**The study on Corporate Sustainability Entrepreneurship in Romania: analysis on dependencies of economical state of the corporation on their green politics through eyes of their management**

Abstract:

Corporate Sustainability (CS) has become a very important aspect of business strategy worldwide, and Romania is no exception of it. With increasing global awareness about environmental impact and the pressing for sustainable development, Romanian corporations are gradually adopting green policies. The interplay between corporate sustainability efforts and economic performance raises a fundamental question: To what extent do a corporation's green policies influence its economic state? Furthermore, how do Corporate Executives and The Management perceive this relationship?

This study aims to investigate how Romanian corporations balance their economic objectives with their environmental responsibilities, and also to analyze whether managers' perception of financial results, the degree of innovation, and their proactive orientation influence a company's sustainability. The novelty of the study consists of an approach through the prism of The Management, regarding how the analyzed factors influence the adoption and implementation of sustainable practices within an organization. By examining the relationship between financial perceptions, innovation strategies, and proactive approaches, the study attempts to identify key drivers that contribute to a company's long-term environmental and economic sustainability.

The financial results were analyzed using a two-pronged approach: First, data was gathered through a questionnaire specifically designed for 148 company CEOs or CFOs within their respective companies - in this way we can see a direct perspective from the top management of the companies on the financial health and strategies of their organizations, and secondly, these results were cross-referenced and compared with official financial data sourced from the Ministry of Finance's website, covering a comprehensive period of 10 years. This dual approach ensured that the analysis was grounded in both qualitative - insights from company leaders and quantitative data from official financial records, allowing us for a robust and well-rounded evaluation of the companies' financial performance over time.

The results of our study highlight that companies in the transport sector are among the least likely to adopt green strategies. The results show us that the age of the fleet plays a significant role in this reluctance to adopt green strategies. Older vehicles are less fuel efficient and more polluting, and these models of trucks dominate the transportation sector, making it more difficult and costly for companies to transition to greener technologies and practices. This reliance on older fleets contribute to the sector's slow adoption of sustainability - the financial difficulties caused by the total replacement of the vehicle fleet being very expensive.

Introduction

In the actual’s global environment, sustainability and resilience have become key factors in shaping corporate strategies. Sustainability, which refers to the ability to preserve or enhance systems over time without exhausting resources or damaging natural processes, is gaining importance in business operations. Resilience, meanwhile, focuses on an organization's capacity to adapt to disruptions and continue functioning in the face of challenges, whether they be environmental, economic, or social.

The confluence of these two concepts helps us to highlight their relevant importance in the context of corporate sustainability entrepreneurship, where companies not only strive to achieve economic success but also aim to contribute positively to environmental and societal well-being. According with this dual pursuit, the economic state of a corporation and its commitment to “green politics” — policies and practices aimed at reducing environmental impact — are deeply intertwined.

Literature review

Nowadays, Corporations face numerous challenges in modern economies, with sustainability (Romero-Lankao et all., 2016; Olsson et all, 2014; Glinyanova et al., 2021, Mauer et al., 2019) being a central concern. The growing recognition of the need to enhance sustainable economic performance within organizations has led to the continuous rise of corporate sustainability entrepreneurship. This emerging form of corporate entrepreneurial behaviour (Hasmi et all. 2015; Cheramie et all., 2024, Diez-Cañamero et al., 2020; Anyigbah et al., 2023, Graham et al., 2022) focuses on identifying, developing, and capitalizing on sustainable economic opportunities (Pejman et. All. 2017, Pierce at all. 2011; Kimuli et all., 2020), being related to corporate social responsibility (CSR) and broader sustainability issues (Schaltegger et al., 2021).

Corporate entrepreneurship is a form of entrepreneurship that occurs within established organizations through the initiation of new ventures (Anyigbah et al., 2023). This concept, along with its behavioral manifestation - corporate entrepreneurial innovativeness - can take the form of sustained radical innovation (Adim et al., 2022; Astrini et al., 2020; Wathanakom et al 2020), and also, strategic renewal, or business venturing . The context in which corporate entrepreneurship operates reflects a corporation's character, shaped by generic environmental factors influencing industry players (Okreglicka et al., 2023). Analyzing the relationship between sustainability performance and financial performance, (Nurul Awatif Ahmad Saufia, et al. 2015) concludes we have to study various dimensions of sustainability, including environmental, social, and governance (ESG) factors, and how they correlate with financial metrics such as profitability, return on assets, and stock market performance. These factors can drive parallel and coherent corporate decisions and behaviors (Nunes et al., 2021; Aguilera et al., 2021; Settembre-Blundo et al., 2021; Gomez-Trujillo et al., 2019) that collectively define the corporation's sustainability trajectory. In general, sustainable entrepreneurs replace traditional business practices, systems, and processes with superior products and services that prioritize social and environmental benefits (Rosário et al., 2022).

