

EXPERIMENTAL EVALUATION OF MOST SUSTAINABLE COMPANIES: IMPACT ON ECONOMIC GROWTH, RETURN ON EQUITY (ROE) AND METHODOLOGICAL COMPARISON

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Abstract

Research purpose. The study aims to analyse, how the sustainable performance of the company impacts the economy and businesses' economic performance, and to build a model, using environmental, social, and financial indicators.

Design / Methodology / Approach. To achieve this goal such methods as the Pearson correlation, Multiple Linear Regression, Cook's distance method, K-nearest neighbour and COPRAS technique were implemented.

Findings. The results indicate no significant correlation between the sustainability activities of companies and the GDP of their respective countries, nor between companies' ROE and their sustainability performance. These findings suggest that conventional methods of evaluating corporate sustainability may not accurately reflect its economic impacts. Furthermore, discrepancies observed between the Corporate Knights rankings and those calculated using the COPRAS method highlight the critical need for a deeper examination of assessment methodologies. This outcome calls for a reassessment of sustainability practices and methodologies to better understand and leverage their benefits in the corporate and economic realms. While the study provides initial insights into the current sustainability assessments, further research should explore alternative evaluative models and their implications across different industries.

Originality / Value / Practical implications. Companies have a significant impact on the environment and society, and sustainability is important not only for ethical concerns but also for financial and economic reasons.

Keywords: sustainability, sustainable performance, sustainable companies, impact of sustainability, economy.

JEL codes: M15, M21.

Introduction

From pre-industrial times, the world's temperatures have risen by 1.1°C, according to the Intergovernmental Panel on Climate Change (IPCC). This increase is the result of greenhouse gas emissions from human activities, including business (IPCC, 2021). This suggests that every year the risks created by human activity will become an increasing concern both for society and for the state and businesses. Environmental hazards, including extreme weather events, biodiversity loss, and the failure of global climate action, are the most probable and significant dangers confronting the world in the coming ten years, according to the World Economic Forum's (WEF) Global Risks Report 2021 (World Economic Forum, 2021). Therefore, it is essential to conduct a thorough evaluation of corporate behaviour with the goal of proactively addressing the current consequences of human activity as well as mitigating the risks they pose.

The reassessment of a company's sustainable development concerns not only global environmental issues, but also social trends and inclusive management policies. According to the findings of the 2021 Edelman Trust Barometer, a global survey on institutional trust, 61% of respondents think CEOs should take the initiative on societal concerns rather than waiting for the government to impose change

(Edelman, 2021). Thus, companies now need to build a strong system of social responsibility to meet the needs of modern society.

Surveys show that companies have a significant impact on the environment and society and that sustainability is important not only for ethical reasons but also for financial and economic reasons. A study by Harvard Business Review found that companies that prioritize sustainability outperform their peers financially in the long run, with a 4.8% higher return on assets and a 5.4% higher return on equity (Nasdaq, 2019). By incorporating sustainable practices into their operations, companies can create new markets and new revenue streams, reduce costs, manage risk, and enhance their reputation. Moreover, they are better positioned to succeed in the long term and are more attractive to investors, employees, and customers. From a global perspective, the promotion and development of sustainable companies can have a significant impact on achieving an equitable future. According to the Business & Sustainable Development Commission, fulfilling the Sustainable Development Goals (SDGs) of the United Nations could open up \$12 trillion in economic opportunities and generate 380 million new employments by 2030 (Development Commission, 2017).

Corporate sustainability refers to corporations taking on sustainability difficulties by integrating environmental and social considerations into their strategy, business model, and ultimately their business operations (Manninen & Huiskonen, 2022). It means that the company invests in sustainable technologies and processes to manage resource efficiency, creates a fair and ethical working environment with respect to human rights throughout the company's supply chain and simultaneously generates revenue and maximizes profits.

In order to promote sustainable development, companies need to adopt a forward-thinking and comprehensive view on sustainability, which requires companies to consider the long-term impact of their actions on the planet and society and take steps to ensure that they operate in an environmentally responsible and socially conscious manner (Manninen & Huiskonen, 2022). This underscores the importance of measuring sustainability using a variety of indicators and considering their interrelationships, as this is supposed to help businesses make informed decisions that contribute to a more sustainable future. It was expected that the adoption of circular economy practices will drive companies towards greater sustainability, nevertheless, this impact could be unclear with stakeholder pressure, digitalization growth and other variables (Mora-Contreras et al., 2023).

Companies must conduct a thorough evaluation of their business strategies and sustainability efforts. The most frequently used definition measures a company's concentration and advancement in three areas known as the "triple bottom line": financial prosperity, environmental integrity, and social justice (Ajmal et al., 2017). The main goal of each company is to gain profit, which means that the economic sustainable performance is determined by the ability to generate it on a long-term basis. The performance of economic sustainability is typically evaluated by measuring long-term operational efficiency, effectiveness, and productivity. Such measurements are commonly disclosed through financial indicators in financial statements, including return on equity, return on assets, and economic value added. These key performance indicators can be particularly useful to investors, as they enable them to more accurately evaluate the risks and returns associated with their investments (Alsayegh et al., 2020). Due to the presence of various environmental issues on a global scale, such as ozone depletion and global warming, manufacturers are facing growing pressure from customers, governments, and non-governmental organizations to act responsibly towards the environment and future generations. These entities expect manufacturers to take into account the environmental impact of their activities (Ali et al., 2019). That's why measuring the environmental sustainability of the company, it is essential to check the rates of emissions and resource productivity in the sustainability report. Social sustainability is no less important for the performance of the company in the market. Effective management strategies help fulfil the sustainability criteria of balancing social equity, promoting health, wellness, and the overall well-being of both the organization and its employees. These practices aid in achieving economic stability and environmental balance (Amrutha & Geetha, 2020). Additionally, it plays a crucial role in business reputation, which is a key to building a successful business and providing an attractive return on investment for shareholders. Based on the findings, to build a good reputation, companies need to create a long-term orientation culture that analyses how each business decision affects their employees (Kucharska & Kowalczyk, 2019).

