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EVALUATION OF THE IMPACT OF WAGE EXPENDITURES ON COMPETITIVENESS AND SUSTAINABILITY IN THE ROMANIAN ENERGY INDUSTRY

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Abstract
The paper analyses the impact of personnel costs on the financial results of five important companies in the energy field in Romania (nuclear energy, oil, gas and hydropower) based on the financial statements reported in the last decade, following the assessment of how salary expenses affect revenues and profitability. The energy industry in Romania significantly influences GDP and regional development, so understanding the relationship between investments in human resources and financial success is essential for promoting the growth and competitiveness of companies in the field, especially during the transition to renewable energy. Using econometric methods (such as simple and multiple linear regressions, logistic regression and time series analysis such as ARIMA and VAR, Granger test, and PCA analysis), the study investigates the direct and dynamic relationships between personnel expenses and the performance indicators of companies. The results show a significant positive relationship between the salary expenses and the companies' total revenues, indicating that more significant investments in the workforce can lead to operational growth. In contrast, social protection spending shows a weaker correlation, suggesting that it has a minimal effect on financial performance. The two-way relationship revealed by the Granger test underlines the reciprocal impact of wage policies on financial results, underscoring the strategic value of investing in human capital. This research provides important insights for improving personnel spending strategies and promoting long-term sustainability and competitiveness in Romania's energy sector.

Keywords: Personnel expenses, companies' financial performance, energy sector, econometric analysis, sustainability

JEL Classification: C58, M52

I. INTRODUCTION

The energy industry contributes approximately 7-8% to Romania's GDP, employing over 100,000 people and generating additional construction, transport and services jobs. It stimulates economic growth at the regional level, ensuring salaries above the national average. The companies in the field are characterised by the diversification of energy sources, investing a significant amount in the monetisation of the infrastructure and renewable energy sources, such as the investment of over one billion euros by the Nuclearelectrica company in the Cernavodă plant. Romania has an installed capacity of approximately 4.5 GW in wind and solar energy and produced 65 TWh of electricity in 2022, of which over 40% came from renewable and nuclear sources. This surplus production allows Romania to be a net exporter of electricity, supporting the positive trade balance.

Among the main actors of the Romanian energy sector are also the companies selected for the analysis: Nuclearelectrica (the leading producer of nuclear energy), OMV Petrom (leader in the production of oil and natural gas), Romgaz (a key player in the natural gas sector), Rompetrol (specialised in refining and fuel production), Hidroelectrica (the leading producer of hydro energy). These companies provide the necessary infrastructure for energy distribution and transmission at national and international levels. Through continuous investments, these companies contribute to the transition to sustainable energy sources and the consolidation of Romania's energy security, which is essential for macroeconomic stability and competitiveness in the regional market.

The present paper analyses how the expenses related to the performance influence the performance of the companies, with an example of 5 companies from Romania in the energy sector. Using econometric models and

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methods, an examination of how personnel expenses/costs influence turnover and net profit, values reported by the companies analysed in their annual financial statements. Personnel expenses have an important influence on the performance of Romania's energy sector (it can be seen directly from the total amount of expenses related to salaries, allowances and related contributions), being essential to analyse how investments in human resources (along with the transition to renewable energy) have a positive or negative impact on the operational and financial performance of companies, with an emphasis on sustainability (Morosan-Danila & Bordeianu, 2020). The paper starts with the idea that salary policies can be a strategic tool for improving the performance and competitiveness of companies, especially in the energy field.

The paper uses different econometric and statistical methods and models to explore the complex connections between personnel expenses and financial performance. This study provides insights into the significant role that human resources play in influencing the overall results of a business. The research methodology includes the following approaches:

1. Correlation between financial variables - analyses the linear relationship between salary expenses and economic performance (through indicators such as net turnover), through which strong (positive or negative) influence correlations are traced.

2. Simple and/or multiple linear regressions - used to assess the direct or indirect effect of variables related to salary expenses on net turnover and other performance indicators.3. Logistic regression - allows a probabilistic analysis of the impact of wage variables on this indicator.

4. Time series analysis (ARIMA and VAR) - used to analyse the long-term evolution of salary expenses and turnover. ARIMA examines trends in a single variable (e.g. wages), and VAR examines the two-way dynamic relationship between multiple variables over time.

