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Exploring the influence of company sustainability performance on financial performance within and across GICS sectors

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Submitted to David Leonard, PhD

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AFFIDAVIT

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ABSTRACT

Private firms play a significant role in generating the social and environmental issues addressed by the UN's Sustainable Development Goals (SDGs) and are key actors in the implementation of solutions. Ideally, the socio-economic framework in which they operate would be configured so as to reward firms exhibiting superior sustainability performance in order to incentivize further action. According to the results of this study, that is not the world in which we live.

This study employs a quantitative approach to examine the impact of sustainable company performance on financial performance using secondary data collected from the 324 GRI-compliant S&P 500 companies. Data on twelve sustainability indicators considered applicable across the 11 GICS sectors were sourced from the companies' most recent sustainability reports, while data on ten financial measures of business performance were obtained from the latest annual reports, resulting in 3,346 observations. Based on the prescriptions of legitimacy- and stakeholder-theory, regression analyses explored the relationship between sustainable performance indicators (as predictors) and financial performance metrics (as dependent variables), both within and across GICS sectors.

In the 110 regression models for individual sectors, the various sustainable performance indicators were insignificant predictors of financial performance in 93.7% of cases, significant positive effects were observed in 3.1% of cases, and negative effects were observed in 3.2% of cases. While this is not what would be expected in the ideal socio-economic framework described above, the insignificant findings can be interpreted as suggesting that there is no reason not to perform more sustainably in those areas. The impact on financial performance differs by sustainability indicator, whereby better performance on 'grid electricity' showed the overall most positive impact and on 'scope 3 emissions intensity' showed the overall most negative impact. By sector, business performance was most positively impacted by sustainability performance in the IT sector and most negatively in the Real Estate sector. The economywide analysis across all sectors painted a less promising picture. Sustainable performance was associated with better business outcomes in only 4.1% of cases and with worse business outcomes in 8.3% of cases. This finding has worrying implications, as, ceteris paribus, investors that are otherwise indifferent between the sectors will be drawn towards less sustainable sectors.

This research contributes to the plethora of existing literature suggesting theoretical advantages of sustainable performance through a detailed empirical analysis. The suggested positive relationship was found within individual GICS sectors, but overall negative relationships were found in other sectors and economywide. The methodology precludes interpretation of effect sizes, which is among the limitations listed for future research to address. The research further suggests which sustainability metrics are currently rewarded in the market and which might require regulatory and/or market reforms to incentivize.

Keywords: Sustainability performance, Financial performance, Corporate sustainability, S&P 500, Global Classification Standard (GICS), Global Reporting Initiative (GRI).

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LIST OF ABBREVIATIONS

CEO: Chief Executive Officer

CSD: Corporate Sustainability Disclosures

CSR: Corporate Social Responsibility

CSP: Corporate Social Performance

CWI: Capitalization Weighted Index

DPS: Dividend Per Share

DW: Durbin–Watson

EBITDA: Earnings Before Interest, Taxes, Depreciation, and Amortization

EIRIS: Ethical Investment Research and Information Service

ESG: Environmental, Social, and Governance

EVA: Economic Value Added

FCF: Free Cash Flow

FPI: Financial Performance Indicator

GDP: Gross Domestic Product

GHG: Greenhouse Gasses

GICS: Global Industry Classification Standard

GIR: Global Reporting Initiative

GM: Gross Margin

GP: Gross Profit

IT: Information Technology

KLD: Kinder Lydenburg Domini

M: Mean

Mdn: Median

MSCI: Morgan Stanley Capital International

MT: Metric Ton

MVA: Market-Added Value

MWh: Megawatt-hour

NIM: Net Interest Margin

PBT: Profit Before Tax

ROA: Return on Assets

ROC: Return on Capital

ROE: Return on Equity

SASB: Sustainability Accounting Standards Board

SD: Standard Deviation

SDG: Sustainable Development Goal

SIP: Social Issue Participation

SPE: Sustainability Performance Evaluation

S&P 500: Standard & Poor 500

TCFD: Task Force on Climate-Related Financial Disclosures

TQ: Tobin's Q

VIF: Variance Inflation Factor

WACC: Weighted Average Cost of Capital

YTD Return: Year-To-Date Return

1 INTRODUCTION

The sustainability issue has become a hot topic for many businesses in recent years. Businesses must satisfy all three pillars of sustainability (environmental, social, and economic) while also satisfying investors interests. As investors have become increasingly interested in the non-financial performance of companies (Ernst & Young, 2009), it is suggested that sustainability performance may have an impact on a company's financial performance. Globally, however, the majority of firms are not fully sustainable but rather undertake specific measures to become more sustainable (Hessels et al., 2011), or to appear more sustainable. This relationship between sustainable performance and business performance is at the heart of this study.

In recent years, sustainability and its impact on financial performance has become an important research area (Aggarwal, 2013). According to the author, results have been mixed and inconclusive. There have been a number of studies conducted in developed countries such as the US and in developing countries like China[1] and India, etc., as well as in specific industries, such as the financial and discretionary sectors.

Sustainability reporting and evaluation have been extensively examined as well (Gallego-lvarez and Ortas, 2017; Ching et al., 2017; Hussain, Rigoni, and Cavezzali, 2018; Buallay and AlDhaen, 2018; Hussain, Rigoni, and Orij, 2018; Shad et al., 2019; Buallay, 2019). In their study, Buallay et al. (2019) highlight that even when various industries look at the same issue, they focus on it differently, and that there is a lack of cross-sector studies focusing on sustainability and financial performance.

With respect to financial performance, some scholars state that sustainability has a positive effect on a firm's performance (e.g., Bird et al., 2007; Margolis et al., 2009). There are, however, some studies that find no relationship (e.g., Hillman and Keim, 2001; Mittal et al., 2008; Nollet et al., 2016) or have found a negative correlation (e.g., Brammer et al., 2006; Cowen et al., 1987) between sustainable and financial performance of a company.

According to Legitimacy, Stakeholder, and Agency theory and in line with the prior research described above, this study seeks to answer the following question: *What is the impact of sustainability performance on company financial performance across Global Industry Classification Standard (GICS) sectors?*

For a comprehensive analysis of the impact sustainable performance has on the financial performance of companies in a given GICS sector, this study must achieve four specific objectives:

1. Conduct a literature review to identify theories on sustainable and financial performance as well as empirical findings on the relationship between financial and sustainable performance;
2. Decompose notions of sustainable and financial performance in order to describe their respective components and determine appropriate metrics;
3. Collect data on the sustainable and financial performance of companies across GICS sectors;

[1] China is considered to be developed and developing country.

4. Quantitatively analyze how sustainable performance affects company financial performance within and across GICS sectors in order to draw conclusions.

Management, researchers, and regulators might benefit from the results of this study. It is essential to determine how certain sustainable performance indicators might affect financial performance at the sector level, since different sectors vary greatly in terms of purpose, processes, and size, and therefore might provide different results. It is important to combine these results in a cross-sectoral analysis, as this might reveal whether investors are drawn towards more or less sustainable sectors. Results are expected to enhance understanding of sustainable performance at the sector level and cross-sectoral.

This thesis consists of five sections: Section 1 is this introduction; The literature review discusses relevant theories and findings in Section 2; The third section contains the methodology, including the research design, hypotheses, variables and their descriptive statistics, data collection, and data analysis; The results of the empirical analysis are presented in section 4; Section 5 presents the limitation of the study and research recommendations; And Section 6 presents conclusions.

2 LITERATURE REVIEW

2.1 Financial performance

"*It is the firms, not nations, which compete in international markets*" (Porter, 1998) defines each firm as a unique entity of the market and describes the imperative for firms to perform. Survival of the company to a large extent depends on the ability to adjust to current trends in customer and shareholder demands. Competitiveness refers to the ability of a firm to master new markets and develop a competitive advantage over its competitors (Fagerberg & Srholec, 2017; Justine Falciola et al., 2020). Having a competitive advantage within the sector or across the sectors positions a company higher in the marketplace. The higher position a company has in the marketplace, the better its reputation and the more profit it receives.

In most scientific studies, the level of competition is examined at the county level (Fagerberg, Srholec, and Knell (2007); Prehalad & Hamel, 1990; Ma & Lia, 2006). The present study examines firm-level competitiveness. It is the goal of this study to investigate how sustainable performance affects firm competitiveness (via financial performance) within and across different sectors. It is crucial from a managerial perspective to know which tools (from a set of sustainability-related indicators) help gain a competitive advantage and hence attract more investors.

Justine Falciola et al. (2020) suggest that firms must satisfy the following three conditions in order to reach a competitive advantage:

1. Firms are expected to meet the needs of their customers. This applies to the quality and quantity of products produced and/or services provided, and the price.
2. The firms should follow trends regarding sustainable development and adapt to changing environmental conditions in a timely manner.
3. Firms must proactively engage and stay connected to the latest market trends.

According to the author, without entering the appropriate market segment, firms following the three stated conditions will not be able to attain a competitive advantage.

The three dimensions of sustainable development are economic, environmental, and social, which are further explained in the next chapter. The three-dimensional approach has also been applied to competitive analysis, with *Compete*, *Connect*, and *Change* being the pillars of competitiveness (International Trade Centre, 2015). To *compete* in a given market segment, a firm must produce an appropriate quantity of products (or services) and set prices that are competitive for the quality level.

The second dimension of competitiveness is *change*: firms' ability to quickly adapt to changing market conditions. Finally, the firm should consider how well it is *connected* to its customers and other stakeholders. In order to exchange knowledge and experience, firms often form clusters with other firms (Stam & Winters, 2007). Collaboration and competition are boosted with this kind of connectivity. Similar to the pillars of sustainable development, the three dimensions of competitiveness are interdependent and cannot be considered separately. It is a challenging task to consider all three dimensions of competitiveness yet highly beneficial for policymakers and managers since it allows them to identify crucial factors that affect competitiveness, identify sudden economic bottlenecks, and design more effective policies while taking into consideration *Sustainable Development Goals* (Justine Falciola et al. 2020).

There is no unique approach that will assist organizations in achieving a competitive advantage (Newbert, 2008; Esteban Lafuente et al., 2020). Due to this, the result of many companies actions to increase competitiveness is heterogeneous and linked to financial capabilities. According to many studies, the multidimensional construct of competition should be analyzed holistically to reveal the underlying structure of all variables which are correlated with performance (Barney, 2001). Multidimensionality depends on the size and sector of the firm. However, the focus is on integrating all elements that affect the performance into one system since they cannot be properly understood if viewed separately. As a result, the strategic decision would be incomplete. Esteban Lafuente et al., (2020) emphasize the importance of considering idiosyncratic characteristics of the system when analyzing a firm’s competitiveness.

Studies have shown that firm performance is determined by a number of factors, including financial strength, technological resources, operational efficiency, customer satisfaction, and innovations (Hong et al., 2010). In order for a company to grow and develop sustainably, it must also navigate the three key dimensions of sustainable development —social, economic, and environmental— in order to remain competitive in the marketplace in the long run (Ioannou, Serafeim, 2012; Engert, Baumgartner, 2016). Jintao Lu et al., (2020) state that investing in sustainable development efforts positively impacts a company's reputation, brand, financial capacity, product specificity, customer loyalty, employee satisfaction, market share, cost reduction, and risk reduction. Given the fact that most environmental metrics continue to worsen year after year, the statement by Jintao Lu et al. (2020) remains scientifically unclear; if sustainable performance is truly win-win, why are we not seeing more of it?

Kirikankuman S. M. (2019) argues that strategies and international business are intertwined with competitiveness and innovation, so they require further exploration and cross-disciplinary linking. Aiginger and Vogel (2015) describe competitiveness as a country’s ability to deliver beyond its GDP-goals to its citizens. A fascinating approach is to combine the social and ecological factors into the classical economic approach to expressing a country’s welfare.

There is still an open question about why a certain country can achieve and sustain a competitive advantage in a particular sector (Porter 1990; Momaya 2001). Research on competitiveness and sustainability is young, but with tremendous potential across multiple disciplines with the goal of integrating multidisciplinary and multi-level competitiveness across various sections, where new methodologies could be developed and data collection could be augmented. In this regard, the goal of this study is focused on measuring how competitiveness, via financial performance, and sustainability, via sustainable performance, are interwoven. To do so, measures must be identified for each.

In their paper, Hong et al. (2010) consider financial strength to be one of the factors which contribute to a company's higher financial performance. Financial statements such as income statements, balance sheets, and statements of cash flows are used to measure a company's financial strength. As a result of these three statements, investors are able to gain a clear understanding of the strength of a company's financial position and underlying value. Following this, the present study identified a range of *Financial Performance Indicators* (further referred to as FPIs) as measures of the competitiveness of a company. These are explained in detail in section 3.4.1.