Cecilia Van Der Steen in her study “The impact of Corporate Sustainability on Firm Value, using the Corporate Knights' Global 100 sustainable rankings Master Thesis Finance Tilburg School of Economics and Management” implemented the multivariate regression analysis to answer the question “What is the impact of corporate sustainability on firm value?”. The author assessed the reaction of investors to companies appearing in Corporate Knights' Global 100 sustainable rankings. It was found that investors appreciate the companies published in the report more, and they react negatively when a company falls in its position in the list. The results, generally, represent that companies need to enhance their practices related to corporate sustainability to continue attracting investors (Van Der Steen, 2020). L. M. Schreijer conducted a study, which discovered that companies listed in the Corporate Knights Global 100 Sustainability Index have higher cumulative abnormal returns, which also indicates a positive relationship between sustainability performance and financial performance (Schreijer, 2020). Rashid Ameer and Radiah Othman in their article “Sustainability Practices and Corporate Financial Performance: A Study Based on the Top Global Corporations” received the statistical results, showing that businesses which prioritize sustainable practices exhibit better financial performance as evaluated by metrics such as return on assets, pre-tax profit, and cash flow from operations. Based on these studies, it can be assumed that the sustainable development of a company affects its economic performance (Ameer & Othman, 2012).

However, not all studies can confirm this. Robert Sroufe and Venugopal Gopalakrishna-Remani in the article “Management, Social Sustainability, Reputation, and Financial Performance Relationships: An Empirical Examination of U.S. Firms” were building a representative sample of top sustainable companies from such lists as Newsweek's rankings of green companies, The Corporate Knight's Global 100, 100 Best Corporate Citizens. The relationships between sustainability practices and financial performance were measured using structural equation modelling. There were no notable correlations discovered between social sustainability and either reputation or financial performance. Authors suggest that the accounting and financial metrics currently used may not be reliable indicators of how well social sustainability practices are being implemented in the future (Sroufe & Gopalakrishna-Remani, 2019). It means that the impact of sustainable performance could be measured not accurately due to methodology. Focusing on social and environmental responsibility, in combination with effective corporate governance, can contribute to creating value in a broader sense, but factors such as corporate size and available resources also play a significant role (Manninen & Huiskonen, 2022).

According to Ali Alshehhi, Haitham Nobanee, and Nilesh Khare methodologies of studies on the topic of sustainable development of companies can differ because of measurements for the dependent variable of corporate financial performance. Also, the results of studies are representative of the particular data, industry, company size, or market that was investigated. Authors conducted a review, in which it was found that 78% of articles reported a positive correlation between sustainability and financial performance. Only 7% of the articles reported no impact, while 6% of the articles reported a mixed relationship, where some sustainability practices had a positive impact, while others had a negative effect (Alshehhi et al., 2018).

Ahsan Anwar, Summaira Malik, and Paiman Ahmad “Cogitating the Role of Technological Innovation and Institutional Quality in Formulating the Sustainable Development Goal Policies for E7 Countries: Evidence from Quantile Regression” used the Stochastic Impacts by Regression on Population, Affluence and Technology (STIRPAT) model to find the link between sustainable development and macroeconomics factors. They suggest that governments should implement institutions, which will improve the effectiveness of rules and regulations related to sustainable development goals, in particular, environment-related policies (Anwar et al., 2022).

Galletta et al. (2022) use panel regression to find the relationship between gender diversity and corporate performance in the bank industry. They found that augmenting the representation of women in leadership roles within banks can enhance their value-generation capabilities and potentially enhance their financial and societal outcomes (Galletta et al., 2022).

Praveen Kumar and Mohammad Firoz applied eight different OLS multivariate regressions to analyze the connection between Environmental, Social and Governance disclosures and Corporate Financial Performance and discovered a positive relationship between those factors (Kumar & Firoz, 2022).

Evaluating sustainability is challenging due to the lack of a universally accepted definition of sustainability and the complex and multifaceted nature of the factors involved. There are plenty of methods how to assess sustainability, including sustainability reporting, environmental, social, and governance (ESG) ratings, corporate social responsibility (CSR) reporting, and others (Ioannou & Serafeim, 2019). However, there is no standardized approach for assessing the sustainability of a company. Evaluating the sustainability performance of various businesses and drawing conclusions about the wider economic ramifications of sustainable business practices may be problematic. Thus, the research problem of this study is how to evaluate the impact of corporate sustainability on the domestic economy, using regression analysis. The aim is to build a model, using environmental, social, and financial indicators of the specific company. To achieve this goal several tasks should be implemented during the work:

- To conduct a literature review and bibliographic analysis of the relevant literature on the topic of sustainability.
- To select and apply a suitable methodology to address the research questions.
- To perform the empirical analysis of the data, using the appropriate methodology.
- To synthesize the findings and draw evidence-based conclusions.