5. Granger causality test - assesses the causality between wages and performance.

6. Principal component analysis (PCA) and factorial - PCA reduces the complexity of the data by identifying the main variables explaining the variation in performance. Factor analysis is applied to discover common latent factors among variables and how they influence performance.

These methodologies were chosen to cover a wide range of perspectives on the impact of salary expenses on companies' performance. Each method offers a unique perspective, enabling an integrated and profound analysis of the available data.

II. LITERATURE REVIEW

Personnel expenses usually comprise the company's total costs for employee salaries, as well as benefits, training and other associated expenses (Morosan-Danila, 2022). In the specialised literature, these costs are classified either from a financial point of view or from an operational point of view, highlighting the distinction between the direct financial impact, such as salary, and the indirect one, such as employee motivation programs (Morosan-Danila, 2015). Pererva et al. (2018) introduce the notion of "motivational elasticity", which evaluates how different costs related to employee motivation affect productivity within firms in the industry, the perspective supporting companies in more efficient evaluation of staff-related costs through the use of "block modules" which include social, psychological and financial factors and thus allowing a more strategic allocation of resources and increased productivity of human resources.

Understanding the structure of personnel costs is strategic, even crucial, for recognising the impact of human resources on companies' economic value (Albu & Morosan-Danila, 2009; Manolescu et al., 2010). For example, a study by Al-Delawi and Jameel (2023) shows that investments in employee training and financial and non-financial support positively and significantly affect the company's market value, not just its image. Bondarenko (2023) extends the research to include personnel expenses in the resources that ensure the achievement of the company's objectives. Thus, we can discuss a financial and/or accounting approach to them (Morosan-Danila & Fercal, 2022). Kuritsyna et al. (2021) carry out a more detailed classification of personnel costs, including logistics related to human resources, highlighting the importance of specific criteria for improving the decision-making process and evaluating personnel performance.

Mizikovsky et al. (2017) study the differences between "costs" and "expenses" according to International Accounting Standards (IFRS) and how these costs are included in the cost of finished products, recommending the unification of accounting approaches for the correctness and unification of reporting. Sinambela and Djaelani (2022) analyse costs' fixed and variable nature, which is important for optimising financial reporting and supporting managerial decisions.

Galvão (2018) analyses personnel costs (in the example of some schools in Brazil), demonstrating that a correct classification of them can improve the performance of the organisation and can make investments in human resources more efficient.

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Different personnel expenses, such as those related to social protection and private health insurance, significantly impact financial performance (Manolescu et al., 2012; Morosan-Danila & Bordeianu, 2021). Different studies present evidence that investments in work ergonomics and using prediction techniques can forecast companies' turnover and reduce operational costs, such as the study by Guerranti and Dimitri (2022). Chan et al. (2021) demonstrated that various predictive models based on employee health history can optimise the allocation of healthcare resources, enabling adjustments to improve staff productivity.

The specialised literature presents several important categories of expenses for organisational effectiveness, including expenses directly involved in improving financial performance and optimising investments in human resources, as presented in Table 1.

Table 1. Categories of expenses related to human resources

Type of expenses	Involvement	Author
Pedagogical coordination expenses	These expenses significantly impact school performance in the educational field, exemplifying how investments in teaching staff contribute to the institution's efficiency.	Galvão, 2018
Marketing expenditure	Funds dedicated to marketing, encompassing advertising and sales incentives, contribute to financial success even in challenging economic situations, boosting revenue and profitability.	Hossain & Islam, 2018
General and administrative expenses (SG&A)	Administrative and general expenses and investments in corporate social responsibility (CSR) affect financial performance, highlighting the value of a strategic distribution of human resources.	Nowar, 2023
Health and wellness expenses	Essential costs for ensuring sustained employee productivity in large organisations, improving overall results.	Lascuña et al., 2017
Operating expenses	The composition of operating expenses, which encompasses direct and indirect personnel costs, affects financial performance by enhancing pricing strategies and boosting profitability. Efficient oversight of these expenses is crucial for the company's financial success.	Oshchepkov & Mahdenko, 2023