It is important to note that the FPIs taken for further analysis in this study are not single indicators representing the financial strength of a company. To gain a complete picture of the financial health of a company, multiple parameters should be included. However, it is beyond the scope of this study to analyze the multi-level complexity of the FPIs.

2.2 Sustainability performance

Human development is an increasing function over time. The population is becoming more crowded, more consuming, and more connected each year. Under such circumstances, scientists, policymakers, and businesses are faced with the challenging task of determining a solution that meets the current needs without putting future generations at risk. As such, the approach should be a combination of multiple components and be context and scale-specific (Amadei, 2021).

This multidimensional reality led to the concept of sustainability (Bai et al., 2020; Vacchi et al., 2021). Sustainable development is a multiphase, progressive process. The United Nations published the Agenda for Development in 199“ ("UN–P - 19–7 - Human Development to Eradicate Poverty" n.d.) where sustainable development was described as:

“*Development is a multidimensional undertaking to achieve a higher quality of life for all people. Economic development, social development, and environmental protection are interdependent and mutually reinforcing components of sustainable development.”*

The definition of development thus implies the integration and simultaneous consideration of the economic, social, and environmental aspects of society in order to improve quality of life for all.

Sustainable development demands a specific approach to problem-solving that integrates complexity and an interdisciplinary approach (Weber et al. 2021). Sustainable issues are sometimes referred to as *wicked problems* because they are complex, lack clear definitions, require multidisciplinary approaches, have numerous options, have fuzzy outcomes in some cases, and are described as open-ended in timeframes (Weber, et al. 2021; Brown, et al. 2010; Rittel, et al. 1973; Lotz-Sisitka et al. 2015; Seager, Selinger, and Wiek 2012).

An explanation of the multidisciplinary and complex nature of this approach can be outlined through the three-pillar-based balanced development model, incorporating the economic, social, and environmental dimensions. A short definition of each dimension is given as follows:

> *"For present and future generations, the environmental dimension of sustainability performance includes reducing carbon footprints, improving workplaces, and improving air and water quality."* (Zabihollah Rezaee et al. 2019).
>
> *"The economic sustainability dimension refers to the growth and improvement of the economy per capita. Economic systems at the regional, national, and global levels are included in this dimension."* (Mairal David 2015).
>
> *"A number of goals are defined under the social sustainability category, including poverty reduction, social investment, and the creation of safe and caring communities. The goal of this dimension is to improve the living standards of the population at all levels."* (Torjman 2000).

While recent papers urge a fundamental study involving all dimensions simultaneously, there is still no scientific framework that integrates them holistically. Additionally, these three dimensions are poorly understood in terms of their complex interconnections (Vacchi et al. 2012). In contrast, (Braccini and Margherita 2018) emphasize the importance of understanding the complexity of the structure but not necessarily integrating each dimension in the research because they overlap and interact.

In spite of the complex nature of sustainable development, the SDGs have been introduced to set and achieve sustainable goals across the three dimensions (Table 1). The Sustainable Development Goals are 17 goals set by the United Nations in 2015 to provide a more sustainable future for present and future generations. The Goals are to be achieved by 2030.

Table 1. The list of the 17 SDGs

SDG Number	SDG Name	SDG Description	SDG Target	SDG Dimension
1	No Poverty	*the goal is to end poverty and reach those in the greatest need*	7	Social

2	Zero Hunger	*the goal is to secure food for all*	8	Social
3	Good Health and Well-being	*the goal is to provide or improve the lifestyle of the population*	13	Social
4	Quality Education	*the goal is to provide learning opportunities for all and set the basic level of education that all people should have*	10	Social
5	Gender Equality	*the goal to provide equal opportunities for all disregarding gender*	9	Social
6	Clean Water and Sanitation	*the goal is to secure and maintain water resources*	8	Environmental
7	Affordable and Clean Energy	*the goal is to develop affordable, sustainable, and modern sources of energy, available for all*	5	Economic
8	Decent Work and Economic Growth	*the goal is to buster employment through economic activities and develop a more efficient work environment for all*	12	Economic
9	Industry, Innovation, and Infrastructure	*the goal is to develop sustainable and more resilient industry, infrastructure, and innovations*	8	Economic
10	Reduced Inequality	*the goal is to reduce inequality between and within the countries*	10	Economic
11	Sustainable Cities and Communities	*the goal is to make cities and communities more resilient, cleaner, and safer*	10	Economic
12	Responsible Consumption/ Production	*the goal is to develop a strategy for more effective use of natural resources*	11	Environmental

13	Climate Action	*the goal is to combat climate change and its impacts*	5	Environmental
14	Life Below Water	*the goal is to conserve and sustainably use the marine ecosystem*	10	Environmental
15	Life On Land	*the goal is to protect and promote the sustainable use of terrestrial ecosystems*	12	Environmental
16	Peace, Justice, and Strong Institutions	*the goal is to promote peace and proved justice for all through strong derestriction institutions*	12	Social
17	Partnerships for the Goals	*the goal is to improve or develop sustainable global partnerships via finance, trade, technology, capacity building, and systematic issues*	17	Economic

* *It is beyond the scope of this study to describe the SDGs in more detail. However, additional information can be found on United Nations (n.d.)*

The Agenda 2030 stresses that the 17 SDGs take into account that actions in one area may affect those in other areas as well.

In order to examine further the relationship between sustainable and financial performance, we must first understand how SDGs and companies are linked. Thus, the following graph is shown as an example of how sustainability can be explained as a complex phenomenon (Fig. 1).

In order to understand how the SDGs affect companies, it can be useful to think of the relationship as a network. The field of network science deals with complex graphs, analyzes patterns that are non-trivial and is considered an interdisciplinary subject. Social networks, food networks, the world wide web, air-traffic networks, neural networks, etc. are examples of various kinds of networks. In all cases, these types of networks have underlying structures, some of which are still scientifically incomplete. By analyzing the network, we aim to understand the graph representation. Different types of graphs exist, including Small World (Watts and Strogatz 1998), Random Graphs (Erdős–Rényi, 1959), Scale-free (Barabasi and Albert 1999), Tree graphs (Cayley A. 1857), etc.

In a graph, nodes (vertices is another synonym) represent information about the subject/object, whereas links (edges is another synonym) describe the relationships between two or more subjects/objects within the system. Nodes and links can be connected according to different rules, but

that is beyond the scope of this study. In this study, we used the software *Gephi* (Bastian M. et al., 2009) for network analysis in order to visualize the relationship between the SDGs and S&P 500 companies.

The network analysis of SDGs and the S&P 500 comprises two datasets. The first dataset provides details about the nodes, which represent the SDG goals and the S&P 500 companies. The second dataset contains information regarding the connections between nodes. Links are represented using 0s and 1s, where 1 indicates a company's stated intention to work towards a specific SDG, while 0 signifies the opposite. Nodes with multiple incoming links are identified as hubs, and their size varies depending on the number of connections. However, the hubs themselves are not directly connected to each other.

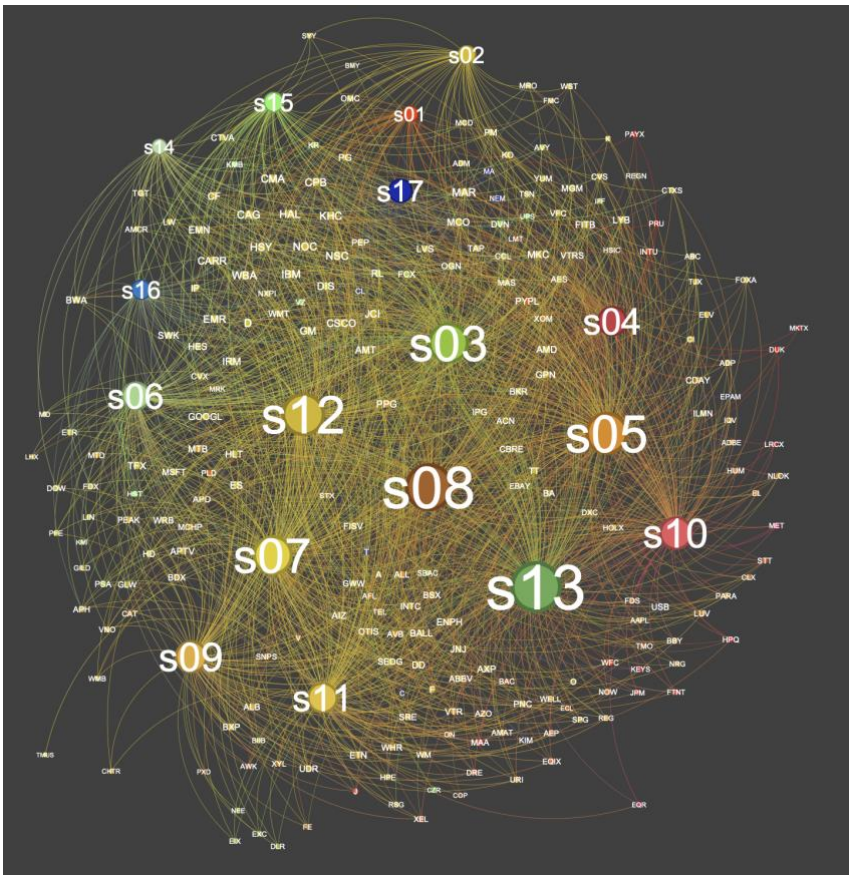

Figure 1. Network analysis of SDGs and S&P 500 (own analysis and illustration)

In the analysis of the interdependencies between the SDGs, a paper by (Weber et al. 2021) presents a graph that represents the *Small-World*[2] network on how all 17 goals are connected through a complex

[2] The small-world network refers to a graph in which most nodes are not neighbors but can be reached by a small number of steps from any other node.

system approach. Nonetheless, the authors emphasize the limitations of their study regarding the unique nature of each SDG and the need for a more holistic approach. As opposed to this, our graph is based on a dataset used to define relationships between nodes from the company's alignment with a certain SDG. In the context of Sustainability reports, *alignment* refers to a company's claims of an endeavor of working towards the attainment of a specific Sustainable Development Goal (SDG) objective. It is crucial to acknowledge that the reports frequently lack clarity in defining a company's alignment with a specific SDG goal. On the basis of the dataset, our graph resembles a *Scale-free*[4] graph. For mathematical simplicity, we further explain what our graph contains and why this is relevant to our further research.

According to Fig. 1, the size of each hub varies according to the number of companies aligning with that SDG. The importance of SDGs across companies is divided into 4 levels. Four levels are based on the clustered result of the analysis and data availability from the companies' sustainability reports. In order to analyze the data further, at least 50% of the data across different SDGs had to be covered. Furthermore, the data does not cover companies engagement in a form of external initiatives[5] with respect to certain SDGs. Moreover, approximately 23%[6] of companies have not specified a particular alignment with any of the SDGs.

As can be seen from the network, most of the companies state an intention to work towards SDG 13[7] (Climate Actions). One reason for this is the increasing regulatory and societal expectations on firms to reduce air pollution across all sectors. The results of SDG 8 (Decent Work and Economic Growth) are also similar[8], as businesses typically aspire to growth, which implies the creation of jobs. SDGs 13 and 8 represent the first level of importance to companies when it comes to sustainability initiatives and this study will cover them in more detail.

Further analysis shows that SDGs 3[9], 5[10], 7[11], and 12[12] are of the second level of importance to companies when it comes to sustainability initiatives and are sector-specific. Good health and well-

[4] Scale-free graphs are often referred to as Real-world networks. This type of network is centralized, which means there are many nodes with a low level of connectivity while there are a few or only one with a high level of connectivity.

[5] Result of the analysis shows that 22 companies (out of 324) are engaged in external initiatives only regarding certain SDGs.

[6] Result of the analysis shows that 74 companies (out of 324) did not specifies in their reports alignment with any of the SDG.

[7] Result of the analysis shows that 191 companies (out of 228) are aligned with SDG 13.

[8] Result of the analysis shows that 176 companies (out of 228) are aligned with SDG 8.

[9] Result of the analysis shows that 145 companies (out of 228) are aligned with SDG 3.

[10] Result of the analysis shows that 155 companies (out of 228) are aligned with SDG 5.

[11] Result of the analysis shows that 143 companies (out of 228) are aligned with SDG 7.

[12] Result of the analysis shows that 156 companies (out of 228) are aligned with SDG 12.

being, gender equality, comfortable and clean energy, and responsible consumption and production are important sustainability indicators, and this study will cover them in more detail with an appropriate set of factors.

SDGs such as 9[13] and 10[14] are of the third level of importance to companies when it comes to sustainability initiatives and are also sector-specific. These SDGs are part of further analysis.

