

## THE IMPACT OF ECOLOGICAL MANAGEMENT PRACTICES ON ENTERPRISE COMPETITIVENESS

### IMPACTUL PRACTICILOR DE MANAGEMENT ECOLOGIC ASUPRA COMPETITIVITĂȚII ÎNTREPRINDERILOR

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**Sumar.** *Lucrarea analizează impactul practicilor de management ecologic asupra competitivității întreprinderilor din Republica Moldova, cu accent pe sectorul întreprinderilor mici și mijlocii. Cercetarea are la bază o metodologie mixtă, combinând analiza statistică a datelor oficiale cu rezultatele unui chestionar aplicat unui eșantion de 56 de întreprinderi din diverse sectoare economice. Rezultatele indică o corelație pozitivă între gradul de ecologizare și indicatorii de performanță economică (productivitatea muncii, venitul pe salariat), confirmând că sustenabilitatea poate deveni un vector strategic al competitivității. Studiul oferă recomandări privind politici publice și sprijin instituțional în vederea consolidării managementului ecologic și promovării dezvoltării durabile în economia națională.*

**Cuvinte-cheie:** *management ecologic, întreprinderi mici și mijlocii, sustenabilitate, dezvoltare durabilă, competitivitate.*

## INTRODUCTION

In the context of increasingly intense environmental pressures, ecological management has become a strategic and operational imperative for enterprises, rather than a merely optional or formal attribute. The intensification of climate change, accelerated depletion of natural resources, ecosystem degradation, and growing demands from civil society and international organizations have led to a profound reconfiguration of how corporate environmental responsibility is perceived. Within this framework, ecological management emerges as an essential dimension of sustainable governance and enterprise competitiveness strategies, promoting resource efficiency, reducing ecological impact, and strengthening long-term advantages.

Today, the integration of ecological principles into decision-making and operational processes is not merely a reaction to legal constraints but a proactive approach aimed at delivering concrete benefits: cost reduction through energy efficiency, innovation in green products and services, access to new markets, improved organizational reputation, and increased customer loyalty [1, p. 238]. At the same time, entities that ignore or treat the ecological dimension superficially risk becoming vulnerable to regulatory pressures,

resource market instability, and the growing demands of investors and sustainability-minded consumers.

In the Republic of Moldova, these global transformations are increasingly reflected in public policy and entrepreneurial discourse. The Environmental Strategy for 2024–2030 [2] sets out concrete measures to integrate sustainable development principles into the economy, emphasizing the role of enterprises in the ecological transition. According to data published by the National Bureau of Statistics [3], in 2023, small and medium-sized enterprises (SMEs) accounted for approximately 98.6% of all economic entities, generating over 38% of national sales revenue and employing more than 60% of the active workforce. This share highlights their fundamental role in shaping a resilient and sustainable economic framework.

However, the involvement of SMEs in ecological actions remains relatively low, as indicated by data available up to 2021 regarding current environmental protection expenditures and ecological payments [3]. Despite some targeted investments in environmental infrastructure, recycling, or energy efficiency, most of these actions are not yet integrated into business strategies but remain reactive, driven mainly by regulatory compliance obligations [4].

In this context, the present research aims to analyze the impact of ecological management practices on the competitiveness of enterprises in the Republic of Moldova, starting from a correlation between current economic statistics and data on firms' ecological behavior. The general objective of the study is to assess how the adoption of ecological practices can influence economic performance.

## **MATERIALS AND METHODS**

To carry out this research, a mixed methodology was adopted, based both on the quantitative analysis of official statistical data and on the collection of primary information through a questionnaire applied to enterprises in the Republic of Moldova. The study has an explanatory and applicative character, aiming to highlight the relationship between the implementation of ecological management practices and the level of competitiveness of enterprises, especially among small and medium-sized enterprises (SMEs), which form the backbone of the national economy.

Regarding secondary data, the research relied on information provided by the National Bureau of Statistics for the period 2021–2023. From the perspective of competitiveness, data were analyzed on the number and structure of active enterprises, average revenues per enterprise and per employee, labor productivity, and the sectoral distribution of economic activities. For the ecological component, available data were used regarding current expenditures for environmental protection (including waste management, water and air protection, and biodiversity conservation), as well as ecological payments made by enterprises. Since the most recent publicly available ecological data refer to 2021, these were correlated with economic performance indicators from subsequent years, particularly 2023, to observe potential delayed effects.