Source: Author's processing based on studied literature

Financial performance indicators, such as profit before tax and market value, are often used to assess the effects of personnel expenses on companies. Also, regression analysis reveals a correlation between these expenses and financial performance, indicating that organisational commitments and human resource management play a crucial role in profitability and operational efficiency (Wright et al., 2003; Macovei & Andrioaia, 2022). Here is a selection of key indicators and methodologies applied in recent research:

- Multi-criteria financial performance evaluation—The energy sector requires an analysis combining efficiency, profitability, and liquidity criteria. Studies on Turkish energy companies listed on the Istanbul Stock Exchange used the multi-criteria decision-making method (MCDM) to evaluate the rate of return and the degree of indebtedness (Dagistanli, 2023).
- Energy assessment through Exergy Accounting—In the Dutch energy sector, performance analysis considers cumulative exergy consumption (CExC), providing detailed insight into operational efficiency in various subsectors such as refineries and electricity generation (Ptasinkski et al., 2006).
- Specific Energy Performance Indicators (EnPI)—Specific energy performance indicators in the Italian cement industry have proven fundamental for efficiency monitoring. Statistical analysis and energy auditing establish benchmarks supporting companies and public policies (Bruni et al., 2021; Grosu et al., 2022).
- Hierarchical Multicriteria Analysis (HSMAA)—The evaluation model is based on hierarchical multicriteria analysis, which considers the weights' uncertainty and allows the classification of energy companies. It highlights that the top and bottom positions are stable, while the intermediate ones vary, suggesting the need for multiple criteria for a comprehensive assessment (Angilella & Pappalardo, 2020).
- Sustainability and Corporate Governance Assessment – Energy and financial performance assessed through the lens of sustainability and corporate governance underscores the importance of sustainability in long-term success (Luca et al., 2024). In Turkey, this model applied to companies in the energy sector highlights the impact of social responsibility on operational efficiency (Zehir et al., 2023).

The measures for evaluating and improving energy companies' performance involve market and operational efficiency indicators, with environmental factors playing an important role. Savić and Bonić (2022) present the importance of environmental reporting as an element of performance, emphasising that sustainable practices can improve financial results. In addition, Dagistanli (2023) combines financial and sustainability indicators to provide a comprehensive overview of performance and decision-making.

Different strategies and models examine how personnel expenses affect corporate performance, especially in industries that rely heavily on material but also human resources, such as the energy sector, methods such as the

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multi-criteria decision-making method (MCDM) and regression analyses (see Figure 1). Madenoğlu et al. (2022) introduce the MCDM approach incorporating sensitivity analysis to assess the influence of personnel costs on energy firms in Turkey, emphasising the importance of operational efficiency in managing these expenses.