However, SDGs such as 1[15], 2[16], 4[17], 6[18], 11[19], 14[20], 15[21], 16[22], and 17[23] fall into the fourth level of importance to companies when it comes to sustainability initiatives and are very sector-specific. In this study, this level will not be covered.

Sustainable development involves many real-life problems, which cannot be explained by one field, one SDG goal, or one aspect of sustainable development. This newly developed branch of science aims to bring together specialists from various fields in order to work on the same problem and find sustainable solutions (Jose and Ramakrishna 2021). While some companies have gained experience with innovation processes, managing sustainability initiatives might be a new and different challenge. Many papers confirm that there is a positive correlation between firm financial and sustainable performance, however, some authors hold that embracing sustainability efforts may result in a lower profit margin for many companies (Kuckertz & Wagner, 2010).

It is difficult to perform sustainability studies due to the lack of reliable data (Dziallas & Blind, 2019; Rauter et al., 2019). In addition, the relevant information from the literature or any other sources might not be suitable for the stated hypotheses (Huang, 2021; Rauter et al., 2019). Despite numerous studies in the area of financial and sustainable performance, little is known about how these combined activities affect the performance of the firm in relation to its competitors within and across sectors (Petra A. Nylund et al., 2021). The issue may be influenced predominantly by the variety of industries

[13] Result of the analysis shows that 114 companies (out of 228) are aligned with SDG 9.

[14] Result of the analysis shows that 117 companies (out of 228) are aligned with SDG 10.

[15] Result of the analysis shows that 49 companies (out of 228) are aligned with SDG 1.

[16] Result of the analysis shows that 57 companies (out of 228) are aligned with SDG 2.

[17] Result of the analysis shows that 104 companies (out of 228) are aligned with SDG 4.

[18] Result of the analysis shows that 99 companies (out of 228) are aligned with SDG 6.

[19] Result of the analysis shows that 105 companies (out of 228) are aligned with SDG 11.

[20] Result of the analysis shows that 44 companies (out of 228) are aligned with SDG 14.

[21] Result of the analysis shows that 65 companies (out of 228) are align with SDG 15.

[22] Result of the analysis shows that 63 companies (out of 228) are align with SDG 16.

[23] Result of the analysis shows that 79 companies (out of 228) are align with SDG 17.

involved and varying sustainable levels (Brem and Puente, 2020). It is important to note that not all SDGs are relevant to a particular company or sector.

How to compare sustainable performance across sectors is one of the major challenges of sustainability assessment. The goal was to identify indicators that: 1) covered factors such as process efficiency, reducing pollution, social responsibility, and sustainable products; 2) were relevant across different sectors; and 3) had data available for most firms in accordance with the GRI framework. The selected sustainability indicators cover the first three levels of importance depicted above and are described in detail in section 3.4.2. All data were manually collected from each company's last available GRI-compliant *Sustainability Report,* with a few exceptions. The selected indicators are designed to take into account the different size of companies by using, for instance, intensities and ratios.

2.3 Relationship between Financial and Sustainability performance

Several studies have examined the impact of sustainable development on firm competitiveness (Tantalo et al., 2014; Vilanova et al., 2009; Zait et al., 2015). Other studies are more interested in analyzing the moderating and mediating relations between elements in the system to explain the relationship between a firm's competitiveness and *Sustainable Development* (Anser et al., 2018; Hadj, 2020; Marin et al., 2017; Snircova et al., 2016; Zhao et al., 2019). Nevertheless, a clear framework has not yet been specified.

According to Van Nguyen et al. (2022), literature has employed diverse metrics to depict financial performance. These metrics can fall into different categories: accounting-based measures such as ROA, ROE, NIM, and others; market-based measures like dividend per share (DPS), Tobin's Q (TQ), and others; or a combination of the two, or even neither. In this study, a blend of all three categories is utilized for measurement (accounting-based measures, market-based measures, and other measures that do not fall into either of these two categories).

Sustainable performance, on the other hand, is primarily determined by environmental metrics (Gutowski et al., 2009), including reduced waste, efficient water use, energy consumption, and CO_2 emissions emitted directly and/or indirectly from business activities. Sustainable performance can also take into account social factors such as the work environment, the health of the workforce, inclusion, and diversity policies, .etc. This study covers both environmental and social considerations.

In the study by Surroca et al. (2010), different factors contribute to the heterogeneity of investigations into sustainable and financial performance, including measurement difficulties such as data collection, databases, etc., difficulty in selecting variables that can mediate or moderate the correlation, causality directions, etc. Four outcomes can result from the relationship between sustainable and financial performance:

1. A positive relationship indicates that sustainable performance contributes to better financial performance;
2. Sustainable performance negatively impacting financial performance: a negative relationship;

3. Mixed results in terms of the relationship between sustainability performance and financial performance, with some positive and some negative relationships;
4. An insignificant relationship between sustainability and the financial performance of a company was not detected, whether due to a lack of data or other unknown factors;

As Büyüközkan and Karabulut (2018) found, sustainability-related publications remain widely dispersed in terms of approach, technique, and terminology. There are two main components of Sustainability Performance Evaluation (SPE), accounting for sustainability performance with conceptual frameworks and assessing sustainability performance using conceptual framework information. This study covers the latter component. The literature has also stressed that it is important to study different industries separately due to the unique challenges each industry faces in its internal and external environment (Endrikat, Guenther, and Hoppe, 2014).

In the introduction, it is stated that many studies have been done on the relationship between sustainability and financial performance. In this section, we present a table (Table 2) with some studies and their results that relate to this study.

Table 2. Relationship between sustainable performance and financial performance

#	Study and Reference	Measure	Results
1	Cowen, S., Ferreri, L. and Parker, L. (1987) The Impact of Corporate Characteristics on Social Responsibility Disclosure: A Typology and Frequency-Based Analysis. Accounting, Organizations and Society, 12, 111-122. https://doi.org/10.1016/0361-3682(87)90001-8	ROE with Number of various Corporate Sustainability Disclosures (CSD)	Negative relationship
2	Hillman, Amy & Keim, Gerald. (2001). Shareholder value, stakeholder management, and social issues: What's the bottom line?. Strategic Management Journal. 22. 125-139. 10.1002/1097-0266(200101)22:2<125::AID-SMJ150>3.0.CO;2-H.	ROA, ROE, and Tobin's Q with Social Issue Participation (SIP) and Stakeholder Management (SM)	Insignificant relationship
3	Jones, S. (2005). Notes of the University of Sidney Pacioli Society. Abacus, 41(2), 211-216	Various financial performance ratios with GIR index score	Mixed results
4	Brammer, S., Brooks, C., & Pavelin, S. (2006). Corporate Social Performance and Stock Returns: UK Evidence from Disaggregate Measures. Financial Management, 35(3). Retrieved from http://www.jstor.org/discover/10.2307/30137803?uid =3738256&uid=2129&uid=2&uid=70&uid=4&sid =21101616684413	Stock return with Corporate Social Performance indicators (from EIRIS data)	Negative relationship
5	Bird, Ron. (2007). Corporate Social Responsibility and Corporate Performance: Where to Begin?	Average stock return with CSR activities	Positive relationship

6	Mittal, Raj & Sinha, Neena & Singh, Archana. (2008). An analysis of linkage between economic value added and corporate social responsibility. Management Decision. 46. 1437-1443. 10.1108/00251740810912037.	Economic Value Added (EVA) and Market Added Value (MVA) with various CSR initiatives indicators	Insignificant relationship
7	Margolis, Joshua & Elfenbein, Hillary & Walsh, James. (2009). Does it Pay to Be Good...And Does it Matter? A Meta-Analysis of the Relationship between Corporate Social and Financial Performance. SSRN Electronic Journal. 10.2139/ssrn.1866371.	ROA, ROE, stock return, market/book value ratio with Corporate Social Performance (CSP)	Positive relationship
8	Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary Nonfinancial Disclosure and the Cost of Equity Capital: The Initiation of Corporate Social Responsibility Reporting. *The Accounting Review*, *86*(1), 59–100. http://www.jstor.org/stable/29780225	Cost of Equity Capital with KLD Criteria[24]	Negative Relationship
9	N. Burhan, A. H., & Rahmanti, W. (2012). The Impact of Sustainability Reporting on Company Performance. Journal of Economics, Business, and Accountancy| Ventura, 15(2), 257-272.	ROA with GRI disclosure index score	Positive relationship
10	Nollet, Joscha & Filis, George & Mitrokostas, Evangelos. (2015). Corporate social responsibility and financial performance: A non-linear and disaggregated approach. Economic Modelling. 52. 10.1016/j.econmod.2015.09.019.	ROA, ROC and Ex. Stock Returns with ESG disclosure score	Insignificant relationship
11	Omrane, Amina & Bag, Sudin. (2020). Corporate Social Responsibility and Its Overall Effects on Financial Performance: Empirical Evidence from Indian Companies. Journal of African Business. 23. 10.1080/15228916.2020.1826884.	ROE, Net Sales, Market Capitalization, Operating Profit, Net Profit with labor Cost, Firm's age, Capital Employed	Positive relationship
12	Tyagi, Madhu & Nagarajachari, Abhilasha. (2021). Impact of CSR on Financial Performance of Top 10 Performing CSR Companies in India. IOSR Journal of Economics and Finance. 10. 49-55. 10.9790/5933-1002024955.	PBT, ROC, ROE, and ROA on CSR activities	Mixed results
13	Muchiri, M. K., Erdei-Gally, S., & Fekete-Farkas, M. (2022). Effect of CSR on the Financial Performance of Financial Institutions in Kenya. *Economies*, *10*(7), 174. MDPI AG.	Annual Revenue with CSR practices	Positive relationship

[24] Ref. NBS (n.d.)

14	Canh Thi Nguyen, Liem Thanh Nguyen & Nhu Quynh Nguyen | David McMillan (Reviewing editor) (2022) Corporate social responsibility and financial performance: The case in Vietnam, Cogent Economics & Finance, 10:1, DOI: 10.1080/23322039.2022.2075600	ROA with various CSR index(s)	Negative relationship
15	Huang, Jingjing, 202“. "Corporate social responsibility and financial performance: The moderating role of the turnover of local official”," Finance Research Letters, Elsevier, vol. 46(PB).	ROA, ROE with CSR	Positive relationship

From a theoretical perspective, Deegan (2014) argues that, while many theories support the motivation for firms to report sustainable data, sustainable reporting motives are quite associated with legitimacy and stakeholder theories.

According to Suchman (1995), legitimacy can be defined as *"general perceptions or assumptions that the actions of an entity are desirable, proper, or appropriate under some socially constructed system of norms, values, beliefs, and definitions" (p. 574).* Accordingly, legitimacy theory suggests that a firm must consider not only its shareholders' rights but also the rights of the public. If a firm fails to meet societal expectations, society may restrict its operations and limit its product demand. The legitimacy argument, on the other hand, may argue that sustainable activities can demonstrate that a company can balance the competing needs of its stakeholders and remain profitable.

According to stakeholder theory, a firm has a responsibility towards its stakeholders, including customers, suppliers, government, employees, and public society. Firm’s sustainability reporting is seen as a significant issue by a broad range of stakeholders. Thus, according to this theory, companies are expected to provide and make publicly available sustainable performance reports in order to maintain public trust. The theory was developed by Edward Freeman in the seminal book Strategic Management: A Stakeholder Approach (1984).

Two theories suggest that companies should disclose their sustainable performance in sustainability reports. The two theories could also be interpreted as suggesting a positive correlation between corporate sustainability and company performance. However, the prevalence of greenwashing suggests that firms may not need to perform sustainably as long as they present themselves as such to the public. Therefore, this study does not rely on sustainability rating agencies, whose assessments are largely black-boxes, and instead collects substantial secondary data in order to analyze the relationship between sustainability and financial performance.

3 METHODOLOGY

The topic of this research is to explore the impact of sustainable performance on financial performance in the global market. To this end, data from S&P 500 companies are analyzed as they are considered to be the "drivers" of the global economy and represent every major industry. Selected parameters taken from the sustainability reports of the S&P 500 companies are used to measure their sustainability performance. Selected parameters from the annual reports of S&P 500 companies are taken to measure their financial performance. These processes are described below.

This section explains the methodology and the manner in which it was utilized, starting from the research question and formulating hypotheses, describing the research approach, sampling, dependent and independent variables, and the method of data analysis. This section is considered the focal point of the study.

3.1 Research Question and Approach

Analyzing the relationship between financial and sustainability performance falls under the realm of quantitative analysis. Specifically, it involves conducting a correlation analysis or regression analysis to examine the statistical relationship between financial performance metrics (such as profitability, return on investment, or stock prices) and sustainability performance indicators (such as environmental, social, or governance factors). These types of analyses help determine the extent to which financial performance and sustainability performance are related and provide insights into the potential impacts of sustainability practices on financial outcomes.