In addition to statistical analysis, the research also included an empirical component, conducted through a semi-structured questionnaire applied to a sample of 50 enterprises from various economic sectors (industry, services, agriculture). The enterprises were selected using the stratified random sampling method to ensure the representativeness of different activity domains and organizational sizes. The questionnaire focused on aspects such as the types of ecological practices applied (recycling, energy efficiency, ecological auditing, use of renewable resources), the motivations for adopting them (regulatory compliance, cost reduction, image advantages), the obstacles encountered (high costs, lack of institutional support, insufficient human resources), and the perceived impact of these measures on economic performance.

Data analysis was performed using descriptive and comparative techniques, followed by Pearson correlation analysis to identify the relationship between the level of ecological expenditures and key economic performance indicators, such as revenue per employee, labor productivity, and the number of employees. The triangulation of data - by comparing official statistical information with field responses - helped strengthen the validity of the conclusions and allowed for the formulation of well-grounded recommendations.

The research acknowledged certain limitations, such as temporal discrepancies between environmental and economic data, lack of access to detailed accounting data regarding ecological costs for each enterprise, and the subjective nature of some responses from participants. Nevertheless, the chosen methodology allowed for the construction of a relevant overview of the relationship between ecological management and competitiveness within the realities of Moldova's economy.

## **REZULTATE SI DISCUȚII**

SMEs represent an essential pillar of the Republic of Moldova's economy, holding a dominant share in the total number of active economic entities. Through their capacity to generate employment and significantly contribute to income formation, SMEs emerge as a key driver of economic development and internal market resilience [5, p. 267]. The evolution of the main structural indicators during the 2021–2023 period reflects relative numerical stability, yet is accompanied by challenges related to increasing efficiency, adapting to new market demands, and optimizing profitability. In this context, the following table provides a relevant synthesis of the contribution of SMEs to the national economic structure, serving as a basis for the in-depth analysis of the relationship between ecological management practices and the competitiveness of the sector.

**Table 1.** Evolution of SME contribution to the national economic structure during the 2021–2023 period

| Years | Number of enterprises, thousands |      |                           | Average annual number of employees, thousands |       |                           | Sales revenues, billion MDL |       |                           | Profit (+), loss (–) before taxation, million MDL |
|-------|----------------------------------|------|---------------------------|-----------------------------------------------|-------|---------------------------|-----------------------------|-------|---------------------------|---------------------------------------------------|
|       | Total                            | SMEs | Share of SMEs in total, % | Total                                         | SMEs  | Share of SMEs in total, % | Total                       | SMEs  | Share of SMEs in total, % |                                                   |
| 2023  | 63,8                             | 63,3 | 99,2                      | 539,0                                         | 352,1 | 65,3                      | 636,1                       | 285,9 | 45,0                      | 24697,1                                           |
| 2022  | 62,6                             | 62,1 | 99,2                      | 529,3                                         | 347,3 | 65,6                      | 612,0                       | 274,8 | 44,9                      | 27088,8                                           |
| 2021  | 60,3                             | 59,8 | 99,1                      | 532,5                                         | 342,1 | 64,2                      | 488,0                       | 225,0 | 46,1                      | 28496,1                                           |

*Source: elaborated by the author based on NBS data [2]*

The analyzed data reveal that SMEs continue to represent the central pillar of the economic structure in the Republic of Moldova. Throughout the analyzed period, their share in the total number of reporting enterprises remained consistently above 99%. This stability confirms that SMEs remain the most widespread organizational form in the national economy, with an extensive presence across all sectors of activity.

Another significant aspect is the evolution of SMEs' contribution to employment. During the analyzed period, the average annual number of employees working in SMEs increased from 342.1 thousand in 2021 to 352.1 thousand in 2023, which represents a growth in their share of total employment from 64.2% to 65.3%. This trend reflects the increasing social importance of SMEs, which contribute not only to economic development but also to maintaining labor market balance by providing stable employment opportunities for a significant part of the active population.

