**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.

|  |  |  |  |
| --- | --- | --- | --- |
| **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 factors that can influence the green policy for Romania corporations. So, we tried to group the data from the companies and find the interdependencies between them. In order to achieve this goal, we group these data as subjective financial performance, objective financial performance, innovation performance, pro-active orientation, age of firms, and green performance within Romanian corporations. We estimate the cross dependencies for possible pairs of our collected parameters to obtain the most informative model for Romania transport (and, possibly other fields companies). As long as we focus particularly on transport, we also compare the ecological performance of transport firms versus the other ones.

*Hypotheses development*

**Managerial satisfaction:** Strong financial results enable companies to invest in sustainability, since they are less focused on short-term profits and more focused on long-term gains (Menne et al., 2022; Tolliver et al., 2021). Although much of the literature explores the costs of transitioning to green entrepreneurship (Makloufi et al., 2021; Söderholm, 2020), financial success can drive sustainability and innovation. The managers of companies with financial stability view green investments as strategic, while those facing financial uncertainty prioritize short-term goals. This hypothesis examines if better economic health fosters more green investments among Romanian corporations. The parameters, that we were able to gather that belong to this group are:

* Profit brut (Brut)
* Gross Profit (Profit),
* Return on assets (ROA),
* Sales (Sales),
* Earnings per share (EPS),
* Returnability of Investment (ROI),
* Rate of Profit (Rate).

We will measure the outcome of each of these factors on the sustainability characteristics and also on all of the parameters we will list below, concerning innovation and proactive orientation.

**H1. Managerial satisfaction with a company’s financial performance influences green policies adoption.**

**Proactivity:** Proactive approaches target sustainability challenges and opportunities before they arise (Ari et al., 2020; Carhano et al., 2022). In this way, sustainability is integrated into core strategies, driving innovation and long-term competitiveness (Adamako et al., 2020; Shah & Soomro 2020; Tu & Wu, 2020; Padilla-Lozano et al., 2021). Besides improving environmental performance, this strategy will help businesses stay ahead of potential regulatory changes and meet rising consumer demands. This hypothesis investigates whether a proactive stance towards environmental issues will lead to more effective environmental solutions and better green performance than companies responding to external pressures. With the purpose to estimate the proactivity in the company, we include next questions in the questionnaire:

* Are the technologies used by company are the latest ones (Usage)?
* Does the company anticipate the potential of new technologies/practices (Anticipation)?
* Does the company systematically try to acquire and implement new technologies (Implementation)?
* Is the company’s research and development department a leader in the field (R&D)?

We would like to understand how each of these factors is influenced by managerial satisfaction on financial performance, and how, in its own turn they drive the innovations and sustainability.

**H2. Proactive business orientation enhances green performance.**

**Managerial innovation:** Innovative companies are more likely to develop solutions that reduce environmental impact (Yin et al., 2022; Ionescu et al., 2020). The adoption of eco-friendly technologies often leads to improved economic efficiency (Singh et al., 2020). Innovative managers are also more inclined to pursue green initiatives, since they are better equipped to identify sustainability opportunities. This hypothesis explores managers' self-perception as innovative and their willingness to implement green policies in Romanian corporations. As long as it is hard to objectively estimate innovation, we try to evaluate the following items:

* Research activity (Activity)
* The degree of product novelty within the company (Novelty),
* Usage the latest technologies within the company (Latest),
* Speed of development of new products by the company (Speed),
* Share of new products within the range of company’s products (Share).

Again, we are looking into the possible interconnections between each and every of the mentioned above characteristics

**H3. Managers who perceive themselves as innovative are more likely to pursue green policies.**

**Maturity:** Previous studies suggest that younger companies are more likely to engage in sustainability (Yin et al., 2022; Jerónimo et al.2020; Mukhuty et al., 2021), as they are founded in an era where environmental responsibility is critical. Although established companies have more resources to invest in sustainability, they may be slower to make changes driven more by regulatory compliance or corporate social responsibility (CSR) commitments than innovation (Broccardo & Zicari, 2020). 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. 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).

This hypothesis tests whether age influences an organization's ecological efforts in Romania.

**H4.** **Company age does not significantly affect commitment to ecological practices.**

**Sectoral differences:** Infrastructure and services play an important role in economic, social, and political progress. Although it is a major greenhouse gas emitter, it lacks the expertise to implement green technologies (Stan, 2022). This hypothesis examines whether Romanian transport companies adopt sustainable practices behind other sectors.