Bibliographical Analysis of Sustainable Development Regarding Company Financial Results

Materials and Methods

In the pursuit of understanding sustainability within the corporate sector and its subsequent impact on economic growth, Return on Equity (ROE), and the methodological approaches used for evaluation, we embarked on an extensive bibliometric analysis. Bibliometric analysis stands as a widely utilized and detailed approach for sifting through and understanding large amounts of scholarly data. Academics employ bibliometric analysis to track the latest trends and measure performance in scholarly articles and journals, discern patterns of collaboration among researchers, and dissect the foundational structure of a field as documented in the literature (Donthu et al., 2021). By reviewing literature from the past decade with the implementation of bibliographic analysis, Bartolacci et al. (2020) found a generally positive link between companies' sustainable practices and their financial success and competitiveness. Nobanee et al. (2021) used bibliometric methods to analyse literature related to sustainability practices and risk management, utilizing VOSviewer to identify critical concerns and contributions in the field, highlighting the growing importance of sustainability in managing risks within the corporate sector.

Drawing from the rich repository of the Web of Science Core Collection, our search strategy is intended to encapsulate articles that intersect the domains of corporate sustainability, company performance, and economic metrics. We focused on peer-reviewed articles published during the years 2021, 2022, 2023, and up to the present moment in 2024, representing the most recent and relevant research in the field. The search was refined to include only those articles that address “sustainability”, “companies”, and “economic” aspects in all fields, a combination poised to yield insights pertinent to the most sustainable companies. Our search resulted in a collection of 1475 articles, carefully filtered to include only those that address substantial research on sustainability's economic impact. This selection spans a broad spectrum of European contexts, ensuring a rich variety of sustainability practices are represented in our analysis.

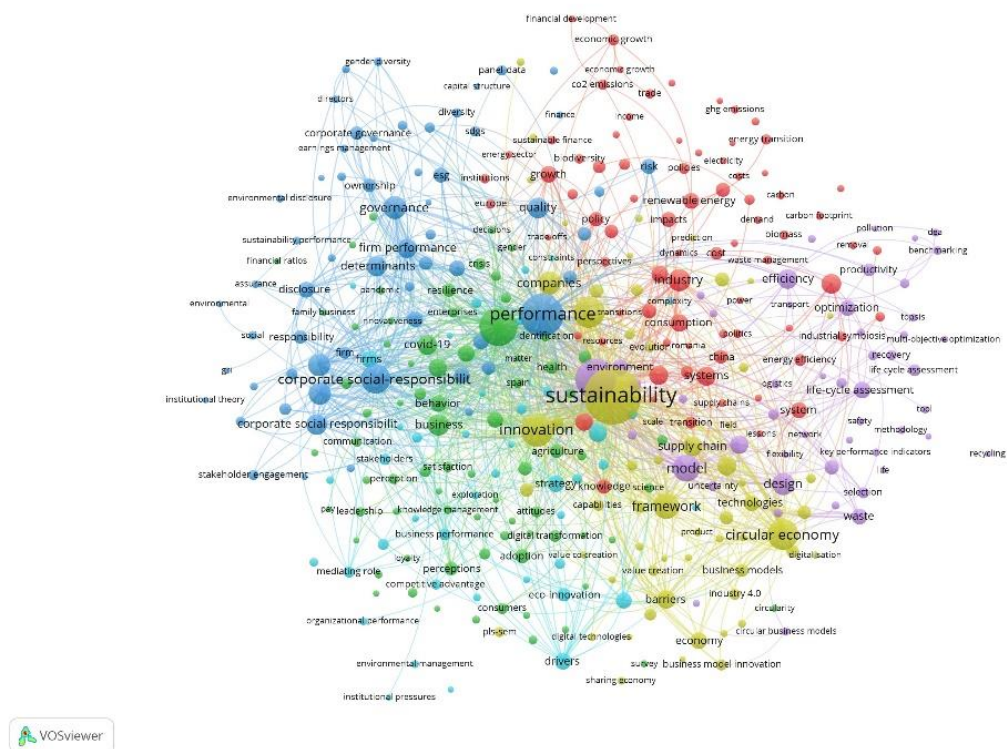


Fig. 1. VOSviewer Results of Total Link Strength (Source: Composed by the authors)

Utilizing VOSviewer, a visualization of the bibliographic data unveiled six distinct clusters, each representing a thematic concentration within the literature. These clusters provide a visual map of the interconnectedness of key concepts such as “corporate social responsibility”, “sustainability”, “performance”, “innovation”, “circular economy”, “environment”, and “efficiency” among others. The intricacy of these conceptual linkages reflects the multifaceted nature of sustainability evaluations and their influences on economic indicators like ROE.

The graph showcases various keywords and their corresponding link strength. reflects the total strength of the connections for each term. It's a measure that takes into account not just the number of links but also the significance of those links, providing an indication of how influential a term is within the cluster. “Sustainability” sits at the top, which suggests it's the most frequently discussed or most significant topic in the literature. It underscores the foundational role of sustainability as a concept that permeates all other areas. “Performance” and “financial performance” also feature prominently, indicating that much of the literature makes a direct connection between sustainability initiatives and financial outcomes. This may point to analyses that evaluate the return on investment for sustainability practices or assess how these practices affect profitability and value creation. “Corporate social responsibility” and “CSR” are significant, reflecting the growing trend of integrating social and environmental concerns into business operations and strategy. The high link strength of these terms indicates that the social and ethical dimensions of sustainability are frequently linked to corporate financial performance, possibly in terms of risk management, brand reputation, and customer loyalty. The distribution and weight of these keywords suggest that sustainability is not viewed in isolation. Instead, it is intricately linked to financial performance, management practices, governance, innovation, and supply chain management. This provides a comprehensive view of how embracing sustainability can lead to financial benefits and contribute to the long-term success of a company.

