based on afir.ro data)

An	Region	Total

	N-E	S-E	S-M	S-V O	V	N-V	C	B-IF	
2015	4.649.242	833.879	2.938.180	0	0	0	0	0	8.421.301
2016	1.658.467	9.969.780	3.409.130	6.507.593	19.975.099	11.654.162	3.161.179	0	56.335.410
2017	13.126.809	12.336.164	9.159.752	7.180.970	20.304.257	16.826.296	7.098.727	4.962.457	90.995.432
2018	10.833.308	20.188.750	27.560.425	13.758.872	19.083.690	50.297.408	8.882.396	0	150.604.849
2019	0	4.000.000	7.622.001	3.790.126	8.994.690	3.997.989	504.181	0	28.908.987
2020	0	0	0	0	0	0	0	0	0
2021	0	1.621.894	3.068.297	5.365.554	1.599.848	7.121.249	0	0	18.776.842
2022	4.113.239	16.224.496	20.963.830	3.341.586	10.228.572	4.844.386	4.657.061	1.199.986	65.573.156
2023	0	0	0	0	0	0	0	0	0
2024	42.035.882	79.966.633	35.906.696	27.309.941	41.039.548	44.945.067	15.596.688	0	286.800.455
Total	76.416.947	145.141.596	110.628.311	67.254.642	121.225.704	139.686.557	39.900.232	6.162.443	

Legend: N-E = North-East; S-E = South-East; S-M = South-Muntenia; S-W O = South-West Oltenia; W = West; N-W = North-West; C = Centre; B-IF = Bucharest-Ilfov.

Table 2. Area cultivated with cereals and industrial crops (ha)
(Source: Own calculations based on afir.ro data)

An	Region								Total
	N-E	S-E	S-M	S-V O	V	N-V	C	B - IF	
2015	858.335	1.631.897	1.657.981	967.901	777.878	571.102	327.522	55.082	6.847.698
2016	883.679	1.612.649	1.627.278	1.081.421	802.546	591.007	329.096	55.053	6.982.729
2017	839.548	1.538.169	1.645.471	1.023.921	787.274	566.724	331.384	56.231	6.788.722
2018	863.422	1.567.661	1.652.698	1.028.392	803.265	585.924	338.780	56.700	6.896.842
2019	932.477	1.540.069	1.672.093	1.074.341	981.356	610.786	338.867	54.421	7.204.410
2020	937.018	1.518.729	1.654.558	1.043.929	694.895	608.901	332.295	53.449	6.843.774
2021	979.830	1.585.681	1.665.313	1.037.218	623.911	624.916	339.255	65.302	6.921.426
2022	985.021	1.458.141	1.680.032	997.993	624.282	607.960	336.048	56.475	6.745.952
2023	971.442	1.507.718	1.751.690	1.018.372	636.327	594.938	350.480	56.791	6.887.758
2024	957.689	1.466.170	1.718.575	1.062.681	653.106	584.161	333.251	55.880	6.831.513

Legend: N-E = North-East; S-E = South-East; S-M = South-Muntenia; S-W O = South-West Oltenia; W = West; N-W = North-West; C = Centre; B-IF = Bucharest-Ilfov.

Table 3. Total authorized storage capacity (tons)
(Source: Own calculation based on data from madr.ro)

An	Region								Total
	N-E	S-E	S. M	S-V O	V	N-V	C	B - IF	
2015	2.050.820	6.192.303	5.713.030	2.140.197	4.263.747	1.391.797	633.841	196.371	22.582.106
2023	2.977.555	8.315.525	7.483.119	2.882.442	4.812.289	2.120.425	978.305	181.511	29.751.171
2024	3.189.912	9.647.065	7.704.476	3.230.025	5.147.080	2.190.731	999.763	214.731	32.323.783

Legend: N-E = North-East; S-E = South-East; S-M = South-Muntenia; S-W O = South-West Oltenia; W = West; N-W = North-West; C = Centre; B-IF = Bucharest-Ilfov.

Table 1 presents the eligible value of investments made for the development of storage capacities for cereals and industrial crops during the period 2015–2024, across the eight development regions of Romania. It can be observed that in 2015, investments were low, totaling only €8.42 million, distributed in just a few regions, which reflects the beginning of the financing process. In 2016 and 2017, the values increased significantly, reaching €56.3 million and €90.9 million respectively, while 2018 marks a first peak, with €150.6 million invested. In 2019, a sharp decrease in allocations was recorded, and in 2020 and 2023 no investments were made, most likely due to the absence of project calls or administrative delays.