Regarding sales revenues, the analysis shows a substantial absolute increase in the total value generated by SMEs: from 225 billion MDL in 2021 to 285.9 billion MDL in 2023. However, their share in total national economic revenues recorded a slight decline - from 46.1% in 2021 to 45.0% in 2023. This seemingly paradoxical evolution suggests that while SMEs continued to grow their activities, large enterprises experienced more dynamic growth, thereby strengthening their market position and leading to a relative decrease in the SMEs' contribution to total revenues.

At the same time, the total number of registered enterprises increased from 60.3 thousand in 2021 to 63.8 thousand in 2023, reflecting a positive trend in the business environment and a tendency toward economic recovery after the pandemic period. In parallel, the total labor force also grew - from 532.5 thousand to 539 thousand employees during the same period - supporting the idea of a gradual revival of overall economic activity.

Nevertheless, the slight decline in the share of revenues generated by SMEs in the total economy may indicate structural or strategic challenges these enterprises face. Possible causes include limited capacity to access new technologies, low levels of digitalization, difficulties in attracting investment, and constraints related to market or financing access. Additionally, the competitive pressure exerted by large enterprises, with superior operational and financial capabilities, may contribute to a certain stagnation in SME competitiveness, despite their vital role in the economy.

Although SMEs retain a dominant role in terms of numbers and social impact, the analysis highlights the need to strengthen their ability to adapt to new economic realities, including through investments in digitalization, innovation, and sustainability [6, p. 192]. These directions become essential to prevent the deepening of the gap between SMEs and large enterprises and to ensure balanced and competitive economic development at the national level.

**Table 2.** Evolution of SME Competitiveness Indicators in the Republic of Moldova during the period 2021–2023

| Indicators                                    | Years     |           |           | Absolute deviation<br>(+,-), thousand<br>MDL |               | Relative deviation<br>(+,-), per-<br>centage points<br>(p.p.) |               |
|-----------------------------------------------|-----------|-----------|-----------|----------------------------------------------|---------------|---------------------------------------------------------------|---------------|
|                                               | 2021      | 2022      | 2023      | 2021-2022                                    | 2022-<br>2023 | 2021-<br>2022                                                 | 2022-<br>2023 |
| Average revenue per enterprise, thousand MDL  | 3762541,8 | 4425120,8 | 4516587,7 | +662579,0                                    | +91466,9      | +17,61                                                        | +2,07         |
| Average profit per enterprise, thousand MDL   | 412,99    | 436,21    | 450,14    | +23,22                                       | +13,93        | +5,3                                                          | +3,1          |
| Average profit per employee, thousand MDL     | 71,19     | 78,00     | 80,93     | +6,81                                        | +2,93         | +8,7                                                          | +3,62         |
| Labor productivity, thousand MDL per employee | 657,7     | 791,2     | 812,0     | +133,5                                       | +20,8         | +20,3                                                         | +2,63         |

*Source: elaborated by the author based on NBS data [2]*

The presented data reflect a positive but moderate evolution of the main competitiveness indicators of small and medium-sized enterprises (SMEs) in the Republic of Moldova. The average revenue per enterprise registered a substantial increase in 2022 (+17.61%), signaling a significant recovery of economic activity after the pandemic pe-

riod. In contrast, 2023 marked a relative stagnation (+2.07%), which suggests either the reaching of a balance threshold or the influence of less favorable external factors.

The average profit per enterprise and per employee increased progressively throughout the analyzed period, with a more sustained pace in 2022 compared to 2023. This indicates improved managerial efficiency, but also a limitation in accumulation potential in the absence of structural reforms or targeted investment support.

Labor productivity - a key indicator of economic performance - experienced a notable increase in 2022 (+20.3%), followed by a clear slowdown in 2023 (+2.63%). This trend confirms that, although enterprises managed to significantly improve their efficiency in a short period, maintaining this progress requires active public policies focused on digitalization, professional training, and the implementation of ecological practices.

Overall, the analyzed developments indicate a gradual strengthening of SME competitiveness, but also highlight their vulnerabilities to economic shocks and the need for a coherent national strategy to support the sustainable development of the sector.

The analysis of the economic indicators presented in Table 2 points to a positive yet fragile trend in the competitiveness of SMEs in the Republic of Moldova between 2021 and 2023. This evolution should be correlated with the results obtained from the questionnaire on ecological management practices, which offers an applied perspective on the factors that can influence economic performance.