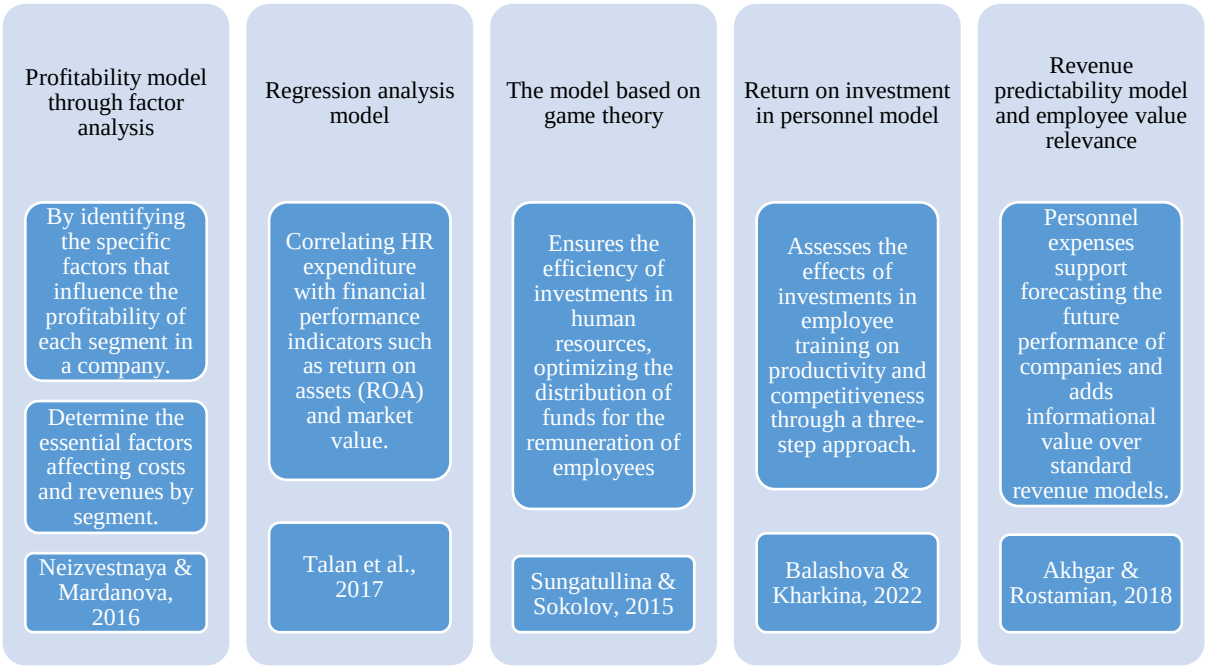

Figure 1. Models and methodologies to study the impact of personnel expenses on company performance
Source: Author's processing based on studied literature

By applying these models, companies can gain a more detailed assessment of the impact of personnel expenses on their economic performance, optimising HR resources and strategies to support long-term success.

III. ANALYSIS OF THE IMPACT OF PERSONNEL EXPENSES ON THE PERFORMANCE OF ENERGY COMPANIES

The study's results on the five energy companies in Romania for 10 years show a significant positive correlation between salaries and net turnover (+0.79), suggesting that investments in human resources have a favourable impact on financial performance. This correlation may indicate that higher wages help attract and retain skilled employees, which supports operational growth and, by implication, turnover. We observe a weaker negative correlation between social protection expenditure and turnover (-0.38), which suggests that although insurance is necessary, it does not contribute significantly to increasing financial performance.

From the correlation analysis, we can deduce that the variables related to wages have a more direct and positive influence on financial performance than other social expenses. This supports the hypothesis that wages directly influence productivity and company performance.

We used simple and multiple linear regressions to determine the influence of "Salaries and allowances" and "Insurance and social protection expenses" on financial performance, particularly net turnover. To begin with, simple linear regression analyses the relationship between "Salaries and allowances" (the independent variable) and net turnover (the dependent variable). The results show a correlation coefficient of +0.79 and an R^2 coefficient of 0.60, indicating that approximately 60% of the variation in turnover can be explained by variations in wages and benefits. This result suggests a strong relationship between wages and performance, emphasising increased staffing costs are reflected in increased turnover.

The equation obtained from the simple regression is:

$$Net\ turnover\ = \beta_0 + \beta_1 \times Salaries\ and\ allowances + \varepsilon \quad (1)$$

where β_0 is the intercept, and β1 is the coefficient indicating the influence of wages on net turnover.

The multiple linear regression model includes 'Insurance and social protection expenditure' as an additional variable alongside "Salaries and allowances" for a more complex perspective. This analysis shows a slight increase in the R^2 coefficient to 0.63, indicating that 63% of the variation in turnover can be explained when both wages and social expenses are included. However, adding social spending only slightly improves the model's ability to

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explain variation in financial performance, suggesting that wages remain the dominant factor.

The equation of the multiple regression model is:

$$Net\ turnover\ = \beta_0 + \beta_1 \times Salaries\ and\ allowances + \beta_2 \times Insurance\ and\ social\ protection\ expenses + \varepsilon \quad (2)$$

where β_2 represents the influence of social spending on turnover, the OLS equation for our five companies is:

$$Net\ turnover\ = -1{,}769{,}732{,}280.09 + 17.6157 \times Salaries\ and\ allowances - 20.7399 \times Insurance\ and\ social\ protection\ expenses \quad (3)$$

The coefficient for "Salaries and allowances" indicates a significant positive relationship, confirming that each additional unit allocated to wages is associated with an increase in turnover. The coefficient for "Insurance and social protection expenditure" is negative and weaker, suggesting little or no adverse influence on financial performance. This model concludes that although both categories of personnel expenditure influence turnover, wages and benefits have a much more substantial positive impact, suggesting a more significant strategic value for direct investment in human resources.