Researchers have developed various research models and used different estimation techniques to investigate whether sustainability performance impacts financial performance. Multiple linear regression analysis was conducted in this case to examine the correlation between the explanatory (independent) variables and the dependent variables. Using a univariate linear regression model, some researchers, for example, analyze the financial performance of the bank with the dependent variable Y, and the independent variable X, which represents the bank's corporate social responsibility (CSR) indicator (Bidhari et al., 2013; Bolanle et al., 2012; Soana, 2011). Other studies construct a multivariable linear regression model, in which the independent variables X_n represent the bank's CSR indicators (Ashraf et al., 2017; Tran, 2016). Our study uses a multivariable linear regression model.

The multiple linear regression models used in this study examine how the independent sustainability variables explain or predict the dependent financial variables. It must be acknowledged from the outset that this assumed unidirectional causality may not fully capture the relationship between the variables. It could be, in fact, that better or worse financial performance motivates sustainable initiatives. Nevertheless, the causal assumptions explored in this study allow us to address the important question of whether firms are rewarded or punished financially for their sustainability efforts.

Despite the huge attention given by researchers to the link between sustainability performance and financial performance, studies tend to show mixed results and conclusive answers remain elusive. In order to survive, companies need to focus on financial value as well as environmental and social value. Since S&P 500 companies have significant economic, social, and environmental impacts, their sustainable development is crucial, and they form the sampling frame for the research.

The purpose of this study is to examine the relationship between sustainability and financial performance by analyzing ESG disclosures and using financial measures from annual reports. The hypotheses shown in the following table (Table 3) have been formulated based on theoretical arguments, the literature review, and the main research question of this study:

What is the impact of sustainability performance on a company's financial performance within and across GICS sectors?

Table 3. Formulation of Hypotheses

#	*Hypothesis*
1	H_0: Female representation in management is not associated with financial performance H_1: Female representation in management is associated with financial performance
2	H_0: The energy sourced from renewable sources is not associated financial performance H_1: The energy sourced from renewable sources is associated financial performance
3	H_0: Reliance on grid electricity is not associated with financial performance H_1: Reliance on grid electricity is associated with financial performance
4	H_0: Energy intensity is not associated with financial performance H_1: Energy intensity is associated with financial performance
5	H_0: The number of employees is not associated with financial performance H_1: The number of employees is associated with financial performance
6	H_0: Reporting on SDGs is not associated with financial performance H_1: Reporting on SDGs is associated with financial performance
7	H_0: Pay-ratio is not associated with financial performance H_1: Pay-ratio is associated with financial performance
8	H_0: Water intensity is not associated with financial performance H_1: Water intensity is associated with financial performance
9	H_0: Waste intensity is not associated with financial performance H_1: Waste intensity is associated with financial performance

#	*Hypothesis*
10	H_0: Scope 1 emissions intensity is not associated with financial performance H_1: Scope 1 emissions intensity is associated with financial performance
11	H_0: Scope 2 emissions intensity is not associated with financial performance H_1: Scope 2 emissions intensity is associated with financial performance
12	H_0: Scope 3 emissions intensity is not associated with financial performance H_1: Scope 3 emissions intensity is associated with financial performance

Each of the stated hypotheses are tested within and across the various GICS sectors through regression analyses.

3.2 Sampling

The sampling frame for this research is the influential S&P 500 companies[25], which are grouped into 11 sectors based on the industry in which each company operates in accordance with the DataHub.io (n.d.) database. Given the need to collect data on comparable indicators from each company, the list of 500 was narrowed to 324 companies based on their commitment to reporting in compliance with the GRI framework[26]. The following figure (Fig. 2) depicts the distribution of the 324 S&P 500 GRI-compliant companies across the 11 GICS sectors.

Row Labels	Count of Sector Indexes
Information Technology	60
Consumer Discretionary	42
Industrials	41
Health Care	34
Financials	33
Real Estate	26
Consumer Staples	25
Materials	22
Utilities	17
Energy	17
Communication Services	7
Grand Total	**324**

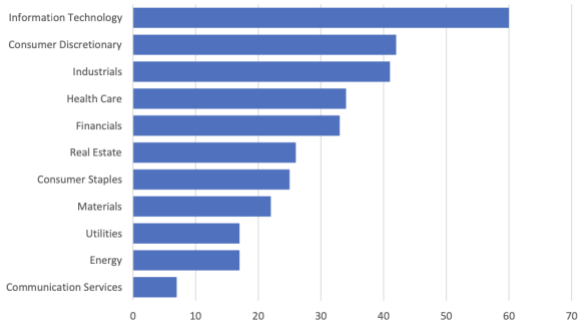

Figure 2. Distribution of S&P 500 companies according to 11 sectors

From the figure, it can be seen that the largest sector in terms of the number of companies complying with the GRI framework is the IT sector (60 companies). The Communication Services sector had the lowest number of companies (7 companies).

The subsequent subsections provide an overview of the S&P 500 sampling frame and the GRI reporting framework. These two components are crucial in selecting the 324 companies and constructing the sample for analysis.

3.2.1 S&P 500 and Global Classification Standard (GICS)

S&P 500 (Standard & Poor 500) is an index of 500 large and influential companies in the United States and has an enormous impact on the global economy. Approximately 80% of the available market

[25] Dated as of 29th and 30th of June 2022.

[26] In the data, 217 out of 324 companies use other frameworks such as SASB and TCFD, besides GRI.

capitalization[27] is in large-cap US equities which are expressed through the S&P 500 (Theophilos P. et al., 2020). This index is part of the S&P Global 1200 family of indices and is created by S&P Dow Jones Indices[28].

The S&P 500 is of great importance to market participants, portfolio managers, and policymakers since it provides accurate forecasts of the economic health of the United States and, to some extent, of the global market as well. Additionally, it provides a solid foundation for examining the company's financial performance and how sustainable initiative affects it since these companies are required, by law, to provide their financial data (or annual reports) to the public. Therefore, data is drawn from this source.

The S&P 500 companies are categorized into 11 sectors, which are further broken down into 24 industry groups, 69 industries, and 158 sub-industries. Developed by Standard & Poor (S&P) and Morgan Stanley Capital International (MSCI), these sectors are also known as the Global Industry Classification Standard (GICS). Companies are classified into sectors based on their primary business activities. As part of this project, 11 sectors were identified as follows:

- **1. Communication Services**

  Businesses in the communication services sector provide people with the means to stay connected. Among these are internet service providers and phone plan providers. According to market share, AT&T Inc. and Verizon Communications Inc. dominate the communication services sector. In the United States, AT&T Inc. is the largest provider of phone plans. On the other hand, Verizon Communications Inc. is the country's largest provider of fiber-optic networks and internet access.

- **2. Consumer Discretionary**

  In the discretionary consumer sector, companies provide items or services that are not essential for survival. Economic conditions and individual wealth determine the demand for these items. Among the products in this sector are cars and electronics retailers. Hotels and restaurants are examples of services in this sector. Ford Motor Company, Best Buy Co., and Hilton Worldwide Holdings Inc. are examples of companies that are part of this sector.

- **3. Consumer Staples**

  Companies in the consumer staples sector provide all the necessities of life. It includes companies that provide food and beverages, household products, and personal products. Philip Morris International Inc., which produces cigarettes under the brands Marlboro and L&M, is an example of a famous tobacco company in this sector. Kroger Co is another example, which is the largest supermarket chain in the United States.

[27] A company's market capitalization, also called its market cap, is the value of its outstanding shares.

[28] The S&P Dow Jones Indices are the premier source for benchmarks and investable indices worldwide.

- **4. Energy**

  A company in the energy sector is one that is involved in the exploration, production, or distribution of oil, gas, and consumable fuels. In addition to refiners and equipment suppliers, this category includes companies that manufacture or provide equipment used in refinement. Exxon Mobil Corporation and Chevron Corporation are two companies that extract and refine gas. These two companies dominate the sector by market share.

- **5. Financials**

  In the financial sector, companies are involved with finance, investments, and the movement and storage of money. There are banks, credit card companies, credit unions, and insurance companies in this category. M&T Bank Corporation, JPMorgan Chase & Co., and PNC Financial Services Group Inc. are famous names in this sector.

- **6. Health Care**

  In the healthcare sector, companies provide medical supplies, pharmaceuticals, and operations or services that improve human health or well-being. Johnson & Johnson, Pfizer Inc., and Moderna Inc. are well-known companies in this sector.

- **7. Industrials**

  A variety of companies in the industrial sector are involved in industrial processes, including airlines, railroads, and manufacturers of military weapons. There are several companies within this sector that are well-known, such as Delta Air Lines, L3Harris Technologies Inc., and Boeing Company.

- **8. Information Technology**

  A company that develops or distributes technology-based products and/or services falls under the information technology (IT) sector. Among the technology products are computers, microprocessors, and operating systems. This sector includes companies such as Apple Inc, Microsoft Corporation, Adobe Incorporated, and Intel Corporation.

- **9. Materials**

  Other sectors are dependent on the raw materials provided by companies within the materials sector. Mining companies that provide gold, zinc, and copper, as well as forestry companies that provide wood, fall into this category. Among the companies in this sector are Ecolab Inc. and Air Products and Chemicals Inc. Ecolab Inc. treats, purifies, cleans, and disinfects water for a wide range of applications. Known as Air Products and Chemicals Inc., the company sells gasses and chemicals to industrial businesses.

- **10. Real Estate**

  Real estate is a sector of the property industry. Based on the type of real estate (residential, commercial, or industrial), companies in this sector sell land, structures, and anything permanently attached to or built on it. There are a number of dominant players in this sector, including American Tower Corporation and Equinix Inc.

- **11. Utilities**

  Companies that provide or generate electricity, water, and gas to buildings and households are known as utility companies and are part of the utility sector. Among the companies in this sector are Duke Energy Corporation, which generates and distributes electricity, and NextEra Energy Inc., which is the largest electric utility company, by market share, and is responsible for providing electricity that is clean, affordable, and reliable.

Each sector features various companies that exemplify the use of GRI compliance. A more detailed discussion of the GRI framework will be covered in the following section.

3.2.2 Global Reporting Initiative (GRI Framework)

In 1997, the Global Reporting Initiative (GRI) pioneered sustainability reporting. A standardized framework for sustainability reporting was developed by Ceres and Tellus Institute Vice President Allen White. The GRI Sustainability Reporting Standards (GRI Standards) are the first and most widely adopted global sustainability reporting standards.

Global Reporting Initiative (2011) defines Sustainability Reporting as – *"the practice of measuring, disclosing, and being accountable to internal and external stakeholders for organizational performance towards the goal of sustainable development."*

In order to comply with the GRI Standards, an organization (or company) must comply with all nine requirements. These requirements are (GRI Standards, 2022):

Requirement 1: Report in accordance with the reporting principles;

Requirement 2: All disclosures must be reported in GRI 2: General Disclosures 2021;

Requirement 3: Establish material topics;

Requirement 4: Compile and present the disclosures in GRI 3: Material Topics 2021;

Requirement 5: Describe each material topic in the GRI Topic Standards;

Requirement 6: Explanation for the omission of disclosures and requirements that the organization cannot meet;

Requirement 7: Release a GRI content index;

Requirement 8: Include a statement of use;

Requirement 9: Notification to GRI Institute of GRI Standards use and statement of use;

Reporting must take into account the following factors (GRI Standards, 2022):

a) The impact that an organization's activities or business relationships may have on the economy, environment, and people.

b) An organization should consider material topics that help it prioritize reporting on the topics that have the greatest impact on the economy, environment, and people, including those that affect their human rights.

c) Due diligence, in which an organization identifies, prevents, mitigates, and accounts for how it addresses its actual and potential negative impacts on the economy, environment, and people.

d) Organizational stakeholders who are affected or could be affected by the organization's actions.

To claim that the reported information has been prepared in accordance with the GRI Standards, an organization must apply the reporting principles (GRI Standards, 2022). Using the reporting principles, the organization ensures the information reported is accurate and presented in a professional manner. Information of high quality enables users to make informed assessments and decisions about the organization's impacts and contributions to sustainable development.

Reporting principles are as follows (GRI Standards, 2022):

- *Accuracy*. Information about the organization's impacts must be accurate and sufficiently detailed.
- *Balance*. Organizations should report information in a fair and unbiased manner, including both negative and positive impacts.
- *Clarity*. Information should be presented in an accessible and understandable manner.
- *Comparability*. The organization is responsible for selecting, compiling, and reporting information consistently to enable an analysis of its impacts over time and their comparison to those of other organizations.
- *Completeness*. The organization should provide adequate information to allow an evaluation of its impacts.