**Table 3.** Descriptive indicators regarding ecological practices and economic performance in the surveyed enterprises (n = 56)

| Indicators                            | Mean   | Minimum | Maximum | Standard deviation |
|---------------------------------------|--------|---------|---------|--------------------|
| Number of ecological practices        | 1,84   | 0.0     | 4.0     | 1.5                |
| Average motivation score (1–5)        | 3,47   | 2.31    | 4.98    | 0.56               |
| Average obstacles score (1–5)         | 3,26   | 2.07    | 5.0     | 0.66               |
| Perceived impact on profit (1–5)      | 3,44   | 2.39    | 5.0     | 0.5                |
| Ecological expenditures, thousand MDL | 347,68 | 0.0     | 605.96  | 125.51             |
| Revenue per employee, thousand MDL    | 787,42 | 635.19  | 989.24  | 76.52              |
| Labor productivity, thousand MDL      | 807,56 | 608.85  | 997.08  | 90.25              |
| Number of employees                   | 131    | 12      | 245     | 67.32              |

*Source: elaborated by the author based on data obtained through questionnaires*

The questionnaire was completed by 56 enterprises from the Republic of Moldova, with a diverse sectoral distribution: industry (25%), services (30%), trade (20%), agriculture (15%), and other fields (10%), thus reflecting a balanced representation of the main economic sectors.

The results of the descriptive analysis highlight a moderate diversity in the application of ecological practices. On average, an enterprise applies approximately two ecological practices, with a maximum of 4, indicating an incipient level of integration of green principles in activity management.

Motivations for adopting ecological practices recorded an average score of 3.47 on a scale of 1–5, indicating a relatively favorable attitude, especially towards legal compliance and cost reduction. In contrast, perceived obstacles (average score of 3.26) remain persistent, with the most reported being high costs and lack of institutional support.

Furthermore, the perceived impact of these measures on profitability was rated with an average score of 3.41, suggesting a moderately positive but still uncertain perception among respondents.

Financially, enterprises reported average ecological expenditures of approximately 347.7 thousand MDL, with a significant standard deviation, indicating major differences in investment capacity. Economic performance indicators – revenue per employee and labor productivity – also show considerable variation, allowing for hypotheses to be formulated regarding possible correlations with the level of ecological expenditures or the degree of implementation of green practices.

This analysis provides a solid basis for the correlational stage of the study and for the formulation of evidence-based recommendations regarding support and incentive policies for the ecological transition among SMEs in the Republic of Moldova.

As part of the research on the impact of ecological management practices on the competitiveness of enterprises in the Republic of Moldova, a correlation matrix was developed as a statistical tool aimed at highlighting the nature and intensity of the relationships between the investigated variables. Using the Spearman correlation coefficient – appropriate for non-linear or ordinal distributions – the analysis seeks to determine the links between: the ecological practices applied (total number); the motivations and perceived obstacles in the implementation process; the perceived impact on profit, as well as the relevant economic indicators: ecological expenditures, revenue per employee, labor productivity, and number of employees.

The resulting matrix provides an overview of the interdependencies between ecological and economic dimensions, contributing to the identification of potential patterns of association or dissociation between sustainability and performance.

**Table 4.** Correlation matrix of coefficients between ecological practices and economic performance

| <i>Indicators</i>                     | <i>Number of ecological practices</i> | <i>Motivation score</i> | <i>Obstacle score</i> | <i>Profit impact</i> | <i>Ecological expenditures</i> | <i>Revenue per employee</i> | <i>Labor productivity</i> | <i>Number of employees</i> |
|---------------------------------------|---------------------------------------|-------------------------|-----------------------|----------------------|--------------------------------|-----------------------------|---------------------------|----------------------------|
| <i>Number of ecological practices</i> | 1.00                                  | 0.35                    | -0.08                 | -0.09                | 0.28                           | 0.37                        | 0.41                      | 0.05                       |