By contrast, in 2024 the highest level of financing of the entire analyzed period was reached, amounting to €286.8 million. At the regional level, the highest total values for the period 2015–2024 were recorded in the South-East (€145.1 million), North-West (€139.6 million), and West (€121.2 million) regions, reflecting the high agricultural potential and extensive arable areas in these zones. The South-West Oltenia region benefited from investments worth €67.2 million, ranking at a medium level compared to the other regions. The lowest values were recorded in the Center region (€39.9 million) and especially in Bucharest-Ilfov (€6.1 million), where agricultural areas are limited. Thus, the data in Table 1 confirm a fluctuating evolution of investments, but with a general upward trend towards the end of the analyzed period, and highlight significant differences between regions in terms of attracting funds allocated to storage infrastructure.During the period 2015–2024, the area cultivated with cereals and industrial crops at the national level ranged from a minimum of 6,745,952 ha in 2022 to a maximum of 7,204,410 ha in 2019, representing a difference of approximately 458 thousand ha between the extremes. The annual average of the cultivated area remained around 6.9 million ha, indicating a relative stability of Romania's agricultural potential. By regions, South-Muntenia recorded the largest cultivated area, totaling 16,725,689 ha over the ten years, followed by the South-East with 15,426,884 ha. Together, these two regions account for almost 50% of the national cultivated area. South-West Oltenia contributed 10,336,169 ha, while the North-East reached 9,208,461 ha, confirming the role of these regions as important agricultural basins. Regions with smaller areas included the West, with 7,384,840 ha, and the North-West, with 5,946,419 ha, followed by the Center, which reported 3,356,978 ha over the analyzed period. At the opposite end, Bucharest-Ilfov registered only 565,384 ha cultivated, representing less than 1% of the national agricultural area. Thus, although the cultivated area at the national level has remained stable, the figures clearly show a concentration of cereal and industrial crop cultivation in the southern and eastern parts of the country, while the central regions and the capital hold only a marginal share (Table 2).

Table 3 presents the total authorized storage capacity for cereals and industrial crops, expressed in tons, in the years 2015, 2023, and 2024, by development regions and at the national level. In 2015, Romania's total authorized capacity was 22,582,106 tons. The

highest values were recorded in the South-East (6,192,303 tons) and South-Muntenia (5,713,030 tons), followed by the West (4,263,747 tons) and the North-East (2,050,820 tons). The regions with the lowest storage capacities were Bucharest-Ilfov (196,371 tons) and the Center (633,841 tons). By 2023, the total authorized capacity had increased to 29,751,171 tons, representing a rise of approximately 7.2 million tons (+31.8%) compared to 2015. The largest increases were recorded in the South-East (8,315,525 tons) and South-Muntenia (7,483,119 tons), confirming the role of these regions as the main production and storage areas. In 2024, the national storage capacity reached 32,323,783 tons, i.e., 9.74 million tons more than in 2015 (+43%). The South-East region reached 9,647,065 tons, remaining the national leader, followed by South-Muntenia (7,704,476 tons) and the West (5,147,080 tons). The lowest capacities continue to be found in Bucharest-Ilfov (214,731 tons) and the Center (999,763 tons). The data show a clear upward trend in authorized storage capacities during the analyzed period, with investments concentrated in the southern and eastern regions of the country, which have the largest cultivated areas and the greatest need for storage infrastructure.

CONCLUSIONS

The indicator of storage capacity per hectare is essential for assessing the adequacy of storage infrastructure relative to agricultural potential. At the national level, values increased steadily from 3.30 t/ha in 2015 to 4.73 t/ha in 2024, which represents a growth of about 43%. This upward trend indicates significant progress in aligning infrastructure with cultivation areas, largely due to targeted public investments. However, disparities among regions remain striking. In 2015, the West region already stood out with the highest ratio (5.48 t/ha), consolidating its lead by 2024 (7.88 t/ha). The South-East region also recorded consistent growth (from 3.79 to 6.58 t/ha), confirming its role as a major agricultural hub. By contrast, structurally weaker regions such as South-West Oltenia and Centre remained below the national average, reaching only 3.04 and 3.00 t/ha respectively in 2024. These gaps suggest that although the national average has improved, investment distribution continues to favor regions with higher absorption capacity and stronger agricultural potential. The indicator of public investment per hectare highlights the intensity of financial support allocated to each region. Unlike storage capacity, which showed a gradual and steady increase, this indicator displays a highly fluctuating pattern over the 2015–2024 period. In 2015, the national average was extremely low (€1.23/ha), with only the North-East and South-Muntenia benefiting from minor allocations. A turning point occurred in 2016–2018, when average investments rose sharply, culminating in 2018 with €21.84/ha, the highest level until then. Notably, North-West reached €85.84/ha, and Bucharest-Ilfov registered an exceptional peak of €88.25/ha in 2017, reflecting highly concentrated but uneven funding.