- *Sustainability context*. The organization should report on its impacts within a broader framework of sustainable development.
- *Timeliness*. A regular reporting schedule is to be adopted by the organization, as well as allowing information users to access it in time for decisions to be made.
- *Verifiability*. The organization should gather, record, compile, and analyze information in a way that allows quality verification.

GRI is an independent international organization that is working to help businesses, governments, and other entities understand and communicate how businesses are impacting critical sustainability issues, such as climate change. In spite of being required to report the most significant impacts of an organization on the economy, the environment, and the people, an organization may choose not to disclose all information as a result of a legal prohibition. In addition, an organization can choose not to disclose a specific item due to its non-existence, but it must provide a reason for its non-disclosure (GRI Standards, 2022). The official GRI website does not provide an option to directly download a company's sustainability report(s). Thus, all reports had to be downloaded manually from each official company's website, section ESG disclosure.

3.3 Data Collection

The analyses in this study rely on secondary data, which needed to be collected from the 324 companies in the sample. As the parameters covered both financial and sustainability-related topics, the researcher manually downloaded each company's sustainability reports, annual reports, and financial statements. The source of each report was the first data entered into the database.

The next step was to manually extract data on a wide range of parameters from each of the reports. In total, 3,346 observations were made and logged to the database across 10 dependent variables and 13 independent variables. The dependent variables relate to financial performance (parameters such as CWI, Tobin's Q, Revenue, Operating income, etc.), and most, but not all, were taken manually from the most recent annual[29] reports. The reference to the specific data source for each dependent variable is provided in the description of the variables. The data on the financial performance indicators were available for all 324 companies.

The independent variables, or predictors, relate to the companies' environmental and social sustainability performance (parameters such as Pay Ratio, Number of SDGs, Total Energy, Scope 1, Total Water, etc.) of a company. All of these parameters were manually taken from the most recent GRI-compliant sustainability reports, except for one. Data on the variable *Pay Ratio* was collected from the AFL-CIO. (n.d.) website. Data on sustainable performance indicators were not available for all companies, with some missing values for certain indicators. 29 of the 324 companies reported on less than 7 of the 13 sustainability indicators used in the analyses.

[29] Focusing only on item 7 of 10-k reports. Scholars emphasize that this item is the most important part of a 10-K report since it provides a summary of what drives a company's success.

3.4 Description of variables

In analyzing the relationship between financial and sustainability performance, it is essential to have a clear understanding of the variables involved. The financial variables typically encompass key metrics and indicators that assess a company's financial health, profitability, efficiency, and overall economic performance. These variables are CWI (Capitalization Weighted Index), ROE (Return on Equity), ROA (Return on Assets), FCF (Free Cash Flow), TQ (Tobin's Q), GM (Gross Margin), GP (Gross Profit), WACC (Weighted Average Cost of Capital), EBITDA (Earnings Before Interest Taxes Depreciation and Amortization), and YTD (Year-To-Date) Return.

On the other hand, sustainability variables focus on assessing a company's environmental, social, and governance (ESG) practices and performance. These variables encompass a wide range of indicators that evaluate a company's impact on the environment, its social responsibility efforts, and its governance structure. Sustainability indicators variables include Women in Management, Electricity Grid, Renewable Energy, Energy Intensity Ratio, Number of Employees, Number of SDGs, Pay-Ratio, Water intensity ratio, Waste Intensity Ratio, Scope 1, Scope 2.1 (market-based), Scope 2.2 (location-based), and Scope 3.

A description of financial performance variables and sustainability performance variables follows.

3.4.1 Financial Performance

3.4.1.1 Capitalization Weighted Index (CWI)

Stock Market Index (Capitalization Weighted Index, further referred to throughout this study as CWI) is a weighted sum of each index component[30] relative to its total market capitalization. Companies with larger CWI have a greater impact on the market. In this study, CWI can be used to evaluate the current stage of competitiveness that a company has on the market. The calculation of CWI is as follows. A company's outstanding shares are multiplied by its current share price. This gives the company's total market value. To get the total market value of all the index components (companies), the total market value of all the companies on the market (in our case, the S&P 500) is added together. Weighting is based on the prices of each company's individual market value. Further, the value of CWI changes proportionally to the price change of each component. It is important to note that not all market indexes[31] are capitalization-weighted. However, the S&P 500 uses this type of index. Thus, data obtained for this dependent variable are collected from the SlickCharts. (n.d.) website, dated September 16th, 2022. CWI represents 70-80% of the US stock. Additionally, the index covers the largest companies in the United States and abroad (S&P Dow Jones, 2022).

[30] Index component represents a company on the market.

[31] The price-weighted index and equal-weighted index among others.

Figure 3 depicts the density histogram of the CWI across 11 GICS sectors. Based on the dominant shape in all 11 sectors, it can be noted that competitiveness is high within and across the sectors as companies are roughly equal in market size.

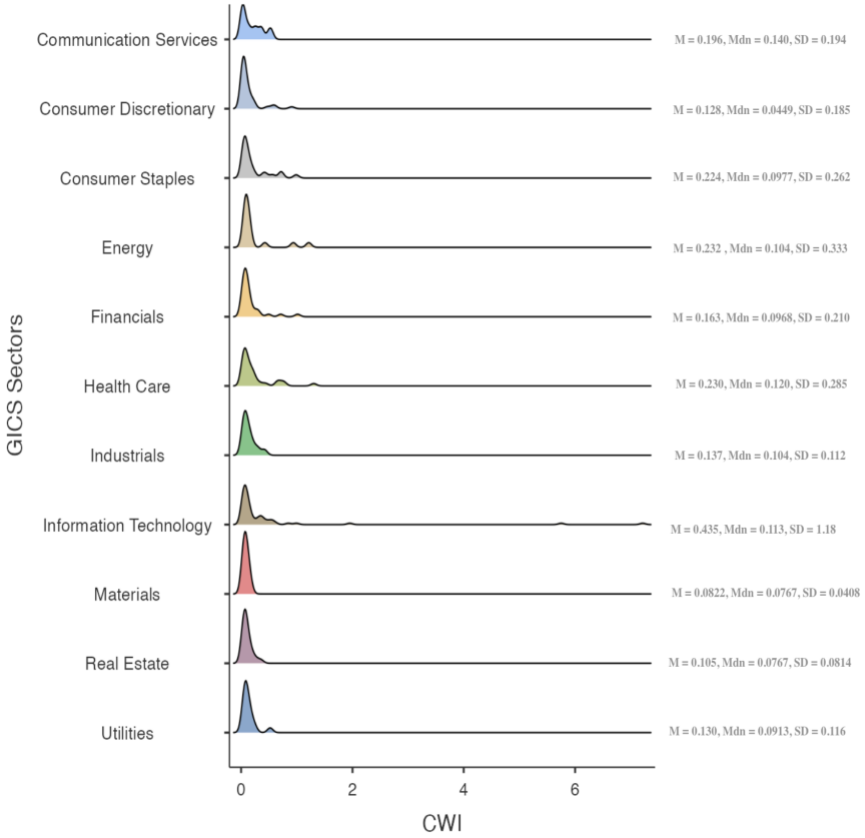

Figure 3. CWI density across sectors

According to statistics, the distribution type is right (positively) skewed. The highest mean is observed in the IT sector (M=0.435) and the lowest in the Materials sector (M=0.0822). When it comes to the standard deviation (further referred to as SD), the most heterogeneous (in terms of CWI value among companies) sector is IT (SD=1.8) and the most homogenous sector is the Materials sector (SD= 0.04088). All other sectors fall under the range of 0.08 to 0.33 SD values for the CWI indicator indicating homogeneity between companies. Further analysis will investigate whether any aspects of sustainability performance influence this factor.

3.4.1.2 Free Cash Flow (FCF)

The Free Cash Flow, or FCF, can be used to evaluate the financial health of a company, as this indicator indicates how capable a firm is of supporting its business and having the potential to grow (Wagner, 2022). Financial statements are unique to every company. Therefore, companies can calculate FCF in

a variety of ways. Regardless of the method used, FCF should have the same final number. Operating Cash Flow is the method most commonly used by S&P 500 companies. In this method, FCF is calculated by subtracting Operating Cash Flow from Capital Expenditures. A company's Operating Cash Flow (OCF) is the cash generated by its primary business activities. A company's capital expenditures cover the cost of maintaining fixed assets such as land, buildings, and equipment. Companies with higher FCF will have a greater potential for further growth of operations. FCF is measured in millions of dollars. S&P 500 company's last available annual reports were used for data collection.

In all 11 sectors, FCF distributions across companies are positively skewed (Fig. 4). The highest mean is observed in the Communication Services sector (M=7476) and the lowest in the Utilities sector (M=-274). The IT sector has the highest SD (SD=15985) indicating a high level of heterogeneity between companies in this sector. On the other side, the most homogeneous sector is the Real Estate sector (SD=960). In the Utility sector, the negative FCF values resulted in a negative mean value, indicating that the average company suffered losses for the reported year, while the high SD value indicates heterogeneity between (in terms of FCF) companies in this sector.

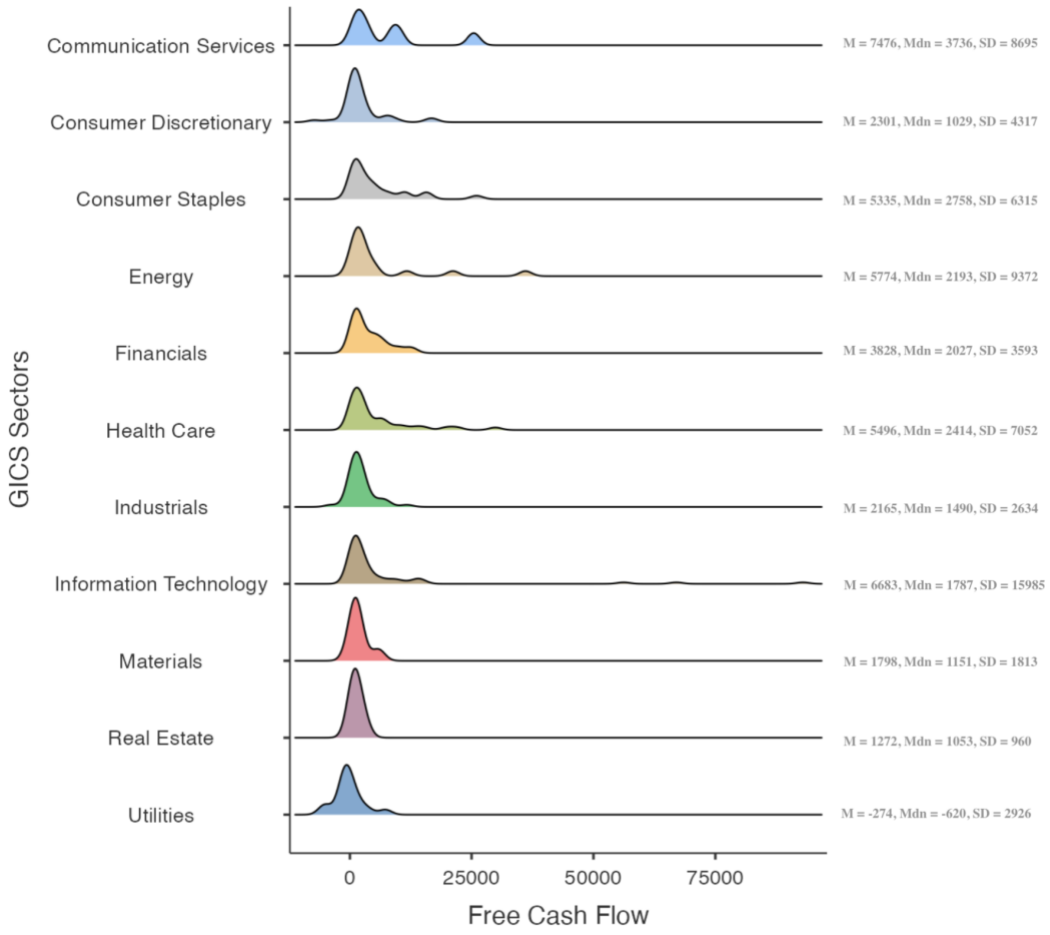

Figure 4. Free Cash Flow (FCF) across sectors

The *Communication Services* sector exhibits an interesting phenomenon where there are three dominant clusters of companies, with respect to FCF levels. Further analysis will investigate what effect sustainability performance has on FCF.