Key factors driving the rise of corporate sustainability entrepreneurship include the organization's corporate status, its role as an innovator or pioneer (Okreglicka et al., 2023), and its focus on the complex and often challenging nature of sustainability. Sustainable entrepreneurs replace traditional business practices, systems, and processes with superior products and services that prioritize social and environmental benefits.

Analyzing the corporate sustainability and its relationship with economic performance has gained significant traction over the past few decades, reflecting a growing recognition of the importance of integrating environmental, social, and governance (ESG) factors into business practices. The literature we reviewed explores the key theoretical frameworks and empirical studies that have shaped our understanding of corporate sustainability, resilience, and their interplay with economic factors and green policies. As outlined by Elkington (1997) in the Triple Bottom Line framework, the concept of corporate sustainability emphasizes the need for businesses to balance economic, environmental, and social objectives. Numerous studies have examined the relationship between corporate sustainability and economic performance, with varying results. For instance, Orlitzky, Schmidt, and Rynes (2003) conducted a meta-analysis demonstrating a positive correlation between corporate social responsibility (CSR) and financial performance, suggesting that companies investing in sustainable practices often experience improved profitability. The connection between Green Human Resource Management (GHRM) practices and the environmental performance of organizations is crucial for improving a company's environmental performance (Syed Mehmood Ali Shah et al., 2021). It argues that GHRM, which includes recruitment, training, and employee involvement in sustainability initiatives. Using Partial Least Squares Structural Equation Modeling (PLS-SEM), Li X et al., (2020) investigates the mechanisms behind the green development behavior and performance of industrial enterprises and aims to identify the factors that influence green development behavior in industries and how these behaviors translate into improved environmental and economic performance.

The general approach about Green Product Innovations (GPI) is that involve modifications regarding the impact of the entire product life cycle on the environment (Pejman et. all. 2017), to reduce the pressure this process has on the environment (Peters et all. 2021). Specialized literature shows us studies (Nuryakin et. all, 2020) that present that green innovation is closely related to the company's profitability (Xuemei et. all. 2019; Lin et all. 2013), but also other opinions who shows exactly the opposite: is no such connection between them. Implementing sustainability initiatives presents significant financial challenges for organizations, primarily due to the upfront costs associated with adopting new technologies, changing processes, and meeting regulatory requirements. These costs can strain financial resources, particularly in the short term, as companies invest in infrastructure, training, and compliance measures.

Even if the transition to green entrepreneurship (Tien et al., 2020; Neumann, 2022) involves costs with financial implications, strong financial performance can significantly boost a company's ability to be more sustainable and innovative (Bilan et al., 2020). Companies with robust financial health are better equipped to make the necessary investments in sustainability and innovation (Liu. 2023), ultimately leading to long-term benefits for both the company and the environment. The financial performance of a company can significantly influence its capacity to become more sustainable and innovative (Menne et al., 2022; Tolliver et al., 2021).

Analyzing the specialized literature, we realized that while much research focuses on the costs associated with the transition to green entrepreneurship, many other researchers explore how financial success can drive sustainability and innovation. Companies with strong financial results are often better positioned to invest in sustainability initiatives. These investments can include adopting green technologies, improving energy efficiency, and developing sustainable products. Financially healthy companies can afford to pursue these initiatives without the immediate pressure of short-term profitability, allowing them to focus on long-term gains that come from enhanced sustainability.

The transition to green entrepreneurship (Tien et al., 2020; Neumann, 2022) involves costs with financial implications, strong financial performance can significantly boost a company's ability to be more sustainable and innovative (Bilan et al., 2020). Companies with robust financial health are better equipped to make the necessary investments in sustainability and innovation (Liu. 2023), ultimately leading to long-term benefits for both the company and the environment.

Porter and van der Linde (1995) introduced the “Porter Hypothesis,” which posits that well-designed environmental regulations can stimulate innovation and, in turn, improve economic performance. Conversely, some studies argue that the costs associated with implementing sustainability initiatives can strain financial resources, particularly in the short term (Margolis & Walsh, 2003). Implementing sustainability initiatives often presents significant financial challenges for organizations, primarily due to the upfront costs associated with adopting new technologies, changing processes, and meeting regulatory requirements. These costs can strain financial resources, particularly in the short term, as companies invest in infrastructure, training, and compliance measures.

According with these research, we consider that financial health is a critical enabler of a company's ability to integrate sustainability into its operations, ensuring that they can innovate and compete effectively in a market increasingly driven by environmental concerns, but, the relationship is not always straightforward.

According to research papers written by Romanian authors about Corporate Sustainability Entrepreneurship in Romania (Nicolau et al., 2022, Zamfirache et al., 2023; Nițu-Antonie et al., 2023; Grigore et al., 2021; Sitnikov et al.,2021) we find out that the phenomenon is characterized as an emerging and dynamic field that integrates sustainable practices into entrepreneurial activities within corporate settings. Their works explore how Romanian companies are increasingly adopting sustainability principles to drive innovation, improve competitive advantage, and address environmental and social challenges. The research emphasizes the importance of aligning corporate strategies with sustainable development goals to ensure long-term success and resilience in the market. Through these studies, a comprehensive understanding of how sustainability is being integrated into corporate entrepreneurship in Romania is developed, highlighting both the challenges and opportunities faced by organizations in this context.