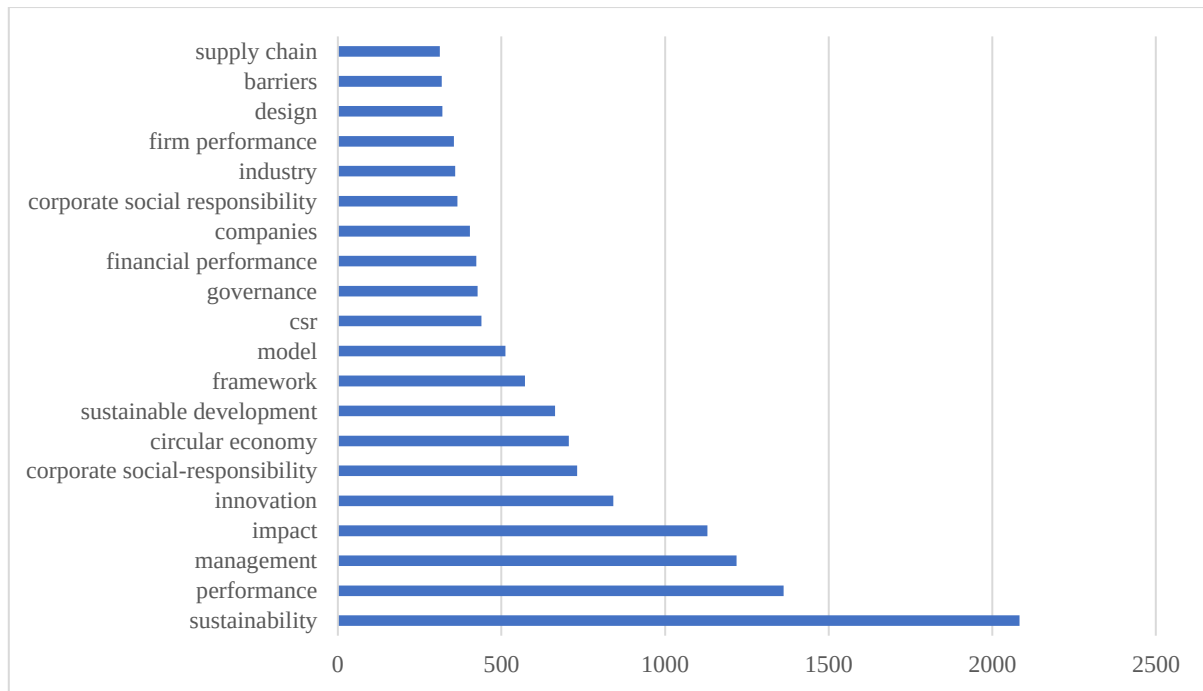


Fig. 2. Keywords with the Highest Link Strength (Source: Composed by the authors)

Table 1. Summary of the Most Related Keywords From 6 Clusters (Source: Composed by the authors)

Factor	Keyword	Cluster	Total link strength
Ecological	Consumption	1	212
	Energy	1	180
	Renewable energy	1	162
	Emissions	1	137
	CO2 emissions	1	81
	Energy efficiency	1	55
	Waste management	1	53
	Carbon	1	45
	Water	1	42
	Carbon footprint	1	37
	Electricity	1	32
	Greenhouse-gas emissions	1	32
	Resource efficiency	4	56
	Food waste	4	36
	Waste	5	208
	Cleaner production	5	64
	Pollution	5	39
	Recycling	5	15
	Sustainable production		47
Social factor	Health	2	88
	Ethics	2	82
	Networks	2	74
	Communication	2	65
	Employment	2	47
	Pay	2	44
	Gender	2	42
	Socioemotional wealth	2	40
	Employees	2	39
	Social responsibility	2	33
	Corporate social responsibility	3	731

	Women	3	80
	Diversity	3	77
	Gender diversity	3	77
	Safety	5	47
Financial factor	Trade	1	57
	Market	3	118
	Investment	3	115
	Stakeholder engagement	3	103
	Profitability	3	93
	Economic performance	3	76
	Volatility	3	35
	Investments	4	37
	Key performance indicators	5	42
	Business performance	6	120
	Stakeholders	6	96
	Economic performance	6	63

Cluster 1 is the most significant for ecological factors of sustainable development, containing the majority of the keywords such as “consumption”, “energy”, and “renewable energy”. These keywords also have high weights, indicating a strong link strength. Clusters 4 and 5 also contribute to the ecological factor but with fewer keywords. The keyword “waste” in Cluster 5 has a particularly high weight, suggesting a significant relevance to the ecological factor within that cluster.

The social factor is mainly addressed within Clusters 2 and 3. Cluster 3 has the highest weight by far for “corporate social responsibility”, indicating a very strong association with this factor. Other important keywords in the social factor include “health”, “ethics”, and “gender diversity”, spread across Clusters 2 and 3, with relatively high weights suggesting strong link strength.

Clusters 3 and 6 contain most of the financial factor keywords. Cluster 3 has several high-weight keywords such as “market” and “investment”, which are central to financial considerations. Cluster 6 includes “business performance” with the highest weight in this factor, implying it's a key keyword. “Stakeholders” and “economic performance” are also significant in this cluster.

The clustering of keywords reveals patterns that provide a conceptual framework for understanding the multi-dimensional impact of corporate sustainability on a company's financial results. Each cluster represents a compilation of themes and discourses that inform the intricate relationship between sustainable practices and financial performance. The diversity of focus areas across clusters signifies the breadth of sustainability's influence, encompassing environmental, social, and economic aspects, which has different implications for financial outcomes.