3.4.1.3 Return on Equity (ROE)

Return On Equity or ROE is the measure of a corporation's profitability and efficiency in generating profits. ROE can be considered an added advantage over the competition (Sajumon, 2023). A company's ROE can be calculated by dividing *Net Income* by *Average Shareholder's Equity*. Income earned by a company before taxes or other expenses is considered *Net Income*. A company's *Average Shareholders' Equity* is equal to the sum of the beginning and end values of its equity[32], divided by two. Higher ROE will give a company a better chance of protecting long-term profits and retaining market share by keeping investors interest. S&P 500 companies' last available annual reports were used for data collection. The ROE is expressed as a percentage.

The higher the ROE, the better it is, but any ROE between 10% and 20% is considered good[33]. The ROE density across sectors shows the right-skewed (positively) distribution type. The highest mean is observed in the Health Care sector (M=37.9) and the lowest in the Real Estate sector (M=14.1). The Communication Services sector is the only sector with a symmetrical distribution, meaning that the mean and median are almost identical (M=19.2 and Mdn=19.3), and the lowest SD (SD=9.89) across sectors, indicating homogeneity between companies in this sector in terms of ROE value. On the other hand, the highest level of heterogeneity occurred in the Health Care sector (SD=60.6).

[32] The difference between a company's liabilities and assets indicates its equity.

[33] Taken from the Business Development Bank of Canada, official website.

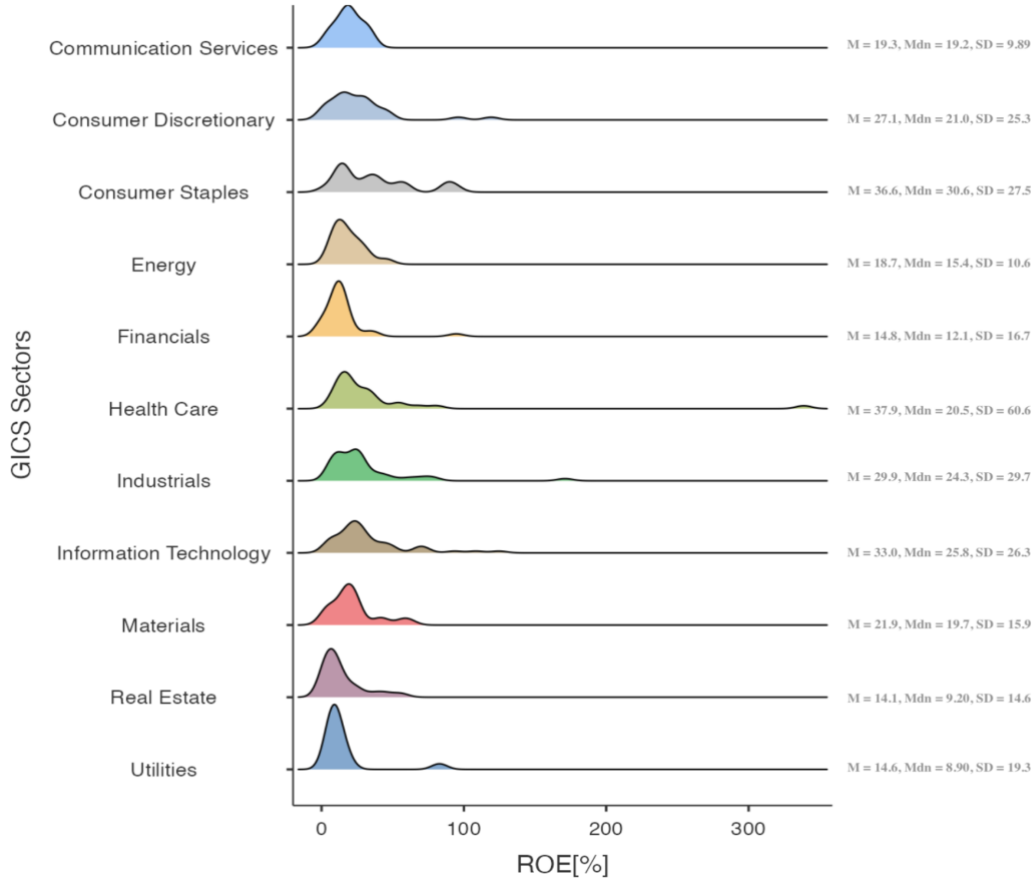

Figure 5. ROE across sectors

Examining the impact of sustainability indicators on Return on Equity (ROE) can yield significant insights into the correlation between sustainable practices and financial performance. Therefore, this research aims to explore whether any dimensions of sustainable performance affect this factor.

3.4.1.4 Tobin's Q (TQ)

Tobin's Q as an FPI is used, among other things, to explain a company's replacement cost. In order to calculate Tobin's Q, equity market value is divided by equity book value. Market Capitalization refers to the market value of equity. Stock price multiplied by the total number of outstanding shares determines a company's value. A company's equity book value, or shareholders' equity, is the amount of cash left after assets have been sold and liabilities have been repaid. Tobin's Q ratios between 0 and 1 indicate that a firm's assets are more costly to replace than its stock value. As a result, the stock is *undervalued*. In contrast, a high Q (greater than 1) indicates that a firm's stock is overvalued because it is more expensive than the company's replacement costs. Q ratios are not suitable for covering a long period of time. For the purpose of this analysis, however, it is suitable since the data cover one year's annual reports. Furthermore, historically, Tobin's Q value was viewed differently. The Q ratio

values never exceeded 1 before 1995. Today, good Q values are considered to be 2.12. There are, however, sector-specific factors to consider. Data obtained for this dependent variable are taken from the YCharts. (n.d.) website, dated September 21st, 2022. Tobin's Q is considered as an approximate annual range for the past 5 years.

Figure 6 represents Tobin's Q values across different GICS sectors. Three sectors, such as *Communication Services, Energy,* and *Utilities* operate under approximately the same range of Tobin's Q value, 0-3. All sectors except Communication Services and Utilities have a positively skewed distribution. The highest mean is observed in the IT sector (M=3.57) and the lowest in the Financials sector (M=0.297). The Communication Services sector has a negatively skewed distribution, and a small SD (SD=0.233) indicating homogeneity between the companies. The Utility sector exhibits a Bell-shaped distribution where the mean and median are almost identical (M=0.958 and Mdn=0.957, respectively) and the lowest standard deviation (SD=0.214) across all sectors indicates homogeneity between the companies. The highest SD (SD=2.46) value in the IT sector indicates the heterogeneous pattern between the companies with respect to Tobin's Q parameter.

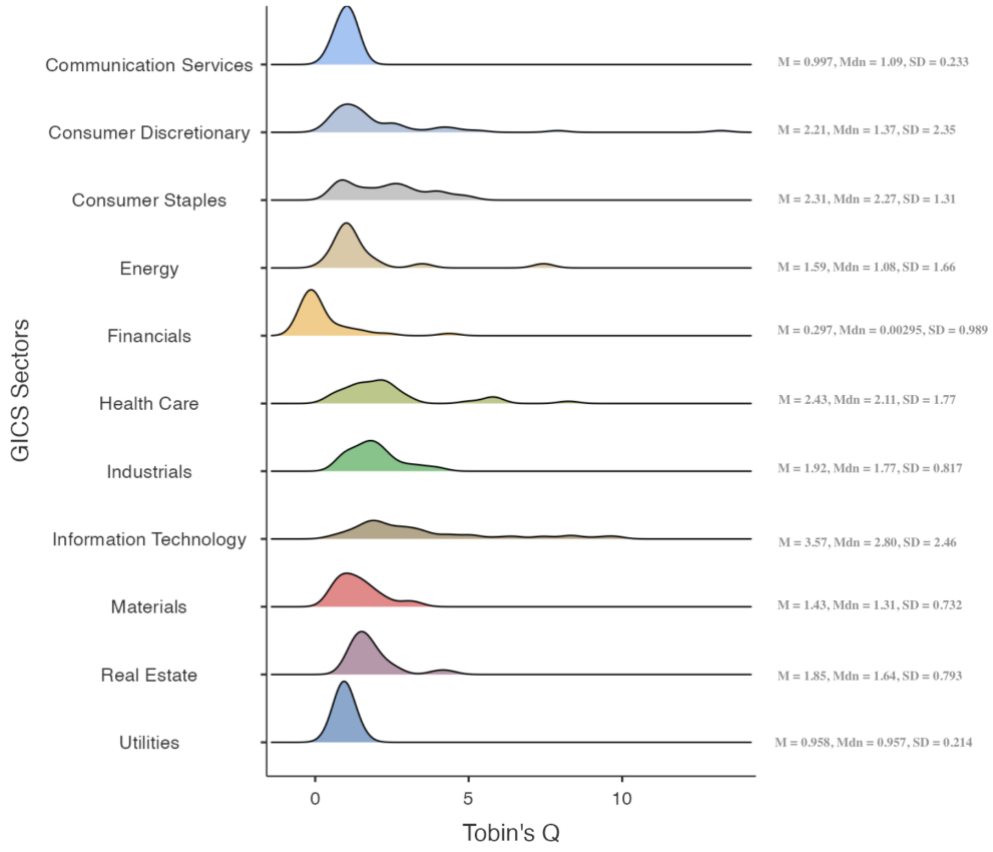

Figure 6. TQ across sectors

In the Financial sector, nearly all companies have Tobin's Q values below 0. This is the only sector in GICS where more than half companies analyzed have Tobin's Q value below 0.

Further analysis will be conducted to investigate if sustainability indicators have an impact on Tobin's Q in some industries.

3.4.1.5 Weighted Average Cost of Capital (WACC)

WACC stands for *Weighted Average Cost of Capital*, and it represents a firm's potential for investment. A WACC is calculated by multiplying the costs of each capital source (debt and equity) by their respective weights, then adding them up.

$$WACC = [E/V \times Re] + [D/V \times Rd \times -1 - Tc)]$$

E/V ratios represent equity-based financing, while *D/V* ratios represent debt-based financing. *TC* stands for corporate tax rate. The relevant weights of equity and debt are *Re*[34] and *Rd*[35]. *Rd* is easy to evaluate in the case of publicly traded companies (such as S&P 500) as they are required to provide their debt obligations. *Re* is an estimate made by companies. Based on the expected volatility of the stock, *Re* represents the rate of return investors demand. A lower value of WACC represents more stable business investments (Dobrowolski et al, 2022). Data for this dependent variable are collected from the Finbox ("WAAC," n.d.) website, dated September 22nd, 2022.

Figure 7 shows that WACC values are highly sector-dependent. While a certain WACC might be a good value in one sector, it might not be a good value in another. Based on statistical analysis, 5 sectors (Consumer Staples, Financials, Industrials, Materials, and Utilities) exhibit a negatively skewed distribution, whereas 5 sectors (Communication Services, Consumer Discretionary, Health Care, IT, and Real Estate) exhibit a positively skewed distribution. The highest mean is observed in the Energy sector (M=9.06) and the lowest in the Consumer Staples sector (M=6.66). Symmetrical type of distribution is evident in the Energy sector, where the mean and median are nearly identical (M=9.06 and Mdn=9.00). The lowest SD is in the Financials sector (SD=0.502), indicating homogeneity between companies and the highest SD can be seen in Consumer Discretionary (SD=1.52), where companies are more heterogeneous in terms of WACC.