**H5. Transport companies in Romania are less inclined to adopt green technologies than other sectors.**

#### **Financial health:** Financial performance is an important metric for any business, but its perception varies depending on objective reality or interpretation. An objective financial performance is measurable, quantifiable, and includes key metrics such as profitability, revenue growth, cash flow, and ROI. Subjective financial performance describes how managers and stakeholders interpret financial outcomes based on personal biases, expectations, and interpretations (Zhong, 2022).

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.

**H6. Good financial performance correlates with positive subjective assessments of financial health.**

The sustainability factors, we will analyze include the following items:

* company invests more than competitors in R&D and innovations for environmental protection (Investment);
* the "green" products and services offered by the company are superior to those of the competition (Superiority);
* the company have a better "green" reputation than the competition (Reputation);
* the company has a competitive advantage in environmental protection based on the lowest costs (Advantage).

The hypotheses H1-H3 explore the various factors that may influence green performance within Romanian corporations. Through testing these hypotheses, we will be able to discover how financial health, innovation, and proactive business practices influence environmental sustainability efforts.

The hypotheses H4 and H5 study how specific characteristics of Romanian companies, such as their industry sector and age, affect their ecological performance and attitudes toward sustainability.

Hypothesis H6 examines the psychological and cognitive factors that influence how company heads perceive and assess 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 to a deeper understanding of how internal perceptions shape the reporting and assessment of a company’s overall performance in the Romanian context.

Figure 1 shows the research model of this study. The proposed model describes the relationships between financial health, innovation and proactive business practices; the Romanian companies’ specific characteristics and management perception and the ecological performance and attitudes toward sustainability.

Financial health

Financial satisfaction

Proactive orientation

Innovation orientation

Sustainability

Sector

Age

Figure 1. Research Model

In fact, we want to investigate the applicability for this model, so we do not need to investigate these relationships with for example PLS-type analysis as proposed (Valerie, 2012), but, instead, apply correlation analysis to every possible pairs of parameter to see whether we can approve the hypotheses for each pair.

This study proposed several direct and indirect relationships as illustrated in Table 2.

Table 2. Summary of the hypotheses

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Hypotheses development for direct relationship** | **Independent variables** | **Dependent variables** |
| **H1** | Managerial satisfaction with a company’s financial performance influences green policies adoption. | Managerial satisfaction | Green policies adoption,  Proactive orientation |
| **H2** | Proactive business orientation enhances green performance. | Proactivity | Green policies adoption,  Innovation orientation |
| **H3** | Managers who perceive themselves as innovative are more likely to pursue green policies. | Managerial innovation | Green policies adoption, |
| **H4** | Company age does not significantly affect commitment to ecological practices. | Maturity | Green policies adoption,  Proactivity, Innovation |
| **H5** | Transport companies in Romania are less inclined to adopt green technologies than other sectors. | Sectorial difference | Green policies adoption,  Innovation |
| **H6** | Good financial performance correlates with positive subjective assessments of financial health. | Financial health | Managerial satisfaction,  Proactivity |

## **Method**

*Sample and data collection*

To examine **how managerial attitudes, company characteristics, and financial health influence environmental sustainability practices within Romanian corporations,** questionnaires were conducted with 149 CEOs and CFOs of companies in Romania. They were asked about economic health and strategy. Accordingly, companies were chosen using convenience sampling to select companies for study, which involves choosing the most readily accessible respondents based on feasibility and timeline considerations (Galloway, 2005).

Here, the description of how the questionnaire was collected, and what was included here

Shifting focus to the content validity (face validity), the current study developed the research instrument though building on the prior theoretical basis. To achieve this, a pre-testing was accomplished, and semi-structured interviews were conducted with representatives from academic institutions and practitioners (owners/managers in Romanian companies) who are acquainted with business strategy and were not included in the subsequent research. Accordingly, some slight changes were made to the research instrument on the basis of the pre-test. With the intention of increasing the clearness of the research survey, the respondents were given introductory notes that described the purposes and approaches of the research. Moreover, to ensure consistency among the measure items and to avoid confusion among the respondents, all instrument items were measured on a seven-point Likert scale and seven-point semantic differentials, with response options ranging from strongly disagree “coded as 1” to strongly agree “coded as 5.” The online questionnaire was prepared in Romanian, the native language of the participants. Further, this study used a structured research survey and followed the backtranslation (forward-backward translations) procedure suggested by Brislin (1986) to translate the research measures. In order to build and understand the best fit model for the dependencies between independent, moderate and dependent variables we perform pairwise correlation analysis for all the possible pairs of values and achieve the comrehansion, that all the reasearched variables are basically corellate between each other.