Table 2. Description of Each 6 Clusters (Source: Composed by the authors)

Cluster	Keywords description
Cluster 1	Ecologically focused, with the majority of high-weight keywords related to energy and emissions, suggesting significant attention to these topics in sustainability research.
Cluster 2	Centres on the social aspect, featuring keywords related to health, ethics, and employment, pointing to an emphasis on the human and ethical side of sustainability.
Cluster 3	Dominant in social and financial discussions, with a very high weight for 'corporate social responsibility', indicating a strong emphasis on the intersection of corporate actions and sustainability.
Cluster 4	Features ecological keywords such as 'resource efficiency', indicating discussions in the literature on efficient resource use within sustainable practices.
Cluster 5	Adds to ecological discussions, especially with the keyword 'waste', suggesting an emphasis on waste management and cleaner production practices.
Cluster 6	Significant for financial keywords, with 'business performance' having the highest weight, indicating a focus on sustainability's impact on business outcomes.

The keywords from the 6 clusters represent how the ecological, social, and financial factors contribute to the corporate framework. It shows that sustainability is not an isolated strategic ideal. As we extract insights from the latest research contained in articles published from 2021 to 2024, we gain clarity in the modern understanding that sustainable business practices are not just an ethical choice but are also increasingly recognized as catalysts for financial sustainability and competitive advantages in the corporate sphere.

The Pearson correlation coefficient gauges the degree of linear interdependence between two real-valued vector random variables. It was the initial established method of measuring correlation and continues to be one of the most frequently employed methods for assessing relationships. The equation of the Pearson correlation coefficient is presented below (1) (Zhou et al., 2016):

$$r_{xy} = \frac{\sum_{i=1}^m (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^m (x_i - \bar{x})^2 (y_i - \bar{y})^2}} \quad (1)$$

Where:

$\bar{x} = \frac{1}{n} \sum_{i=1}^N x_i$ refers to the mean of x;

$\bar{y} = \frac{1}{n} \sum_{i=1}^N y_i$ refers to the mean of y.

The range of the coefficient r_{xy} is between -1 and 1, and it remains unaltered by any linear modifications of the variables involved.

Multiple Linear Regression (MLR) is a statistical method that aims to anticipate the outcome of a response variable by employing several explanatory variables. The primary goal of MLR is to construct a model that describes the linear connection between the independent variables (x) and the dependent variable (y), which will be examined. The fundamental formula for MLR is (2):

$$y = \beta_0 + \beta_1 x_1 + \dots + \beta_m x_m + \varepsilon \quad (2)$$

In Regression Analysis, Cook's distance (D_i) serves the purpose of identifying influential outliers among a group of predictor variables, meaning points that have an adverse effect on the regression model. It combines the leverage and residual values of each observation, and the Cook's distance increases as the leverage and residuals increase. The equation that calculates Cook's distance remains as follows (3):

$$\frac{\sum_{j=1}^n (\hat{y}_j - \hat{y}_{j(i)})^2}{(p+1) \sigma^2} \quad (3)$$

K-nearest neighbour is a type of semi-supervised learning technique that necessitates training data and a pre-determined k value to locate the k closest data points based on distance calculation. When k data points have varying classes, the algorithm predicts that the unknown data point belongs to the majority class. The Euclidean distance, which is a metric used to compute the distance between two points, is calculated by the next equation (4) (Chomboon et al., 2015):

$$d_{st}^2 = (x_s - y_t) * (x_s - y_t)' \quad (4)$$

As a result of the multifaceted nature of sustainability goals and the intricate interplay of socio-economic and biophysical systems, there is an increasing trend in employing multi-criteria decision analysis (MCDA) methodologies for sustainable decision-making (Raza et al., 2023). To evaluate the ranks of companies, based on sustainable performance, a COPRAS multi-criteria decision-making method in combination with the simple additive weighting technique has been employed for comparison (Zavadskas et al., 2008, 2009).

To apply the COPRAS technique, the normalized x values for the j criteria of the i alternative can be computed as follows:

$$\overline{x_{ij}} = \frac{x_{ij}}{\sum_{i=1}^m x_{ij}} \text{ if min is preferable or max} \quad (5)$$

Where:

$x_{ij} < 0$, under conditions $x_{ij} < 0$;

$x_{ij} > 0$, under conditions $x_{ij} > 0$.

To determine the optimality criterion Q_i in the COPRAS approach, the following procedure can be adopted:

$$Q_i = \frac{s_{+i} + (\min_i s_i \cdot \sum_{i=1}^m s_{-i})}{s_{-i} \cdot (\sum_{i=1}^m s_{-i} / s_{-i})} \quad (6)$$

In this study, the list of the 100 most sustainable companies, was conducted by Corporate Knights. were used. The ranks were calculated based on the next approaches:

- The ranking is mainly based on data that is made public, such as financial statements, sustainability reports, and company websites.
- There is no requirement for companies to submit any payment or materials in order to be considered.
- Companies that are part of the Global 100 Universe are contacted to verify the data prior to the finalization of the project.
- The methodology includes a set of up to 25 key performance indicators (KPIs) encompassing aspects, such as resource management, employee management, financial management, sustainable revenue and investment, supplier performance (Corporate Knights, 2023).

Results

To address the research question of this study, a reliable sample of data should be built. The 2022 Global 100 Sustainable Companies report published by Corporate Knights was taken as a base of this analysis. Corporate Knights Inc. is a B Corporation that specializes in sustainable economy research and media. It was established in 2002 by Toby A. Heaps, Paul Fengler, and Peter Diplaros, with a focus on promoting an economic system that benefits both society and the environment. Corporate Knights' research department generates worldwide sustainability rankings, study reports, and financial product ratings that assess corporate sustainability performance. Their most prominent ranking is the Global 100 Most Sustainable Corporations in the World, which is published annually during the World Economic Forum. Information on fiscal and sustainability performance researchers are gathering by reviewing yearly reports, sustainability reports, and corporate websites, and occasionally using data from third-party sources. During the verification stage, companies supplied additional supporting documents and context to assist us in reflecting the most precise figures feasible (Corporate Knights, 2021). Rankings provided by Corporate Knights were based on publicly disclosed data and are enough diverse to cover the research aims.