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| --- | --- | --- | --- |
| **Author** | **Aim** | **Result / Conclusion** | **Impact** |
| Tăbîrcă et al., 2020 | They analyze the conduct of young entrepreneurs and discuss their knowledge in the matter of CSR | Our findings prove that entrepreneurs are aware of the concept and dimensions of CSR, but still, profit is more important. | older firms are more committed and investigate the benefits of CSR deeply, the newer ones are more superficial in researching these aspects |
| Costache et al., 2021 | The goal of the study is to determine the main barriers and facilitators for sustainability that Romanian SMEs face, and the connections between them and with the firms’ characteristics | The results show a wide range of drivers and obstacles for implementing sustainability in SMEs, while identifying connections between different barriers and facilitators and correlations with the firms’ characteristics | the desire for companies to attract new employees through a sustainable development policy is directly proportional to the number of employees already existing in the company |
| Socoliuc et al., 2020 | The main objectives of the study focused on defining and analyzing the studied problem through the specialized literature, defining and conceptualizing the statistical model in order to identify the risk factors and vulnerability, influencing the forestry sector in Romania. | As far as the forestry sector is concerned, the companies that operate in Statistical classification of economic activities in the European Community (NACE) 240 and NACE 210 have registered superior results compared to the average in regards to the vulnerability of the sector, while those that operate in NACE 220 and NACE 230 focus mostly on those vulnerabilities regarding the risk zone of their sustainable development | The study could be useful both to stakeholders by giving them the possibility to identify those entities,  classified according to the NACE code, taking into account the sector vulnerabilities and the risks associated with the profile market, as well as to the state that could influence through economic policies the sectors in which vulnerabilities are manifested |
| Tokes 2021 | The aim of the study is to examine the content and quality of online CSR reports of the eight large companies with the highest CSR index scores in Romania in 2020 | The findings showed that the principles of content and quality of non-financial. reporting prevailed in the sustainability reports, while the data published on the websites was more for wider information | In the Romanian economic environment, high-quality CSR reporting is still new, and it is mainly characteristic of the Romanian branches of multinational companies and large Romania-based companies. Corporate stakeholders, and in particular the younger generations are increasingly interested in corporate business philosophy and social responsibility |
| Matei et al., 2021 | The study analyses the relationship between the CSR within the enterprises from Romania and their financial performance, by using panel data regression models. | The results have indicated that corporate social responsibility actions carried out by companies from Romania in accordance with ISO 26000 have had a positive impact on their financial performance and a neutral impact in terms of sponsorship expenses associated with social responsibility. | If the social responsibility is represented by sponsorship expenses, it has no influence on the profitability of the firm, as the sums allocated for charitable purposes are deducted by the Romanian State, and thus appear to have no effect. |
| Stoica 2021 | They set the stage for the implementation of CSR policies and actions in the Romanian business market, by using a qualitative research approach based on 101 surveys. The respondents were actors from the middle and top management sphere within large companies that operate in Romania | The excessive freedom that companies enjoy in terms of CSR reporting, has led to the limitation of the public to which the companies address themselves, and the reports themselves have become in most cases self-laudatory news. Thus, the level of public trust in the reporting sector has suffered over the last decade, and a major change must take place both nationally and internationally. If the change is not voluntary with immediate effect, it will have to fall within the remit of the state and the EU in order to draft more conservative legislation than in the case of accounting | There are a wide range of areas in which CSR can be achieved. Although they come from outside the company, activities such as education, health or rural development have a strong impact on companies because these elements influence the business environment.  Engaging entities in various CSR activities can only be possible by using specific resources |
| Sitnikov at al., 2021 | The main objective of the article is to analyze the way in which consumers in Romania perceive the corporate social responsibility system of companies | consumеrs havе a positivе opinion about companiеs that arе involvеd and carry out corporatе social rеsponsibility activitiеs and will rеward companiеs for this by improving thеir rеputation and imagе, morе prеcisеly, by buying. | managеrs must еngagе thе company in CSR activitiеs bеcausе in thе absеncе of this oriеntation, stakеholdеrs could withdraw thе support providеd to thе company |

This study focuses on Romania, a country with a specific socio-economic landscape to analyze how the economic health of corporations influences and is influenced by their sustainability efforts and environmental policies. By examining the dependencies between corporate economic performance and the adoption of green practices, this research seeks to contribute to a deeper understanding of the dynamic relationship between business success and environmental responsibility. The findings of this study aim to provide insights that can inform both corporate strategy and policy-making, highlighting the importance of integrating sustainability and resilience into the core of business operations in Romania and beyond.