|                                |       |       |       |       |       |      |       |       |
|--------------------------------|-------|-------|-------|-------|-------|------|-------|-------|
| <i>Motivation score</i>        | 0.35  | 1.00  | -0.22 | 0.03  | 0.32  | 0.22 | 0.29  | 0.13  |
| <i>Obstacle score</i>          | -0.08 | -0.22 | 1.00  | -0.16 | -0.09 | 0.05 | -0.13 | 0.12  |
| <i>Profit impact</i>           | -0.09 | 0.03  | -0.16 | 1.00  | 0.45  | 0.26 | 0.31  | -0.02 |
| <i>Ecological expenditures</i> | 0.28  | 0.32  | -0.09 | 0.45  | 1.00  | 0.34 | 0.43  | 0.40  |
| <i>Revenue per employee</i>    | 0.37  | 0.22  | 0.05  | 0.26  | 0.34  | 1.00 | 0.48  | 0.30  |
| <i>Labor productivity</i>      | 0.41  | 0.29  | -0.13 | 0.31  | 0.43  | 0.48 | 1.00  | 0.25  |
| <i>Number of employees</i>     | 0.05  | -0.13 | 0.12  | -0.02 | 0.40  | 0.30 | 0.25  | 1.00  |

Source: elaborated by the author based on data obtained through questionnaires

The correlation matrix between key questionnaire variables and economic performance indicators allows for the evaluation of the intensity and direction of the relationships between: implemented ecological practices, perceived motivations and obstacles, ecological expenditures, perceived impact on profit, and economic performance (revenue per employee, labor productivity, number of employees). Values close to +1 indicate a strong positive correlation; values close to -1 indicate a strong negative correlation; values near 0 indicate no correlation.

Based on the Pearson correlation coefficient matrix, a series of positive correlations are highlighted between ecological management practices and the economic performance indicators of the surveyed enterprises, supporting the central hypothesis of the study - that sustainability can be a factor of competitiveness.

First, the number of ecological practices implemented shows a moderate positive correlation with labor productivity ( $r = 0.41$ ) and revenue per employee ( $r = 0.37$ ). These relationships indicate that enterprises applying more ecological measures tend to optimize their internal processes, leading to increased efficiency and added value generated per employee.

Furthermore, ecological expenditures recorded by enterprises are positively correlated with labor productivity ( $r = 0.43$ ) and with the perceived impact on profit ( $r = 0.45$ ). This confirms that environmental investments can yield direct economic benefits and are perceived by managers as profit-generating.

Likewise, declared ecological motivations (such as the desire for compliance, cost reduction, or reputational advantages) correlate positively with the number of ecologi-

cal practices ( $r = 0.35$ ) and with ecological expenditures ( $r = 0.32$ ), suggesting that strategic commitments are reflected in concrete behaviors and resource allocation.

In contrast, perceived obstacles (related to costs, institutional support, or human resources) show weak negative correlations with ecological variables, indicating that although challenges are identified, they do not represent major blocking factors.

The correlational results support the hypothesis that ecological management practices are not merely a response to compliance requirements, but also a strategic factor for enhancing competitiveness. Although the relationships identified are generally of moderate intensity, they are consistent and suggest that enterprises investing in sustainability benefit from improved economic performance and labor efficiency. This conclusion justifies the expansion of political and financial support for promoting the greening of the SME sector and the development of a public policy framework that encourages proactive and innovative behaviors in corporate sustainability.

## CONCLUSIONS

The research has shown that ecological practices are no longer merely a compliance mechanism with environmental regulations, but are increasingly being integrated into the competitive development strategies of enterprises. The correlations identified between the number of ecological practices and performance indicators (revenue per employee, labor productivity) confirm their potential to generate economic efficiency and added value. Although SMEs operate with limited resources, they have demonstrated an openness to integrating sustainability principles into economic activities. Representing over 99% of all economic entities, they have the capacity to become key promoters of the green economy in the Republic of Moldova—provided they are supported through appropriate public policies.

The motivations for implementing green practices are predominantly strategic in nature (reputation, efficiency, image), and these motivations are directly reflected in the actions taken. Conversely, obstacles (costs, lack of support, limited resources) negatively influence ecological engagement but do not eliminate interest in sustainability, suggesting the existence of a latent development potential. Ecological expenditures were positively correlated with labor productivity and perceived profitability. This finding supports the idea that pro-environmental actions are not a burden but can constitute an investment in operational efficiency and long-term advantages.

To make ecological management a widespread practice, it is essential to strengthen the institutional framework, facilitate access to green financing, and encourage professional training in the field of sustainability. Only in this way can SMEs transform sustainability into a sustainable competitive advantage.

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