The following years revealed instability: in 2019, allocations fell to just €4.01/ha, while in 2020 and 2023 no investments

were recorded at all. This discontinuity underscores a strong dependence on funding cycles and administrative factors. A moderate recovery appeared in 2021–2022, but the true breakthrough came in 2024, when national investment intensity reached a historical record of €41.98/ha. The leaders were North-West (€76.94/ha) and West (€62.84/ha), followed by South-East (€54.54/ha) and Centre (€46.80/ha). In sharp contrast, Bucharest-Ilfov received no funding, highlighting its marginal role in agricultural development.At the national level, progress is clear: more storage capacity relative to cultivated land and an unprecedented level of financial effort in 2024. Yet, the fluctuations in public investment and the persistence of regional disparities raise questions about the long-term sustainability and equity of these funding mechanisms.

REFERENCES

Davidescu, Adriana AnaMaria, Simona Andreea Apostu, Andra Madalina Pantilie, and Bogdan Florian Amzuica. "Romania's South-Muntenia Region, towards Sustainable Regional Development. Implications for Regional Development Strategies." *Sustainability* (Basel) 12, no. 14 (2020): 5799. https://doi.org/10.3390/su12145799.

Dona, Ion, and Ramona Matusa. "Effects Generated by the Accession to the European Union in the Field of Trading Cereal Products." *Scientific Papers-Series Management Economic Engineering in Agriculture and Rural Development* (Bucharest) 12, no. 4 (2012): 43–49.

Dudoiu, Roxana, Stelica Cristea, Carmen Lupu, Daria Popa, and Maria Oprea. "Micoflora Associated with Maize Grains During Storage Period." *Agrolife Scientific Journal* (Bucharest) 5, no. 1 (2016): 63–68.

Iosub, Laura Mihaela, Madalin Radu, and Costel Mihalascu. "The Dynamics of Wheat Diseases in the Period 2015-2019 in the Moara Domneasca Location, Ilfov County." *Scientific Papers-Series a-Agronomy* (Bucharest) 64, no. 1 (2021): 383–87.

Iurchevici, Lidia, and Rodica Chetroiu. "Swot Analysis of the Cereals Channel in Braila County." *Scientific Papers-Series Management Economic Engineering in Agriculture and Rural Development* (Bucharest) 11, no. 1 (2011): 96–99.

Medelete, Dragos Mihai, and Radu Lucian Panzaru. "Barley Balance Sheet in Romania." *Scientific Papers-Series Management Economic Engineering in Agriculture and Rural Development* (Bucharest) 13, no. 2 (2013): 225–29.

Medelete, Dragos Mihai, and Radu Lucian Panzaru. "Cereal Production of Dolj County in the Regional and National Context (2017-2021), Romania." *Scientific Papers-Series Management Economic Engineering in Agriculture and Rural Development* (Bucharest) 23, no. 4 (2023): 515–22.

Medelete, Dragos Mihai, Radu Lucian Panzaru, Marius Vladu, and Gheorghe Matei. "Some Considerations Regarding the Primary Wheat Supply in Romania and Its Composition (2014 - 2016)." *Scientific Papers-Series Management Economic Engineering in Agriculture and Rural Development* (Bucharest) 18, no. 1 (2018): 245–52.

Soare, Elena, and Irina-Adriana Chiurciu. "Research on the Romanian Wheat Market." *Scientific Papers-Series Management Economic Engineering in Agriculture and Rural Development* (Bucharest) 16, no. 2 (2016): 287–92.

Vladu, Marius, Radu Lucian Panzaru, and Cristina-EmanuelaVladu. "Studies on the Current Stage of the Investments Made, for the Development of Storage Capacities of Field Crops Production, Through the Sub-Measure 4.2 of the 'National Program for Rural Development 2014-2020', in the South-West Region Oltenia." *Romanian Agricultural Research* (Fundulea) 36 (2019): 241–50.