Logistic regression analyses the relationship between the independent variables (personnel expenses) and the probability of a positive or negative net profit outcome. The equation expresses the logistic model:

$$P(Positive\ net\ profit) = 1^{+e} - (\beta_0 + \beta_1 \times Salaries\ and\ allowances + \beta_2 \times Insurance\ and\ social\ protection\ expenses) \quad (4)$$

where P (Positive net profit) is the probability that the net profit is positive, β_0 represents the intercept, β_1 and β_2 are the coefficients of the personnel expenditure variables. The results obtained indicate that:

- The coefficient for "Salaries and allowances" is small and positive, showing a negligible influence on the probability that net profit is positive. This suggests that wages and benefits while influencing overall performance, do not directly affect the chances of having a positive net profit.
- The coefficient for "Insurance and social protection expenses" is also minimal and negative, indicating little influence on the probability of positive returns.

The equation of the logistic regression model is of the form:

$$Logit(P(Y = 1)) = \beta_0 + \beta_1 \times Salaries\ and\ allowances + \beta_2 \times Insurance\ and\ social\ protection\ expenses \quad (5)$$

where P(Y=1) is the probability that the net turnover is above the general average; β_0 is the intercept; β_1 and β_2 are the coefficients for "Salaries and allowances" and "Insurance and social protection expenses", respectively. Based on the results obtained, the logistic equation is:

$$Logit(P(Y = 1)) = -2.63 \times 10^{-16} + 2.95 \times 10^{-10} \times Salaries\ and\ allowances + 1.01 \times 10^{-10} \times Insurance\ and\ social\ protection\ expenses \quad (6)$$

The logistic model achieved 89.8% accuracy in predicting positive or negative net profit, indicating reasonable predictive ability. However, the small coefficients of the wage variables suggest that the critical factors for achieving a positive profit might differ, perhaps including other operational performance indicators.

This logistic regression shows that salary variables influence the probability of a positive net profit to a small extent, indicating that other variables or operational strategies may play a more critical role in determining the positive profit of energy sector companies.

The Autoregressive Integrated Moving Average (ARIMA) model is used to analyse wages and benefits time series, capturing long-term trends and seasonality. The application of the ARIMA model shows the following results:

- The AR (1) coefficient is 0.0948, and the MA (1) coefficient is -0.0234, indicating a moderate autoregressive trend.
- AIC (Akaike Information Criterion), as an indicator of model quality, is 1991.717, suggesting a better fit of the model to the data used.

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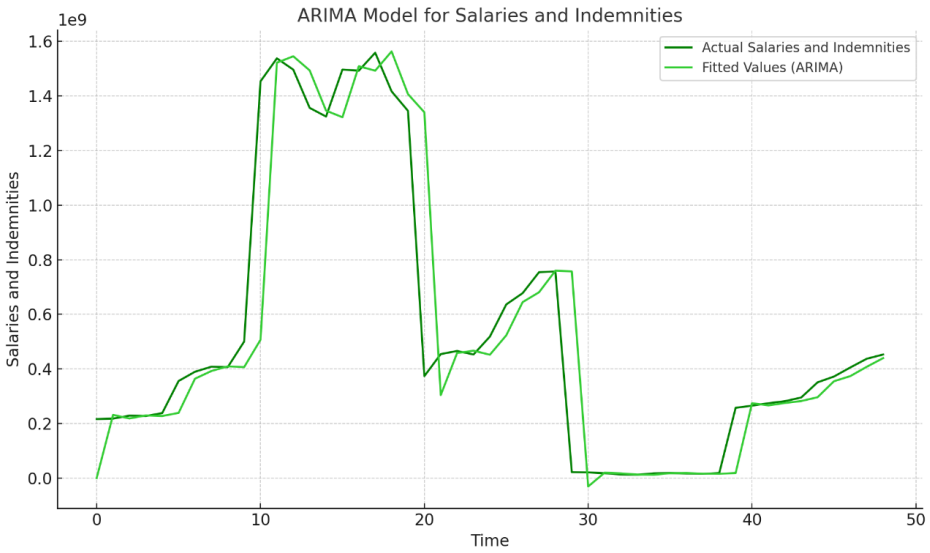

Figure 2. ARIMA Model for "Salaries and allowances"
Source: Graph generated using Python and the Seaborn library

The obtained ARIMA model shows that the time series for salaries and benefits has a slightly autoregressive trend, which proves that values from previous periods have a modest impact on current values.