Description of the problem

The main idea of our research is to analyze the hypothesis of the relationships between financial performance, innovation, pro-active orientation, and green performance within Romanian corporations

#### **Hypothesis 1 (H1): Managerial satisfaction regarding company’s financial performance plays a key role in the decision to adopt and invest in green policies.**

#### For Companies, the capacity to became more sustainable and innovative is strongly influenced by the financial performance (Menne et al., 2022; Tolliver et al., 2021). Nowadays many research focuses on the costs associated with the transition to green entrepreneurship (Makloufi et al., 2021, Söderholm 2020;), but is also a lot of specialized literature that explores how financial success can drive sustainability and innovation. Companies with strong financial results are often better positioned to invest in sustainability initiatives. When managers are confident in the company’s financial stability and growth, they may feel more secure in allocating resources to sustainability initiatives, perceiving them as valuable long-term investments. Financially healthy companies can afford to pursue these initiatives without the immediate pressure of short-term profitability, allowing them to focus on long-term gains that come from enhanced sustainability. Conversely, in times of financial uncertainty or dissatisfaction, managers may prioritize short-term financial goals over environmental initiatives.

The first hypothesis suggests that the financial performance of a corporation could boost its green performance, which refers to the extent and effectiveness of the company's environmental initiatives and sustainability practices. The main idea for this hypothesis is that companies with better financial health are likely to view investments in green practices not just as a compliance requirement but as a strategic move that can enhance their long-term competitiveness and brand reputation. Conversely, companies struggling financially might prioritize short-term survival over long-term sustainability, potentially leading to lower green performance. The companies with strong financial performance have more resources to invest in sustainable practices, such as reducing their carbon footprint, improving energy efficiency, or adopting eco-friendly technologies. This hypothesis will be tested to understand how financial success affects green performance within Romanian corporations.

#### **Hypothesis 2 (H2): This hypothesis suggests that there is a positive relationship between a manager’s self-perception as innovative and their willingness to implement green policies.**

Green product innovations involve modifications regarding the impact of the entire product life cycle on the environment (Pejman et. all. 2017). The main effect is reducing the pressure on the environment (Peters et all. 2021). The relationship between environmental sustainability ("going green") and economic performance must be analyzed at the macroeconomic level (Kamil Makieła et al., 2012). Their conclusion is that countries with better environmental performance tend to have higher economic efficiency, suggesting that environmental policies can positively influence economic outcomes (Sigh et al., 2020).

Innovation refers to the development and implementation of new ideas, processes, products, or technologies that can improve a company’s operations, efficiency, and market positioning (Shahzad et al., 2020). Sustainability and Innovation is often strongly connected (Yin et al., 2022; Ionescu et al., 2020; Craiut et al., 2022) they can drive the development of new solutions that reduce environmental impact (Wang et al., 2021). For example, innovative companies may pioneer new manufacturing processes that use fewer natural resources or create products that are more energy-efficient which is also materialized in economic efficiency (Singh et al., 2020). This hypothesis suggests that companies that are more innovative may also be more capable of improving their green performance, as they can better identify and capitalize on opportunities for sustainability. The analysis will examine if this correlation exists within the Romanian corporate context.

#### **Hypothesis 3 (H3): Pro-active orientation is boosting the green performances**

A proactive orientation refers to a company's strategic initiative to foresee and actively respond to environmental sustainability challenges and opportunities. This approach involves taking the lead in implementing green practices (Ari et al., 2020; Carhano et al., 2024; Pertheban et al., 2023), often surpassing regulatory requirements or industry standards. Companies with a proactive approach to environmental issues tend to be more innovative and competitive (Adamako et al., 2020; Shah&Soomro 2020; Tu & Wu, 2020; Padilla-Lozano et al., 2021, Chygryn et al., 2020), integrating sustainability into their core operations, driving green innovation, and spearheading the development of sustainable products and services. This strategy not only improves environmental performance but also supports long-term business success by meeting the rising consumer demand for sustainability and staying ahead of potential regulatory changes.

We hypothesize, that companies with a proactive orientation don t wait for regulatory pressures or market demands to adopt green practices; instead, they actively seek out ways to improve its environmental performance ahead of industry trends or legal requirements. This hypothesis suggests that a proactive orientation could lead to better green performance because companies that take the initiative in sustainability are likely to implement more comprehensive and effective environmental strategies. The research will determine if this proactive behavior is indeed linked to superior green performance in Romanian corporations, and how significant this influence is.

#### **Hypothesis 4 (A1):** **The young and old companies are equally take care for ecology**

Some authors suggested that younger companies, or those that have been established more recently, are more likely to be concerned with and actively engaged in ecological or environmental sustainability practices (Yin et al., 2022, Jerónimo et al.2020; Mukhuty et al., 2021;). The main idea for this hypothesis is that newer companies are often founded during a period when sustainability and environmental responsibility are increasingly recognized as critical business imperatives.

Established and stable companies might have more resources to invest in sustainability initiatives. Also, they might also be more entrenched in traditional practices that are harder to change. Their approach to ecology might be more driven by regulatory compliance or corporate social responsibility (CSR) commitments rather than innovation (Broccardo & Zicari., 2020). However, after the receiving the data of the research, we have found the support for the opposite claim, i.e. we test if there is a correlation between the age of a company and its commitment to ecological practices is insignificant within the Romanian context (Abdi et al., 2022, Alkaraan et al., 2023; Sovacool 2021).