Some challenges arose with the processing of the data sample. More than half of the collected factors were deleted from the data set, because of the strong correlation between them. Removing correlated indicators is an essential step to avoid the potential problems with multicollinearity, which causes difficulties with the interpretation of the model. Some indicators didn't contain full data, which also was a reason to delete them from the sample. Only 12 independent variables remained for the regression analysis. Since some factors still contained empty values, the K-Nearest Neighbour (KNN) Algorithm was implemented. The process of k-nearest neighbour imputation involves filling in missing values of incomplete instances by using the average of the corresponding attribute of its K-nearest neighbours. This technique is effective in handling records with multiple missing values and considers the correlational data structure (Cheng et al., 2019).

A dependent variable was chosen based on the GDP of countries each company belongs to, to evaluate the impact of corporate sustainable results on the global economy. Also, Return on Equity was considered to measure the relationships between sustainable and economic performance (Balabanis et al., 1998).

The table below represents independent variables, which will be used for further analysis.

Table 3. Indicators of Company Sustainable Performance (Source: Composed by the authors)

Ecological factors	Financial factors	Social factors
Energy Productivity Score	Cash Taxes Paid Ratio	Injury Rate Ratio
Carbon Productivity Score	Clean Revenue Ratio	Employee Turnover Ratio
Water Productivity Score	Clean Investment Ratio	Non-male Boards Ratio
Waste Productivity Score	Purchasing Power Parity Revenue	Racially Diverse Among Boards Ratio

The correlation analysis for the GDP of each country and the sustainable performance of the company was made to investigate how sustainability results impact the global economy.

Results show that Clean Revenue Ratio (0,412), Clean Investment Ratio (0,224), Purchasing Power Parity Revenue (0,171), and Racially Diverse Among Boards Ratio (0,285) show positive correlations with GDP. Among these, the Clean Revenue Ratio shows the strongest positive correlation. It was found that there is no significant correlation between GDP and Carbon Productivity Score (-0,119), Water Productivity Score (-0,090), Cash Taxes Paid Ratio (-0,113), Injury Rate Ratio (0,088), Employee Turnover Ratio (-0,028) and Non-male Boards Ratio (-0,229). It means that there wasn't found significant impact of sustainable performance indicators on GDP. The table of correlation results is presented below:

Table 4. Pearson Correlation Results Between Sustainable Performance and GDP (Source: Composed by the authors)

Factors	Pearson correlation	p-value
Energy Productivity Score	-0,031	0,808
Carbon Productivity Score	-0,119	0,358
Water Productivity Score	-0,09	0,487
Waste Productivity Score	-0,191	0,138
Cash Taxes Paid Ratio	-0,113	0,382
Clean Revenue Ratio	0,412	<0,001
Clean Investment Ratio	0,224	0,08
Purchasing Power Parity Revenue	0,171	0,183
Injury Rate Ratio	0,088	0,495
Employee Turnover Ratio	-0,028	0,829
Non-male Boards Ratio	-0,229	0,073
Racially Diverse Among Boards Ratio	0,285	0,025
Cook's Distance	0,339	0,007

Since no correlation was found between sustainability and GDP, the evaluation of the relationship between sustainable indicators and the economic performance of the company will be made.

Before the correlation, it was checked if there were any exceptions in the data with the Cook distance methodology. The results show that in one line there was an exception. Apple Inc. was excluded from the analysis because its Cook distance was higher than 1.

The Pearson correlation was performed to analyse the relationship between ROE, as an indicator of the financial performance of the company, and factors of sustainable performance.

The results of the Pearson correlation analysis show that ROE has a positive correlation with Clean Revenue Ratio ($r=0,113$) and Clean Investment Ratio ($r=0,160$), but a negative correlation with Purchasing Power Parity Revenue ($r=-0,122$), Injury Rate Ratio ($r=0,183$), Non-male Boards Ratio ($r=-0,088$), and Racially Diverse Among Boards Ratio ($r=-0,062$). The correlations with Waste Productivity Score, Cash Taxes Paid Ratio, Carbon Productivity Score, Energy Productivity Score, and Water Productivity Score are not statistically significant ($p > 0.05$).

It is important to note that the statistical significance of the correlation coefficients was also tested using a two-tailed hypothesis test. The p-value for each correlation coefficient indicates the probability of observing such a correlation by chance, assuming that there is no true correlation between the variables. A p-value less than 0.05 is generally considered statistically significant, indicating that the correlation coefficient is unlikely to have occurred by chance.

In this case, the correlation coefficients for Clean Revenue Ratio, Clean Investment Ratio, Purchasing Power Parity Revenue, Injury Rate Ratio, Non-male Boards Ratio, and Racially Diverse Among Boards Ratio have p-values greater than 0,05, indicating that these correlations are not statistically significant. Therefore, it can be concluded that the observed correlations between ROE and these variables may be due to chance and not a true relationship between the variables. There is no statistically significant relationship between the ROE and sustainable performance factors.