[34] Cost of equity

[35] Cost of debt

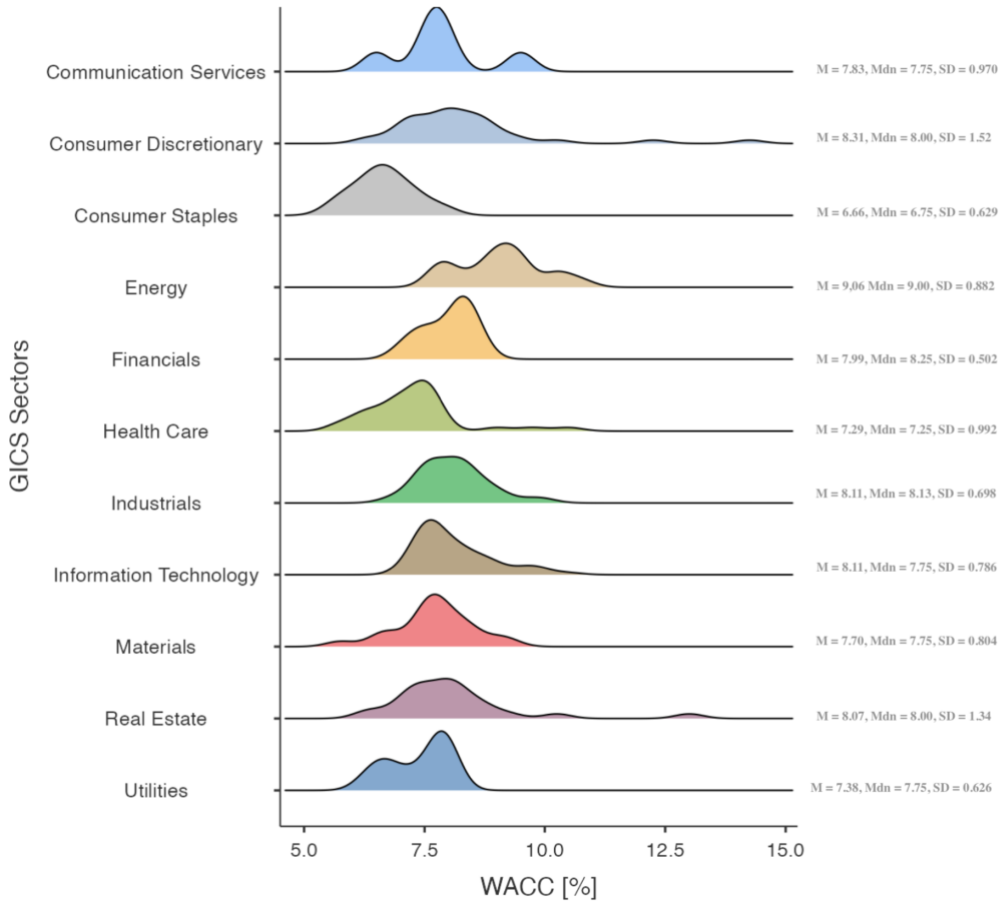

Figure 7. WACC across sectors

WACC values for the *Consumer Discretionary, Consumer Staples, Energy,* and *Financials* sectors vary widely, but the rule *"the lower the value, the better"* applies. Further analysis will explore how WACC is effected by any sustainability performance indicator.

3.4.1.6 Year-To-Date Return (YTD Return)

Year-To-Date Return (further referred to as YTD Return) refers to how much profit a company has made from its investments during the observed period. The YTD Return represents the company's profit or loss on investment for the current calendar or fiscal year. The current value of the portfolio, as well as its beginning value, are obtained. This is followed by subtracting the value that the portfolio had at the start of the year from the portfolio's current value. Therefore, the YTD Return in dollars is calculated. Once the YTD Return has been calculated, its dollar value is divided by its starting value. The final step is to multiply the decimal number by 100 in order to convert it to a percentage. Data obtained for this dependent variable are taken from the SlickCharts. (n.d.) website, dated September 15th, 2022.

According to Figure 8, all mean values are negative, except in the Energy and Utilities sectors. The highest mean value, across sectors, can be observed in the Energy sector (M=37.0) and the lowest is in the IT sector (M=-23.5). Right-skewed distributed sectors are Communication Services, Consumer Discretionary, Financials, Health Care, Industrials, Materials, and Real Estate, whereas left-skewed distributed sectors are Consumer Staples, Energy, IT, and Utilities. The highest SD value is in the Materials sector (SD=24.3) indicating a high level of heterogeneity between firms. The lowest SD value (SD=10.0) is in the Utility sector, indicating relative homogeneity of YTD Return values across firms in this sector.

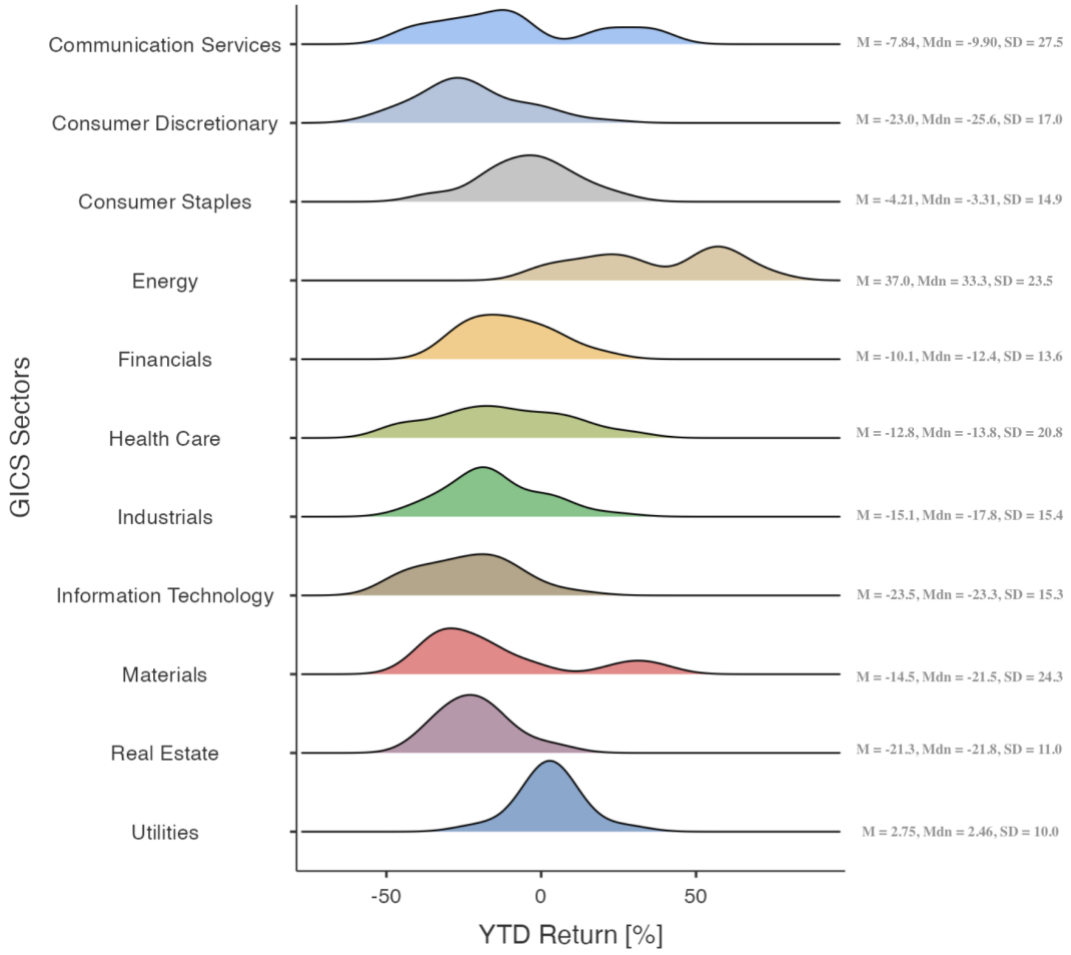

Figure 8. YTD Return across sectors

Based on YTD Returns, it can be concluded that the global economy has not performed well for the observed period, but further analysis will examine how it relates to sustainability performance.

3.4.1.7 Gross Margin (GM)

Gross margin measures how much profit companies make as a percentage of sales revenue. GM is a good tool for measuring how efficient companies are at making a profit from their products and

services. In order to calculate GM, a company subtracts its cost of goods sold from its net sales[36]. The result of this calculation is divided by net sales, which provides the GM in percentage terms. GM is a useful metric because it shows the margin of a company's products and/or services. A high gross margin supports long-term growth because a high value means more investment in research and development and therefore more profit (Beaver, 2020). S&P 500 companies' last available annual reports were used for data collection.

Figure 9 presents GM distribution across GICS sectors. From the figure, it can be noted that the GM is sector-depended. It can be seen that Communication Services, IT, Materials, and Utility have bell shaped distributions, while Real Estate, Health Care, and Industrials are negatively skewed, and Financials, Energy, Consumer Staples, and Consumer Discretionary are positively skewed. The highest mean is observed in the Real Estate sector (M=61.0) and the lowest in the Materials sector (M=30.6). The highest level of heterogeneity occurs in the Consumer Discretionary sector (SD=19.9) and the highest level of homogeneity in the Communication Service sector (SD=6.73).

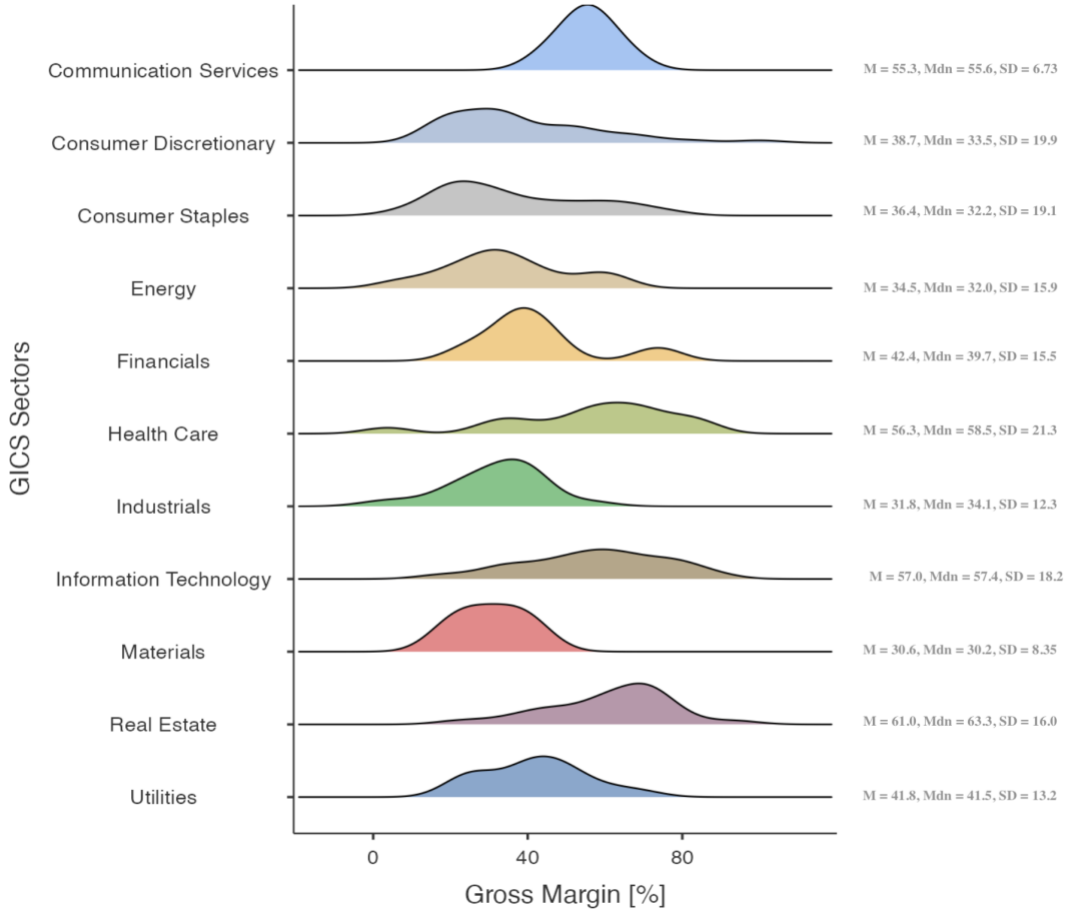

Figure 9. GM across sectors

[36] The term *Net sales* refer to total revenue minus the costs of sales, allowances, and discounts.

Further analysis will investigate whether GM is correlated with any sustainability performance indicator.

3.4.1.8 Gross Profit (GP)

Gross Profit (further referred to as GP) as an additional FPI, represents a company's efficiency in using its labor and supplies in producing goods or services. GP is calculated by subtracting from Revenue the Cost of Goods Sold[37]. The higher the GP value, the more efficient a firm is in producing goods or services. GP is measured in millions of dollars. S&P 500 companies' last available annual reports were used for data collection.

GP density is shown in Figure 10 across sectors. It can be seen that GP distribution across and within sectors shows a right-skewed distribution. The highest mean is observed in the Communication Services sector (M=35723) and the lowest in the Real Estate sector (M=2362). When it comes to the standard distribution regarding GP indicator, it can be seen that the highest value is in the Communication Service sector (SD=32155) indicating a high level of heterogeneity. The lowest value of SD can be seen in Financials sector (SD=1168) indicating the high level of homogeneity between companies with respect of the GP indicator.

[37] An expense that relates directly to the creation of a product and/or service is the cost of goods sold.