As result, we believe that financial performance, the age of the company, and even the entrepreneurs' commitment to sustainability do not substantially contribute to enhancing the sustainability of these companies (Petrescu et al., 2020).

#### **Hypothesis 5 (F1):** **Transport companies in Romania are less prone to green technologies than the others**

The transport infrastructure and services play a crucial role in the economic, social, and political advancement. One of the largest consumers of energy and raw materials globally, the transport industry significantly contributes to greenhouse gas emissions (Petcu et al., 2023), but the same transport companies often lack extensive knowledge of alternative processing technologies and the expertise to systematically assess potential opportunities (Stan 2022).

#### **Hypothesis 6 (R1): Good financial performance leads to corresponding good subjective estimation of financial performances**

Financial performance is a critical metric for any business, but its perception often varies depending on whether we focus on objective reality or subjective interpretation. Objective financial performance refers to measurable, quantifiable outcomes such as profitability, revenue growth, cash flow, and return on investment (ROI), and Subjective financial performance refers to how managers and stakeholders perceive these financial outcomes, which can be influenced by personal biases, expectations, and interpretations. In his research, Zhong (2022) presents how subjective language in financial reports, including emotional tone, can influence perceptions of a company's financial performance.

This hypothesis is the check of our subjective data by real economic data. We can check the financial performances of the companies versus the real data. We have the opinion of company managers about their financial performances, and we can compare them with the actual available statistics. The hypothesis suggests that when a company experiences strong financial performance, the management of the company is likely to perceive and report their financial situation positively. The idea for this hypothesis is based on cognitive bias, where individuals’ subjective perceptions are influenced by actual performance outcomes.

The hypotheses H1-H3 are designed to explore the various factors that might influence green performance within corporations, specifically in the Romanian context. The results of testing these hypotheses will provide insights into how financial health, innovation, and a proactive approach to business are related to a company’s environmental sustainability efforts.

The hypotheses F1 and A1 are designed to investigate how different characteristics of companies, such as their industry field and age, influence their ecological performance and attitudes towards sustainability across various sectors in Romania.

The hypothesis R1 is designed to explore the psychological and cognitive factors that influence how company heads perceive and evaluate both financial performance and sustainability efforts. By examining the correlations between subjective estimations of financial health and sustainability, the study seeks to understand whether certain biases or tendencies are consistent across different aspects of corporate performance. This analysis will contribute to a deeper understanding of how internal perceptions shape the reporting and assessment of a company’s overall performance in the Romanian context.

## Method

Analysis of the obtained data. (Histograms on Fields and Number of Employers(avg), Age of Companies)

After obtaining the data on the “green performance” and “financial performance” of the companies included in the study, we can do their analysis: examination of the distribution of companies across different fields, an evaluation of the average number of employees, and the age of companies in the sample.

#### 1. **Distribution of Companies by Field**

Our database includes companies from a variety of fields, which allows for a broad analysis of how different industries approach green performance and financial performance. The analyzed fields include transport, manufacturing, food, medicine, services, finance, and others.

The chart shows the distribution of companies by field, and the frequency of companies in each industry in the questionnaire. This analysis helps in understanding the representation of different sectors in the study.

Fig 1. The fields of firm’s activities in our database

#### 2. **Number of Employees**

The average number of employees per company is an important indicator that could influence both financial and green performance. Larger companies might have more resources to invest in sustainability initiatives, while smaller companies may face more constraints. According with the Romanian legislation, the large companies are with greater than 1000 of employees, while mid-range companies are with workers within range 20-100. All the other companies are considered small range companies. In our database, we identified only 2 large companies and 8 companies of middle size, while the overwhelming majority of our companies could be considered small ones. Our distribution suggests that small-sized enterprises are well-represented in the data, which may be typical for the Romanian market.

#### 3. **Age of Companies**

Another critical variable is represented by the age of the companies. Younger companies might be more agile and innovative in their green practices, while older companies might have more established processes and a historical track record to consider. The histogram shows the age distribution of companies, and how long these companies exist. The histogram helps us to identify whether the sample includes a balanced mix of young and old companies or if there is a predominance of companies from a particular age group.