*Data analysis and research instrument*

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.

#### **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.

**Figure 2.** Sectorial breakdown of companies in the Database

#### **Numbers 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 two large companies and eight 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.

#### **Ages 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.

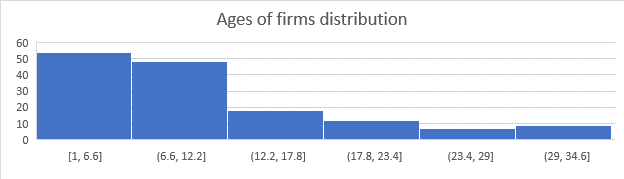


Fig 2. Histogram of firms age ranges

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**

In order to check 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.

We fix the level of confidence for our hypotheses in all these tests to usual value of 0.95.

## 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. Again, the level of confidence to reject the hypothesis is set to 0.95.

## Statistical Analysis of Hypotheses F1

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.

In the first part of the analysis, we tried to estimate the state of the Romania cargo transport by using the statistics about age of the tracks. These statistics includes not only companies, that took part in our questionnaire, but the general data of transport in Romania. This analysis emphasises that, significant part of the transport parks is overaged. Then, we tried to estimate whether the ecological performance displayed in our answers corresponds to the age of the tracks used by the companies in our list. Also, we looked in whether ages of the tracks form regarding companies are in the same state that overall age of the transport.

Finally, 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.

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 official bulletin of Ministry of Finance in Romania (Ministry of Finance in Romania, 2024).

Here, we have the next data for each firm: Turnover, Profit Net, Liabilities, Fixed assets, Circular 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.

We tried also to estimate the objective financial results on relative terms by changes in the last 2-3 years, however we faced the next issues:

* part of the financial data includes only one year statistics
* different nature of the financial parameters makes it hard to understand correctly  
  the progress/regress.

However, given the data, we 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 with the following approach.

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 + Circular 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

### Checking H1 hypothesis

We perform described earlier correlation analysis to explore the relationship between green performance and financial performance across the sample and receive the following results.

The p-values for all of the parameters are almost equal to zero (with maximum value is 6.681962e-08), therefore we must reject the hypothesis, that our data have no correlation.

Now, we calculate Kendall’s Tau as p-values is close to zero, Pearson correlation coefficients, and Spearman’s Rank Correlation Coefficients.

The full result is represented in the Appendix, while Pearson correlation coefficients are in the next table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Finance parameter | Investment | Superirority | Reputation | Advantage |
| Brut | 0.475009 | 0.451672 | 0.457395 | 0.426107 |
| Profit | 0.475009 | 0.451672 | 0.457395 | 0.426107 |
| ROA | 0.534273 | 0.50931 | 0.501177 | 0.441552 |
| Sales | 0.492854 | 0.456346 | 0.475342 | 0.43801 |
| EPS | 0.513717 | 0.499747 | 0.503604 | 0.462833 |
| ROI | 0.563941 | 0.532551 | 0.572841 | 0.516004 |
| Rate | 0.496409 | 0.485327 | 0.476414 | 0.458953 |

Table 1. Pearson correlation coefficients for Finance vs Ecological parameters

Thus, we can conclude, we have not very strong linear positive relationships for every pair of our parameters.

Now, we can estimate for the data, is whether the linear equivalence gives us the same value, or mathematic estimation is skewed, i.e. how much ecological performance is lower or greater than financial results. 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):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Finance parameter | Investment | Superirority | Reputation | Advantage |
| Brut | -10.2157 | -9.16889 | -9.33645 | -9.78056 |
| Profit | -10.2157 | -9.16889 | -9.33645 | -9.78056 |
| ROA | -11.0431 | -9.90104 | -9.94439 | -10.0947 |
| Sales | -10.2603 | -9.10179 | -9.38389 | -9.7507 |
| EPS | -8.81812 | -7.85241 | -8.00826 | -8.3944 |
| ROI | -11.7523 | -10.4945 | -11.1071 | -11.1563 |
| Rate | -9.85552 | -8.90953 | -8.95619 | -9.51257 |

Table 2. t-statistics for Finance minus Ecological parameters with mean equal to one

Corresponding p-values for t-stats are all close to zero, with maximum value 7.844526-13.