Table 5. Pearson Correlation Results Between Sustainable Performance and ROE (Source: Composed by the authors)

Factor	Pearson correlation coefficient	Two-tailed p-value
Energy Productivity Score	-0,071	0,586
Water Productivity Score	-0,029	0,826
Carbon Productivity Score	-0,032	0,807
Waste Productivity Score	0,029	0,822
Cash Taxes Paid Ratio	-0,021	0,873
Clean Revenue Ratio	0,113	0,388
Clean Investment Ratio	0,16	0,219
Purchasing Power Parity Revenue	-0,122	0,351
Injury Rate Ratio	0,183	0,159
Employee Turnover Ratio	-0,052	0,691
Non-male Boards Ratio	-0,088	0,501
Racially Diverse Among Boards Ratio	-0,062	0,636

Since the data does not meet the assumptions of a Pearson correlation, Nonparametric Correlations (Kendal method) were performed. The Kendall's tau-b coefficients for ROE and each of the independent variables are generally small and not statistically significant at the 0,05 level, except for the Clean Revenue Ratio and Injury Rate Ratio. Clean Revenue Ratio has a positive correlation coefficient of 0,109, indicating a weak positive association with ROE, although the p-value of 0,219 suggests this association is not statistically significant. Injury Rate Ratio has a correlation coefficient of 0,147, indicating a weak positive association with ROE, and the p-value of 0,095 suggests this association may be marginally statistically significant. The results suggest that there may be some weak associations between ROE and certain independent variables, but these associations are generally not statistically significant at the 0,05 level.

In the next step, the regression analysis was performed. The results are as follows. The model has a low R-squared value of 0,09, which means, that the model is statistically insignificant. The regression is not statistically significant, as the F-value of 0,398 is not significant. This suggests that the independent variables are not significantly related to the dependent variable. Only a few independent variables have a significant effect on ROE. The Waste Productivity Score has a positive coefficient of 19,550, indicating that it has a positive relationship with ROE. The Injury Rate Ratio also has a positive coefficient of 2,641. The regression analysis shows that the relationship between sustainability metrics and ROE is weak and not significant, which means that the model is not suitable for practical use.

Table 6. Regression Model Summary of Sustainable Performance and ROE (Source: Composed by the authors)

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0,301	0,09	-0,137	29,99431	1,922

To increase the statistical significance of the model the decision to exclude the economic factors from independent variables was made since the correlation between ROE and economic indicators of sustainability performance was discovered.

The results did not change drastically, as the correlation between the economic performance of companies and social and environmental factors remains insignificant. The results of the regression analysis will be put in the table below:

Table 7. Regression Model Summary of Sustainable Performance and ROE Without Economic Indicators (Source: Composed by the authors)

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0,249	0,062	-0,08	35,10776	1,827

R-squared suggests that the significance of the model became even worse after the exclusion of economic variables. Since the results of correlation and regression analysis are extremely low, the COPRAS technique was utilized to revise the methodology of the company's sustainable performance evaluation. Firstly, the normalisation of the data was done, and then the new ranks were calculated to compare them with the Corporate Knights list.

Table 8 provides the results of the COPRAS method. Each company and country were included in the table. The new ranks were calculated based on normalised dependent factors (ROE, GDP) and independent variables (Energy Productivity Score, Water Productivity Score, Carbon Productivity Score, Waste Productivity Score, Cash Taxes Paid Ratio, Clean Revenue Ratio, Clean Investment Ratio, Purchasing Power Parity Revenue, Injury Rate Ratio, Employee Turnover Ratio, Non-male Boards Ratio, Racially Diverse Among Boards Ratio). Also, the Corporate Knights ranks was added.

Table 8. Ranking with COPRAS Method (Source: Composed by the authors)

Company	Country	Qi	Ui	Rank	Previous rank
Vestas Wind Systems A/S	Denmark	0,013581	28,70381	40	1
Chr Hansen Holding A/S	Denmark	0,015024	31,75346	28	2
Autodesk Inc	United States	0,022387	47,3152	8	3
Schneider Electric SE	France	0,023368	49,38851	7	4
City Developments Ltd	Singapore	0,01134	23,96708	51	5
American Water Works Company Inc	United States	0,019859	41,97274	13	6
Orsted A/S	Denmark	0,014037	29,66719	37	7
Atlantica Sustainable Infrastructure PLC	United Kingdom	0,014637	30,93499	31	8