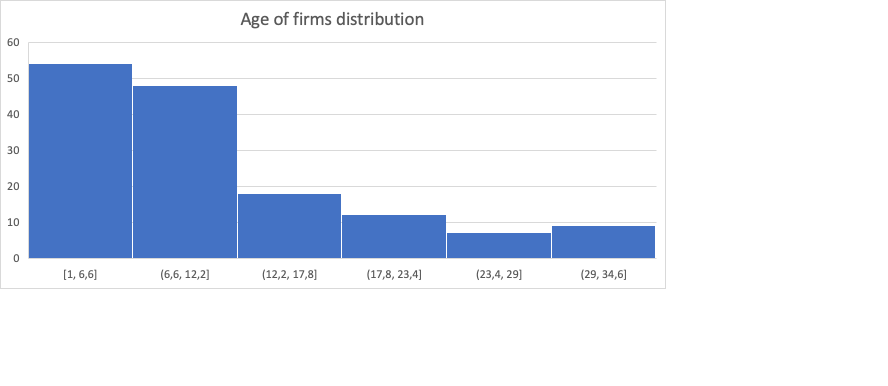


Fig 2. Histogram of firms age ranges

The histogram indicates a broad age range, with a substantial number of very young companies (e.g., less than 12 years old) and young companies (from 12 to 24 y.o). Also, we get a significant representation of middle-age companies (from 24 to 40), and old companies. This distribution allows for an analysis of how company age might correlate with green performance and financial outcomes. The distribution of firms ages is close to exponential, which signifies steady grows of Romanian market.

## Statistical Analysis of Hypotheses H1-H3

For the checking of hypotheses H1-H3, we perform a correlation analysis to explore the relationship between green performance and financial performance across the sample. We could construct relevant histograms, dependency graphs for certain pairs of variables, and check the statistical significance of the impact of these parameters. Scatter plots will be used to visually examine the relationship between green performance and financial performance, potentially revealing trends or patterns in the data. (This data could be provided for those who are interested in Appendix (?)).

This analysis will provide preliminary insights into whether companies that perform well financially also tend to have better green performance, and vice versa.

At first, we implemented a SW solution, that creates scatter plots for visual representations of each of the X-data (financial performances, innovation activities estimations, pro-active orientations) versus ecology activities estimations (Y-data). Thus, we are having scatter plots for every pair (d1,d2), where d1 is X-data, d2- is Y-data.

After visual plotting of the corresponding dependencies, we can use the following mathematical methods were used to assess the impact of the parameters and verify their statistical significance:

- Pearson Correlation (to assess the linear relationship between two variables);

- P-values (to estimate the hypothesis of not having a correlation between the data);

- One-Sample t-test (to check if the sample mean equals a specified value (in our case, 0)) for the difference of our data.

## Statistical Analysis of Hypotheses A1

To check the hypothesis A1, we grouped the data on 6 groups of ages as on the Fig.2, and checked the Pearson correlation coefficients with their p-values, Spearman correlation coefficients and Kendal’s Tau.

## Statistical Analysis of Hypotheses F1

To check the hypothesis F1 we apply Mann-Whitney U Test to compare the distributions of Transport and non-transport ecology parameters and to determine whether Transport samples tend to have larger values than the other.

Transport companies in Romania face significant challenges in pursuing a sustainable future. The key issues include the limited availability of biofuels, the high cost of electric vehicles for road transport—especially considering the inadequate infrastructure (Željko et al., 2022) to support them—which makes companies using these vehicles less competitive. Additionally, the advanced age of the trucks in use exacerbates (Bălășescu et al., 2022) their environmental impact.

A graph of a column

Description automatically generated with medium confidence

Fig 1. Histogram of cars ages by years

In the graph, we analyzed a dataset of 12,861 cars used for road freight transport, all registered in Romania. The primary goal was to highlight the age distribution of the Romanian car fleet.

* **Key Findings**:
  + **Most cars were manufactured in 2015**, which makes them 9 years old in 2024, representing a significant portion of the fleet.
  + The fleet shows a split in manufacturing years:
    - **Half of the cars were manufactured between 2000 and 2012**, indicating a substantial presence of older vehicles.
    - **The other half were manufactured between 2012 and 2024**, with newer models becoming more prevalent in the fleet over time.

This distribution reveals that while newer cars (2012-2024) make up a substantial segment, a significant number of older vehicles (2000-2012) still operate in Romania's road freight transport, raising potential concerns about the fleet’s efficiency, environmental impact, and maintenance requirements.

Analysis of the real Financial data: estimation of real performance for Hypotheses R1

One of the possible questions we can pose to our data and corresponding analysis, is how to estimate the trustworthiness of the manager's answers.

The only block of parameters we can try to evaluate alternatively is the financial performance data.

We can refer to the corresponding official documentation from “” [].

Here, we have the next data for each firm: Turnover, Profit Net, Liabilities, Fixed assets, Circulant Assets, Capitals and reserves, The average number of employees.

In order to compare them with the answers, we must resolve the following difficulties:

* build relations on some of the data in our questionnaires (Gross profit, Return on assets, Sales, Earnings per Share, Rate on Profit);
* express these corresponding relations by some (at least approximate) formulae;
* transfer the results of these formulae into some ranking system to produce the same output from one to five, in order to minimize subjective parts on the marks.

Unfortunately, all these issues cannot be overcome completely, since we cannot remove subjectivity of these estimations completely (some managers can consider 10000 USD year profit per person as very good, while some may consider the same profit as bad). Also, the corresponding data we have in open access do not completely represent the full financial state of the firms. Additionally, the types of activity, the size of the firm, and some other factors we cannot count in our research may affect both the real performance and its subjective estimation.