The Vector Autoregression (VAR) model analyses the bidirectional relationship between "Salaries and allowances" and "Net turnover", facilitating a simultaneous analysis of the dynamics of both variables and the identification of interdependencies between them. The equation for "Salaries and allowances" formulated within the VAR model presents:

$$Salaries\ and\ allowances = 29{,}280{,}439.96 + 1.1678 \times Salaries\ and\ allowances_{t-1} - 0.0191 \times Net\ turnover_{t-1} + \varepsilon_t \quad (7)$$

The coefficient of the lagged variable L1, "Salaries and allowances" (of 1.1678), suggests a strong influence of past salary values on current values. At the same time, the coefficient of lagged variable L1, "Net turnover" (of -0.0191), indicates a modest negative influence of turnover on wages.

The equation for "Net turnover" formulated within the VAR model presents:

$$Net\ turnover = -1{,}460{,}809{,}103.62 + 14.7755 \times Salaries\ and\ allowances_{t-1} - 0.0799 \times Net\ turnover_{t-1} + \varepsilon_t \quad (8)$$

The coefficient of the lagged variable L1, "Salaries and allowances" (of 14.7755), indicates wages' positive and significant influence on net turnover. The coefficient of the lagged variable L1, "Net turnover" (of -0.0799), suggests that the previous turnover does not significantly influence the current value.

The results of the VAR model show that salaries positively influence net turnover, underlining the importance of salary expenses in supporting financial performance; at the same time, net turnover also slightly influences wages, indicating a bidirectional relationship.

Time series analysis indicates that salary expenses have a long-term positive impact on net turnover, and the relationship is reciprocal, even if it is weaker, highlighting the importance of investment in human resources for the sustainable performance of companies. The Granger causality test determines whether changes in Salaries and Benefits expenses statistically influence changes in net turnover and vice versa, helping to analyse the direction of influence between salary expenses and company performance, providing crucial insights into potential two-way causality. The results of the Granger test applied to the five companies are as follows:

- Test from "Salaries and allowances" to "Net turnover" show the results: F-test: $F = 15.59$, $p = 0.0003$; Chi-square test: $\chi^2 = 16.63$, $p < 0.0001$; the probability test (Likelihood Ratio): $\chi^2 = 14.28$, $p = 0.0002$, suggesting that changes in salary expenses can predict changes in turnover.
- Test from "Net turnover" to "Salaries and allowances" show the results: F-test: $F = 23.53$, $p < 0.0001$; Chi-square test: $\chi^2 = 25.10$, $p < 0.0001$; the probability test (Likelihood Ratio): $\chi^2 = 20.19$, $p < 0.0001$, indicating bidirectional causality between the two variables.

The Granger test results indicate a bidirectional causality between salary expenses and net turnover,

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reinforcing the idea that HR policies affect financial performance. At the same time, company performance can also influence salary expenses. Consequently, the connection between investments in human resources and company performance is intricate and mutually dependent, highlighting the strategic significance of managing salary costs within the framework of long-term performance.

Principal Component Analysis (PCA) helps to simplify the data set by identifying the most essential components that explain the variation in the data. The first two principal components were the most relevant:

- The first component explains 78.42% of the total variability and is strongly associated with financial performance variables such as net turnover, income and net profit. This indicates that a combination of performance variables can explain much of the variation in financial performance.
- The second component explains 15.48% of the variability and is more correlated with the variables related to personnel expenses (salaries and social protection).

Thus, the first two components explain approximately 93.9% of the total variability, suggesting that these components capture most of the information in the data, with financial performance and personnel expenses being the most influential.