**Therefore, we can conclude that the differences of Ecology parameters and Finance parameters are normally distributed with mean equal to one, i.e. financial performance is estimated on one point less by 1—5 mark than ecological performance, in average. Also, the results show good level of confidence above 0.95.**

Checking H2 hypothesis

Using the same analysis approach to estimate dependency between proactive orientation of the firms and their ecological orientation, we get the following results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proactivity parameter | Investment | Superirority | Reputation | Advantage |
| Usage | 0.486759 | 0.458815 | 0.462047 | 0.491229 |
| Anticipation | 0.479994 | 0.472283 | 0.476528 | 0.484429 |
| Implementation | 0.49239 | 0.50591 | 0.510216 | 0.527903 |
| R&D | 0.527903 | 0.477587 | 0.48248 | 0.507144 |

Table 5. Pearson correlation coefficients for Proactivity vs Ecological parameters

The p-values for all of the parameters are almost equal to zero (with maximum value is 9.795415e-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. Full statistics with Kendall’s Tau as p-values is and Spearman’s Rank Correlation Coefficients is presented in Appendix.

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

t-stat for differences

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proactivity parameter | Investment | Superirority | Reputation | Advantage |
| Usage | -7.87377 | -6.87386 | -7.0147 | -7.90812 |
| Anticipation | -8.96548 | -8.09345 | -8.24649 | -9.00382 |
| Implementation | -9.20875 | -8.49884 | -8.66025 | -9.54747 |
| R&D | -4.8793 | -4.11442 | -4.25859 | -5.04982 |

Table 6. t-statistics for Proactivity minus Ecological parameters with mean equal to zero

Where p-values for t-stats are close to zero with maximum value 0.000064.

**Thus, we can conclude that the Ecology estimations are almost equal to proactive orientation, with difference as normally distributed with zero mean value, i.e.** innovations and ecology **are estimated almost equally in average. Also, the results show good level of confidence above 0.95.**

Checking H3 hypothesis

The same analysis on the data related to innovations and ecology we obtain next tables:

Pearson correlation coefficients

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Innovation parameter | Investment | Superirority | Reputation | Advantage |
| Activity | 0.518528 | 0.41129 | 0.4376 | 0.373892 |
| Novelty | 0.526478 | 0.492545 | 0.495252 | 0.440965 |
| Latest | 0.515422 | 0.499071 | 0.449267 | 0.420069 |
| Speed | 0.476235 | 0.44546 | 0.438668 | 0.389703 |
| Share | 0.475906 | 0.434086 | 0.423374 | 0.390624 |

Table 3. Pearson correlation coefficients for Innovation vs Ecological parameters

The values of corresponding Spearman rates and Kendal’s Tau are close to the above values. Full statistics with Kendall’s Tau as p-values is and Spearman’s Rank Correlation Coefficients is presented in Appendix.

The p-values for all of the parameters are almost equal to zero (with maximum value is 9.795415e-07), therefore we must reject the hypothesis, that our data have no correlation.

For the estimations of t-stat for differences with suspected mean equal to zero:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Innovation parameter | Investment | Superirority | Reputation | Advantage |
| Activity | -5.49689 | -4.23674 | -4.45247 | -4.82057 |
| Novelty | -7.69839 | -6.63556 | -6.7759 | -7.08552 |
| Latest | -9.24315 | -8.25507 | -7.99443 | -8.45429 |
| Speed | -6.67825 | -5.70406 | -5.78952 | -6.18992 |
| Share | -7.09049 | -6.04877 | -6.10982 | -6.57799 |

Table 4. t-statistics for Innovation minus Ecological parameters with mean equal to zero

We see, that p-values for t-stats are close to zero with maximum value 0.0000398, therefore we can conclude that the values of **Ecology parameters minus corresponding values of Innovation parameters form normal distribution with mean equal to zero, i.e.** innovations and ecology **are estimated almost equally in average. Also, the results show good level of confidence above 0.95.**

Analysis of Sustainability on different company’s ages

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, Spearmen correlation coefficients and Kendal’s Tau.