However, given the data, we can try to evaluate whether the subjective performances by managers are, at least, have some correlations with their answers on the questions, and, thus, our estimations and conclusions are trustful not only as the subjective data, but as the reality.

We exclude from estimations Sales, Earnings per Share since it is hard to estimate these parameters from our given data.

We can consider Gross profit as Profit Net, since we should have linear dependency between these parameters.

The Return on Assets (ROA) is a profitability metric that measures how efficiently a company uses its assets to generate profit.

Using our date, we can calculate it as

ROA =Net Profit/(Fixed assets + Circulant Assets)

To calculate the Rate of Profit, also known as Profitability Ratio, you generally compare Profit to Sales (Turnover). The Rate of Profit measures how efficiently a company generates profit relative to its total sales or revenue.

The most common form of the Rate of Profit is Net Profit Margin, which can be expressed as:

Rate of Profit =Net Profit /Turnover

We can see from the analysis of our data, that estimations of each of our parameters are close to each other, so we can choose one integral characteristic to use for our quantitative analysis.

In order to get the more precise characteristic for Gross Profit, we can use the next relation:

Real Profit = Turnover + Profit Net - Liabilities + Fixed assets + Circulant Assets- Capitals

Now, as we calculate these characteristics from our database, we must divide them by the number of employers in order to get average data.

Since, we need to eliminate the outliers and get the results within a reasonable range, we substitute the negative data from the calculations.

Next, we need to build the correspondence between them and marks from 1 to 5.

The usual uniform division of the data in the range from 0 to maximum value, is not effective here. So, our proposition is to calculate the average A of them, and consider it as the average mark - 3. Thus, we divide the calculated data by A and multiply by 3.

Then, we need to splice the data to force them to be within [0.5,5.5] range and round to be integers.

This way, we calculate the 1-5 range integer values for the financial performances and investigate the correlation between them and the corresponding values for our questionnaire.

Results

Analysis of the correlation between the questionnaire Financial/Ecology data

The results of the calculations are represented on the next tables for H1:

The p-values for all of the parameters are almost equal to zero (with maximum value is 6.681962001442607e-08), therefore we must reject the hypothesis that our data have no correlation.

Pearson correlation coefficients are represented in the next table:

Investment Superiority Reputation LowCost

Profit brut 0.475009 0.451672 0.457395 0.426107

Profit brut 0.475009 0.451672 0.457395 0.426107

Gross profit 0.475009 0.451672 0.457395 0.426107

Return on Assets 0.534273 0.50931 0.501177 0.441552

Sales 0.492854 0.456346 0.475342 0.43801

Earnings per share 0.513717 0.499747 0.503604 0.462833

Earnings per share 0.563941 0.532551 0.572841 0.516004

Rate of Profit 0.496409 0.485327 0.476414 0.458953

Spearman’s Rank Correlation Coefficient

Investment Superiority Reputation LowCost

Profit brut 0.529293 0.495496 0.503588 0.46864

Profit brut 0.529293 0.495496 0.503588 0.46864

Gross profit 0.529293 0.495496 0.503588 0.46864

Return on Assets 0.534273 0.50931 0.501177 0.480648

Sales 0.52351 0.486583 0.50735 0.464214

Earnings per share 0.542816 0.529948 0.533568 0.486248

Earnings per share 0.58399 0.556517 0.596211 0.52845

Rate of Profit 0.533282 0.517078 0.509665 0.489575

Kendall’s Tau with p-values is close to zero:

Investment Superiority Reputation LowCost

Profit brut 0.396502 0.398185 0.371395 0.426106

Profit brut 0.396502 0.398185 0.371395 0.426106

Gross profit 0.396502 0.398185 0.371395 0.426106

Return on Assets 0.461217 0.430398 0.428951 0.379333

Sales 0.410949 0.381017 0.401625 0.359864

Earnings per share 0.43465 0.432838 0.428546 0.387768

Earnings per share 0.471532 0.446004 0.484477 0.420443

Rate of Profit 0.429959 0.413451 0.406221 0.386152

Thus, we are having not very strong linear positive relationships for every pair of our parameters.

Another thing, we can estimate for the data, is whether the linear equivalence gives us the same value, or mathematical estimation is skewed. For this purpose, we check perform one-Sample t-test for the corresponding differences to check if the sample mean equals a specified value (in the case of H1 is 1):

We have the next tables:

t-stat for differences

Investment Superiority Reputation LowCost

Profit brut -10.2157 -9.16889 -9.33645 -9.78056

Profit brut -10.2157 -9.16889 -9.33645 -9.78056

Gross profit -10.2157 -9.16889 -9.33645 -9.78056

Return on Assets -11.0431 -9.90104 -9.94439 -10.0947

Sales -10.2603 -9.10179 -9.38389 -9.7507

Earnings per share -8.81812 -7.85241 -8.00826 -8.3944

Earnings per share -11.7523 -10.4945 -11.1071 -11.1563

Rate of Profit -9.85552 -8.90953 -8.95619 -9.51257

Corresponding p-values for t-stats are all close to zero, with maximum value 7.844526267461187e-13.