Dassault Systems SE	France	0,017503	36,99303	20	9
Brambles Ltd	Australia	0,013815	29,19824	38	10
Sims Ltd	United States	0,020969	44,31781	11	11
Johnson Controls International PLC	Ireland	0,013173	27,84129	42	12
Kering SA	France	0,017337	36,64325	21	13
Koninklijke KPN NV	Netherlands	0,017541	37,07276	19	14
McCormick & Company Inc	United States	0,018363	38,81095	15	15
Schnitzer Steel Industries Inc	United States	0,01603	33,87974	25	16
Transcontinental Inc	Canada	0,016233	34,30969	23	17
Stantec Inc	Canada	0,011805	24,95047	49	18
Cascades Inc	Canada	0,009832	20,7802	58	19
Evoqua Water Technologies Corp	United States	0,028058	59,30136	2	20
Beijing Enterprises Water Group Ltd	China	0,018329	38,73956	16	21
Banco do Brasil SA	Brazil	0,017553	37,09975	18	22
Sekisui Chemical Co Ltd	Japan	0,010476	22,14225	55	23
Engie Brasil Energia SA	Brazil	0,012105	25,58464	47	24
Neste Oyj	Finland	0,014513	30,67439	32	25
Iberdrola SA	Spain	0,014319	30,26292	33	26
Xerox Holdings Corp	United State	0,011176	23,62004	52	27
Salesforce.Com Inc	United State	0,025129	53,11082	4	28
Cisco Systems Inc	United State	0,022243	47,0116	9	29
Alstom SA	France	0,013165	27,82516	43	30
Legrand SA	France	0,014248	30,11371	36	31
Eisai Co Ltd	Japan	0,010172	21,4997	57	32
Ecolab Inc	Italy	0,013772	29,10815	39	33
Canadian Pacific Railway Ltd	Canada	0,012169	25,71935	46	34
Novozymes A/S	Denmark	0,010613	22,43051	54	35
Alphabet Inc	United States	0,027482	58,08448	3	36
Verbund AG	Austria	0,011123	23,50966	53	37
Workday Inc	United States	0,018174	38,41236	17	38
SunPower Corp	United States	0,014266	30,15111	35	39
Metso Outotec Corp	Finland	0,009061	19,15111	61	40
IGM Financial Inc	Canada	0,013152	27,7967	44	41
Xinyi Solar Holdings Ltd	China	0,01306	27,60352	45	42
Sprouts Farmers Market Inc	United States	0,011408	24,1121	50	43
TSMC	Taiwan	0,023944	50,60658	5	44
Vitasoy International Holdings Ltd	Hong Kong SAR	0,009708	20,5192	59	45
Samsung SDI Co Ltd	South Korea	0,013219	27,93835	41	46
LONGi Green Energy Technology Co Ltd	China	0,014973	31,64587	29	47
Apple Inc	United States	0,047314	100	1	48
Telus Corp	United States	0,014722	31,1149	30	49
HP Inc	United States	0,010206	21,56996	56	50
Atea ASA	Norway	0,016066	33,95701	24	51
Tesla Inc	United States	0,02046	43,2434	12	52
Konica Minolta Inc	Japan	0,008989	18,99902	62	53
Hewlett Packard Enterprise Co	United States	0,02115	44,70036	10	54
SAP SE	Germany	0,015126	31,96845	27	55
Storebrand ASA	Norway	0,023501	49,66984	6	56
Sun Life Financial Inc	Canada	0,014277	30,17537	34	57
Koninklijke Philips NV	Netherlands	0,015892	33,58765	26	58
Arcelik AS	Turkey	0,016994	35,91713	22	59
Citrix Systems Inc	United States	0,019771	41,7869	14	60
UniCredit SpA	Italy	0,012014	25,39285	48	61
Commerzbank AG	Germany	0,009075	19,17988	60	62

The results of the COPRAS method suggest that the ranks of Corporate Knights calculated here are absolutely different, except for two cases. Sims Ltd. from the United States represents the 11th place in

both methodologies. Also, McCormick & Company Inc., a US company, placed 15th rank in the new ranking as well as in the previous one.

Such different results indicate that the methodology for assessing the sustainability of the company is still challenging. It is needed to investigate in greater depth the impact of social, ecological, and economic factors on a company's sustainable performance and how to evaluate it.

Conclusions

To proactively address these consequences and mitigate the risks, companies need to reassess their sustainable development practices, including environmental and social considerations. In this case, it is important to understand, how different factors of sustainable performance impact the economy and performance of the company. In this publication, the regression and correlation analysis were performed to evaluate how the sustainability of the company influences the economy. The analysis also was implemented to find out how sustainable performance impacts the financial performance of the company. Also, the COPRAS method was utilized to compare the calculations with the methodology of Corporate Knights on evaluating the sustainable performance of companies based on ecological, social, and economic indicators.

The study analysed the data from the 2022 Global 100 Sustainable Companies report published by Corporate Knights and used the K-Nearest Neighbour algorithm to fill in missing data. Based on the results presented, it can be concluded that there is no significant correlation between the sustainable performance of companies and the GDP of the countries they belong to. The relationship between sustainable performance indicators and the economic performance of companies was investigated by analysing the Return on Equity (ROE) and factors of sustainable performance. The Pearson correlation analysis showed that there is no statistically significant relationship between the ROE and sustainable performance factors. Therefore, based on the results obtained using the selected indicators in this analysis, it can be concluded that a significant correlation between ROE and sustainable performance indicators was not established. This conclusion does not imply that such a relationship is universally absent, but rather, it reflects the specific context and methodologies applied in this study.

Sustainable performance may not always directly impact financial performance. There could be difficulties in accurately measuring both sustainability and financial performance. Sustainability encompasses a wide range of practices and impacts that are not always easily quantifiable or directly linked to short-term financial metrics. Similarly, financial outcomes influenced by sustainability may be obscured by other economic factors. While the analysis did not incorporate company size, it is acknowledged that this factor could play a critical role in understanding the relationship between sustainable performance and financial performance (Ihsani et al., 2023). This conclusion suggests the need for further research, possibly incorporating company size, to discern the dynamics of this relationship more accurately.

Additionally, normalization of data was done, and new ranks were calculated based on normalised dependent and independent factors. The results of the COPRAS method suggest that the ranks of Corporate Knights and calculated ranks are absolutely different except for two cases. It means that the methodology of calculations differs. Since it is important to investigate the methodology more. The differences in the rankings between the COPRAS method and Corporate Knights observed in this study could be attributed to several methodological variations, particularly in indicator selection and weighting impact of the assessment outcomes. This suggests a need for further research to conduct sensitivity analyses to understand which indicators most influence the rankings and to explore the effects of varying these weights. Additionally, comparing different sustainability assessment methodologies will help identify and mitigate the inherent biases and assumptions that each may introduce. Altogether, these areas of investigation will provide more comprehensive insights into improving the accuracy and reliability of sustainability assessments in future studies.

These results underscore the nuanced and context-dependent nature of the relationship between sustainability and financial performance. Methodological differences, such as the choice of indicators, the industry focus, company size, and market conditions, are critical factors that can influence

outcomes. Furthermore, inconsistencies and a lack of transparency in corporate reporting can make it challenging to assess the relationship between sustainability practices and financial performance. Considering all these factors is crucial for further research to accurately understand the relationship between sustainability practices and financial performance.

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