Factor analysis allows the identification of latent factors that explain the relationships between variables in more detail. Three main factors were extracted:

- Factor 1: Explains most financial performance variables, including net turnover, total expenses, and total income. This can be interpreted as a general factor of financial performance.
- Factor 2: It is related to personnel expenses (salaries and social protection), reflecting a specific factor of salary costs.
- Factor 3: Correlated especially with social expenses, this factor can represent a specific element of social protection costs.

PCA and Factor Analysis indicate that overall financial performance dominates, while salary expenses and social protection costs play secondary roles. The results support the hypothesis that investments in human resources are essential but not the only determinant of performance, highlighting the interdependence between financial performance and salary expenses.

Correlation analysis and linear regression showed that salaries and allowances are positively and significantly correlated with net turnover, indicating a direct and beneficial influence on financial performance. This supports the idea that investment in human resources contributes to increased turnover, perhaps by attracting and retaining skilled staff, which can improve efficiency and productivity.

The results indicated that “Insurance and social protection expenses” negatively correlate with the performance indicators. Logistic regression demonstrated that these costs do not significantly impact the probability of a positive net profit, and the coefficients obtained were very small. This suggests that, although necessary, social spending does not contribute as much to performance as direct wages.

ARIMA and VAR models revealed a bidirectional relationship between wages and net turnover, highlighting the mutual influence between the two correlation variables. The Granger causality test also confirmed that wages influence financial performance and vice versa. These results indicate a complex dynamic where pay policies and operational performance are interrelated, supporting that effective human resource management can boost long-term performance.

PCA analysis and factor analysis indicated that the main factor influencing the variation in the data is overall financial performance, although wages and social costs are also significant. However, direct salary expenses have a greater impact on performance than indirect costs, emphasising the importance of employees' financial and non-financial motivation for a company's success in conjunction with strategic salary strategies. While social spending is vital, its impact on performance is comparatively lower. Consequently, firms in the energy sector can gain from total investment in human resources, prioritising attractive salaries to attract talented employees and thus increase the companies' long-term sustainability and competitiveness.

IV. CONCLUSION

Analysing how personnel expenses affect the performance of energy companies in Romania highlights the importance of investing in human resources for long-term growth and competitiveness and stimulating innovation and efficiency.

The analyses carried out show a strong positive correlation between salary expenses and net turnover (through simple linear regression), demonstrating that investment in salaries contributes directly to improving the financial performance of companies, an effect attributed to competitive salaries and a highly qualified staff that increases productivity and operational performance of the companies involved. Expenditures for insurance and social protection showed a weaker negative correlation with turnover, which indicates that although these expenses

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are mandatory in Romania but also important for the safety and well-being of employees, they do not directly increase financial performance, highlighting thus the need to balance salaries and social expenses to maximise their impact on performance.

According to analyses using time series models and the Granger test, strong financial performance allows companies to increase investment in staff by raising wages, potentially fostering long-term performance improvement in a mutually reinforcing cycle. The results from the PCA and the factor analyses indicate that salaries and benefits are essential factors that significantly account for variations in financial performance. It is necessary to adopt a strategic perspective on salary expenses in the energy industry to ensure the sustainability of the business and for the continuous increase of efficiency and competitiveness.

The study underlines the importance of a balanced approach to personnel costs, salaries being crucial in motivating and retaining company employees, directly influencing performance. While social spending provides a sense of security to employees, it must be managed effectively to avoid negatively impacting resources available for other operational investments.

In modern management and the current era of digitisation and artificial intelligence, analysing the effect of personnel expenses on company performance is a significant concern, especially in complex but strategic industries such as energy. In an unstable and constantly changing economic environment marked by the transition to green energy, investments in human resources become a central pillar for stimulating company growth and innovation. Understanding how wage and social costs affect company performance allows companies to develop effective resource allocation strategies, maximise employee benefits, and optimise costs.

Analysis of personnel expenses significantly improves the understanding of how human resources contribute to organisational performance, regardless of the field of activity. This study offers companies premises and solutions to evaluate and improve their salary policies, achieving a balance between rewarding employees and maintaining financial performance. In the energy sector, where attracting and retaining skilled and talented employees is critical to competitiveness, these findings support strategic decision-making and promote sustainable growth.

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