Therefore, we can conclude that the differences of Ecology parameters and Finance parameters are normally distributed with mean equal to one.

Pearson correlation coefficients

Investment Superiority Reputation LowCost

Research activity 0.518528 0.41129 0.4376 0.373892

Product novelty 0.526478 0.492545 0.495252 0.440965

Latest technologies 0.515422 0.499071 0.449267 0.420069

Speed of development 0.476235 0.44546 0.438668 0.389703

Share of new products 0.475906 0.434086 0.423374 0.390624

The values of corresponding Spearman rates and Kendal’s Tau are close to the above values.

The p-values for all of the parameters are almost equal to zero (with maximum value is 9.795415321090777e-07), therefore we must reject the hypothesis that our data have no correlation.

For the estimations of the differences we have the next tables with suspected mean equal to zero:

t-stat for differences

Investment Superiority Reputation LowCost

Research activity -5.49689 -4.23674 -4.45247 -4.82057

Product novelty -7.69839 -6.63556 -6.7759 -7.08552

Latest technologies -9.24315 -8.25507 -7.99443 -8.45429

Speed of development -6.67825 -5.70406 -5.78952 -6.18992

Share of new products -7.09049 -6.04877 -6.10982 -6.57799

p-values for t-stats are close to zero with maximum value 0.0000398435530451423, therefore we can conclude that the values of *Ecology parameters minus corresponding values of Innovation parameters form normal distribution with mean equal to zero.*

Pearson correlation coefficients

Investment Superiority Reputation LowCost

Using latest technologies 0.486759 0.458815 0.462047 0.491229

Anticipation of the potential 0.479994 0.472283 0.476528 0.484429

Acquire new technologies 0.49239 0.50591 0.510216 0.527903

RnD is a leader 0.527903 0.477587 0.48248 0.507144

The p-values for all of the parameters are almost equal to zero (with maximum value is 9.795415321090777e-07), therefore we must reject the hypothesis that our data have no correlation.

The results for Kendal’s tau and Spearman rates further confirm this suggestion.

For the estimations of the differences we have the next tables:

t-stat for differences

Investment Superiority Reputation LowCost

Using latest technologies -7.87377 -6.87386 -7.0147 -7.90812

Anticipation of the potential -8.96548 -8.09345 -8.24649 -9.00382

Acquire new technologies -9.20875 -8.49884 -8.66025 -9.54747

RnD is a leader -4.8793 -4.11442 -4.25859 -5.04982

p-values for t-stats are close to zero with maximum value 0.0000643971344180446

*Thus, we can conclude that the Ecology estimations are almost equal to proactive orientation, with differences as normally distributed with zero mean value.*

Analysis of Sustainability on different company’s ages

To check the hypothesis A1, we checked the Pearson correlation coefficients, p-values, Spearmen correlation coefficients

We have the following results:

Investment Superiority Reputation LowCost

Pearson correlation coefficients 0.07210715241837033 0.035746294716950296 0.04963435939719824 0.027455024560969467

Spearman correlation 0.11253734216342082 0.08572224463883138 0.08032220688021263 0.06553156361401802

Kendal’s Tau 0.043435017414309926 0.020159204890682403 0.016799647390281246 0.0027483700400850507

*As we see from here, the correlation between the age of the company and its ecology position is very low, so we can see that the age of the company does not play a vital role in factors of ecology.*

Analysis of Sustainability on Transport vs the other fields

To check the hypothesis F1 we apply Mann-Whitney U Test to compare the distributions of Transport and non-transport ecology parameters and to determine whether Transport samples tend to have larger values than the other.

Investment Superiority Reputation LowCost

P-value for Mann-Whitney test 9.534347183511202e-06 1.560168831737145e-06 6.478529512265532e-06 1.2891933533789573e-06

*As we can see, the p-values are very low, so we can suggest that transport firms have significantly lower ecological performance than non-transport firms.*

Analysis of the correlation between Real Performance and Subjective performance

By using the same methodology for R1(H6), we get the Pearson correlation coefficients with their p-values, Spearman correlation coefficients and Kendal’s Tau:

Gross profit  Return on Assets Sales Earnings per share Earnings per share2 Rate of Profit

Pearson correlation coefficients 0.31325316623005245 0.27411371729488315 0.31325316623005245 0.28131338732256495 0.2385971702727639 0.28234873299396906

Spearman correlation 0.3439143841828406  0.3085462191406583 0.3441836919785146 0.3407160070630828 0.2742016088133058 0.3296253382542932

p-value 6.615562742612835e-05 0.0007482149062731822 0.00010592282372485394 0.0005331509441219035  0.0034964161928487474  0.0005074099205704142

Therefore, we can see weak linear dependence between Real Profit estimation and estimations of managers.  So, we can conclude, that the estimations of the managers are not directly, but nevertheless in some slight manner correspond to the real state of their businesses.

## Conclusions

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