We have the following results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type of statistics | Investment | Superirority | Reputation | Advantage |
| Pearson correlation coefficients | 0.072107 | 0.035746 | 0.049634 | 0.0274550 |
| Spearmen correlation | 0.112537 | 0.085722 | 0.080322 | 0.0655316 |
| Kendal’s Tau | 0.043435 | 0.0201592 | 0.016800 | 0.0027484 |

Table 7. Correlation coefficients of Ecology parameters vs ages of firms

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

Analysis of Sustainability on Transport vs the other fields

In order to estimate the state of the Ecology in transport of Romania, we took the data from the track registration systems to represent the histogram of transport age groups:

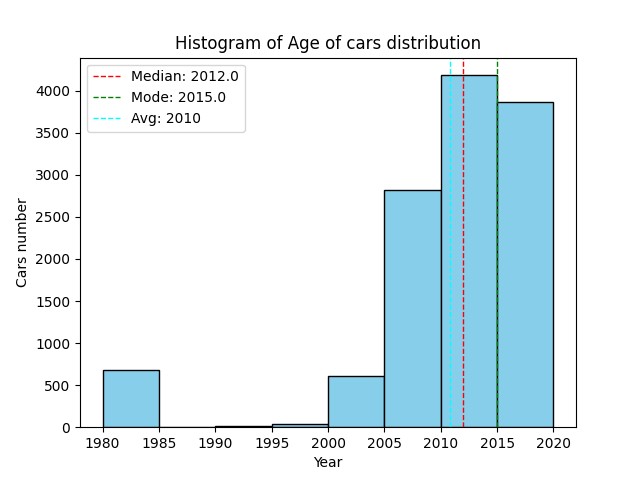


Fig 3. Histogram of tracks ages by years

In this graph, we analyzed a dataset of 12,861 vehicles 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.

Now, we tried to estimate the ages for the companies in our list.

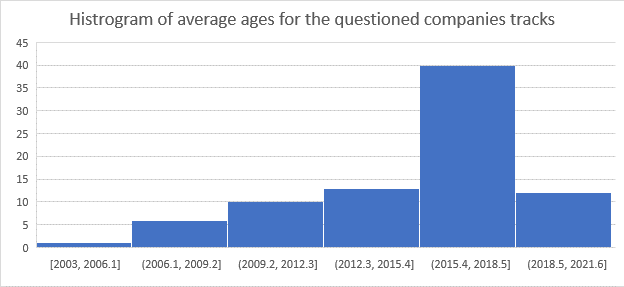


Fig 4. Histogram of average tracks ages for the regarded transport firms by years

As we see, our companies have much newer tracks, that used in Romania in general, so our statistics is dealing with more modern and ecologically oriented companies, with average tracks production date is more than 2015 and minimum production year is 2003.

Therefore, we could not estimate dependency between age of the tracks and ecological performance, and, indeed, or results have shown absence of linear dependencies between these data (You can see this results in Attachment).

Therefore, 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 tends to have larger values than the other.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Investment | Superirority | Reputation | Advantage |
| P-value for Mann-Whitney test | 9.534347e-06 | 1.560169e-06 | 6.478530e-06 | 1.289193e-06 |

Table 8.Mann-Whitney U Test of ecology performance of Transport vs Non-transport corporations

As we can see, the p-values of these tests 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

We apply the methodology described in estimation of real performance for Hypotheses R1 paragraph and exploiting the same approach with Pearson correlation coefficients and their p-values, Spearman correlation coefficients and Kendal’s Tau for our data:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Profit | ROA | Sales | EPS | Rate |
| Pearson correlation coefficients | 0.313253 | 0.274114 | 0.313253 | 0.2813134 | 0.282349 |
| Spearman correlation | 0.343914 | 0.308546 | 0.308546 | 0.344184 | 0.329625 |
| p-value | 6.615563e-05 | 0.000748 | 0.000106 | 0.000533 | 0.000507 |

Table 9. Correlation coefficients of Subjective vs Objective (calculated with our methodology) financial performances

We can observe from these data 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 states of their businesses.

Therefore, we can conclude that personal estimations are relevant with real financial data, i.e. if business really goes good, managers estimate them good overall, if goes bad – they estimate it as bad.

Discussion

It would be interesting to estimate the dynamical changes on the perception of these economic characteristics, but we have some issues when doing this:

* some data are too short (1-2 years only, no real dynamics);
* some data structurally change last years (like profit increased, but not
* proportionally to liabilities and number of employers);
* some businesses are still in a non-profit state while their dynamics are good;
* we may also require some macroeconomic parameters for this;
* etc.

Also, generally, we have that personal estimations are almost the same for every parameter (profit, earnings, sales, etc.) while real data for these fields are very different (like profit - 5, but profit rate - 2, etc.).

So, the research on these directions looks interesting but may require more data and more sophisticated analysis

## Conclusions

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