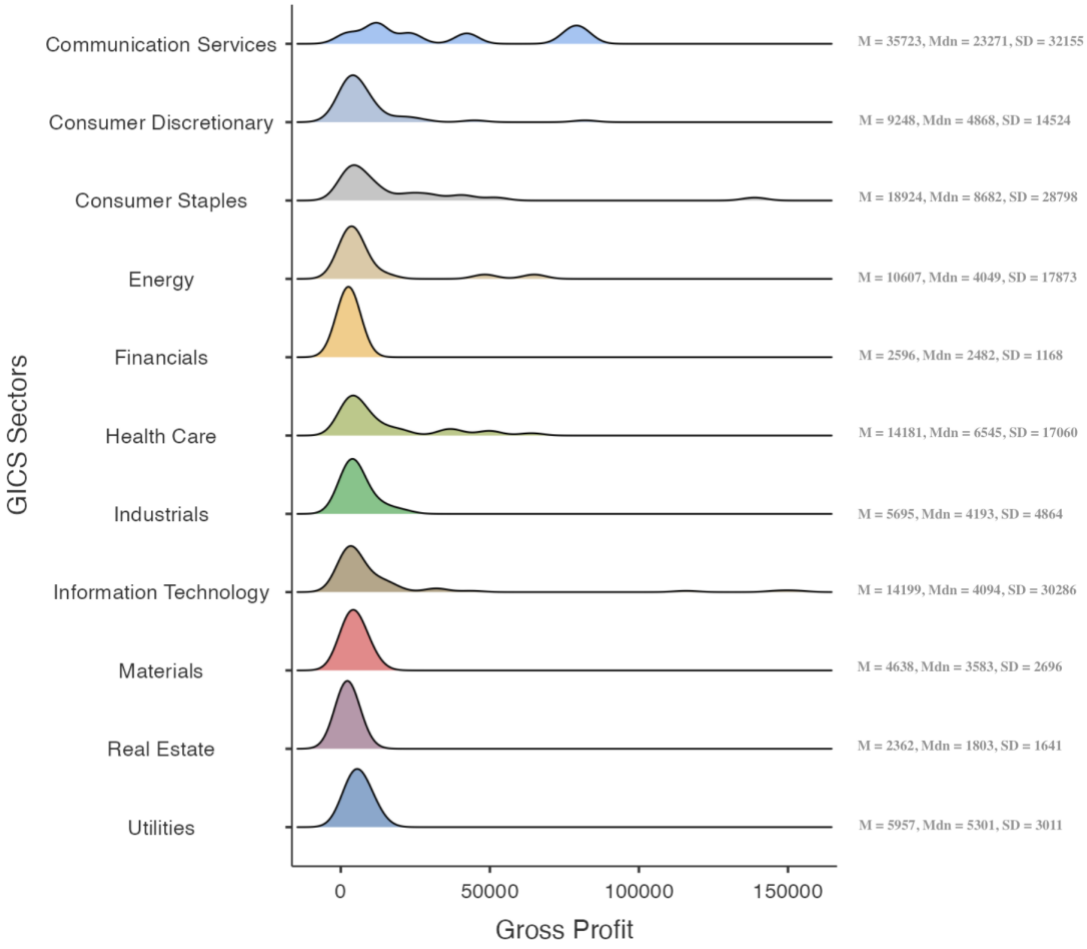

Figure 10. GP across sectors

According to figure 10, all sectors are approximately at the same level of efficiency when it comes to maximizing labor and supplies. Further analysis will investigate whether any sustainability performance indicator influences GP.

3.4.1.9 Return on Assets (ROA)

A company's Return on Assets (ROA) is calculated by dividing its net[38] income by its total assets. This FPI measures a company's profitability in terms of its total assets. S&P 500 companies last available annual reports were used for data collection. The ROA is expressed as a percentage.

[38] The net income of a company is determined after all expenses and costs have been subtracted from its total revenue. Additionally, net income includes any other types of income a company earns, such as interest income from investments or proceeds from asset sales.

In Figure 11, all sectors exhibit an outlier effect when it comes to ROA. It is important to note that a good value of ROA is sector dependent. Values above 20% are excellent, whereas values below 5% are considered poor. *Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials*, and *Information Technology* sectors have some companies that exceed the 20% value indicating that these companies (with respect to ROA variable) have a competitive advantage within and across sectors.

There is a right-skewed distribution of ROA density across for all sectors, expect Materials. The Materials sector is bell-shaped since the mean and median are almost identical (M=7.0 and Mdn=7.05), and the SD (SD=3.55) is relatively small, indicating homogeneity between the companies with respect to ROA. The highest mean is observed in the IT sector (M=13.6) and the lowest in the Utilities sector (M=3.16). The highest SD value is in the Health Care sector (SD=14.0) and the lowest in the Utilities sector (SD=2.48).

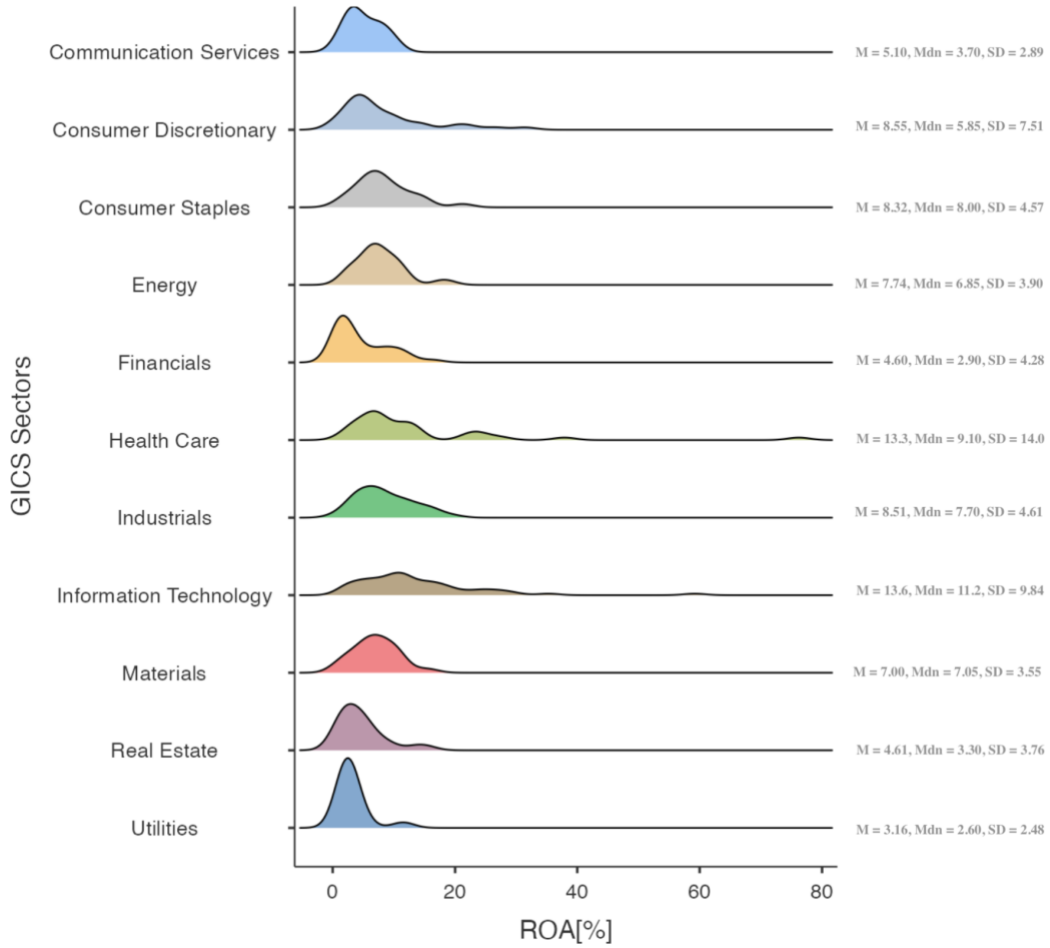

Figure 11. ROA across sectors

Sectors such as *Communication Services, Materials, Real Estate*, and *Utilities*, have high values of ROA within the sector. This is, however, sector-specific, and can be assumed that companies that have the

highest ROA in these sectors are considered to have a competitive advantage. Further analysis will be conducted to examine how a company's sustainability performance effects ROA.

3.4.1.10 EBITDA

EBITDA (as one of the FPIs), which is a line on a company's financial statement, is an acronym for "earnings before interest, taxes, depreciation, and amortization". Calculating EBITDA involves adding *Net Income*, *Taxes*, *Interest Expense*, and *Depreciation & Amortization* together. The EBITDA value can be seen as net income with interest, taxes, depreciation & amortization included. Companies can track and compare their underlying profitability using EBITDA regardless of their depreciation assumptions or financing options. This variable indicates a company's performance in a form of a matrix that excludes cash outlays for interest and taxes and the cost of replacing tangible assets. As a measure of a company's profitability, the higher EBITDA, the better it is. Higher values indicate that a company is more attractive. There are different types of EBITDA(s)[39], but for the purpose of this study, *Normal EBITDA* was used. EBITDA is measured in millions of dollars. S&P 500 companies' last available annual reports were used for data collection.

Figure 12 shows the EBITDA density within and across GICS sectors. A statistical analysis of the EBITDA values for all sectors shows that the distribution is skewed positively. The highest mean is observed in the Communication Services sector (M=20905) and the lowest in the Real Estate sector (M=1950). The most heterogeneous sector is IT sector (SD=21637). The Financials sector has the lowest SD (SD=818), suggesting that companies in this sector tend to have homogeneous EBITDA values.

[39] Taken from Generational Equity (n.d.)

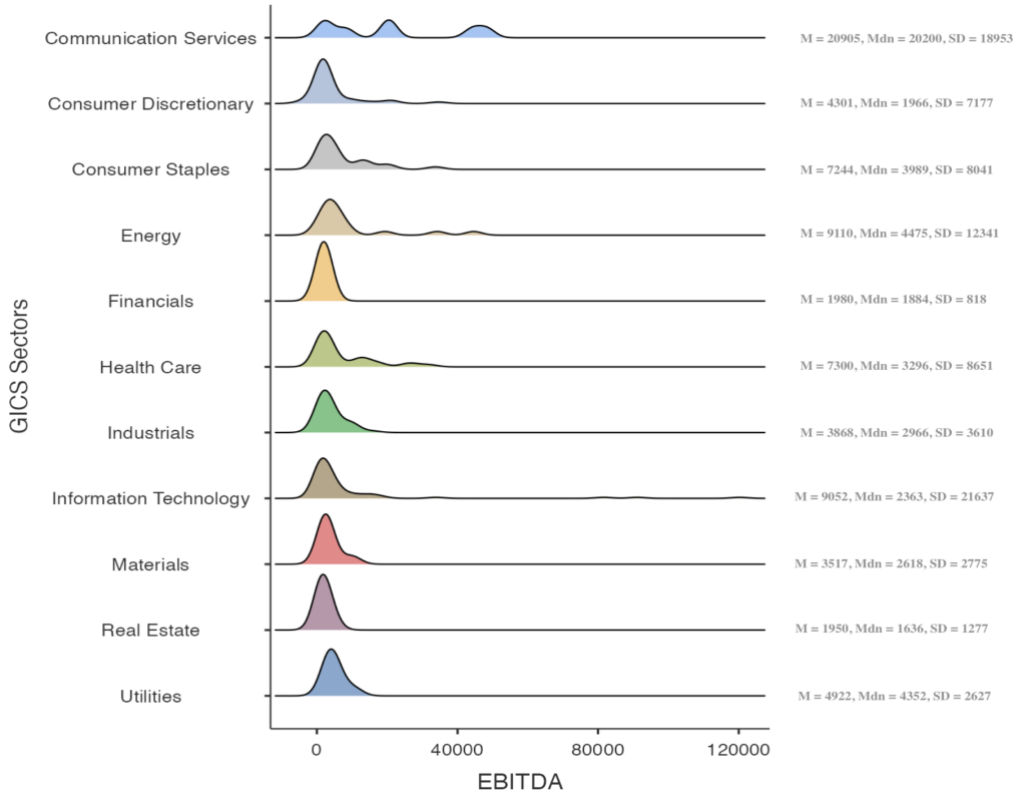

Figure 12. EBITDA across sectors

In all 11 sectors, anomalies indicate that some companies are significantly more attractive than the average. Further analysis will investigate whether being more sustainable affects companies' EBITDA values.

3.4.2 Sustainability Performance

The following variables were selected according to the following criteria:

1) relevance to the SDGs shown as the most relevant to companies, according to figure 1.
2) relevance across different sectors
3) data availability for most firms in accordance with the GRI framework

The selected indicators are designed to account for the differing sizes of companies by using, for instance, intensities and ratios.

3.4.2.1 Gender Equality -SDG 5

Sustainable Development Goal 5 proposes, among other things, to empower women and girls of all ages with equal human rights in education, health care, decent work, work opportunities, and other decision-making processes. This study seeks to analyze the effect of this factor on a company's financial

performance. Specifically, do companies with more women in management positions perform better financially?

3.4.2.1.1 The percentage of Management Positions occupied by Women

The distribution of women in management positions across sectors is shown in Figure 13. Given that the mean in all sectors is less than 50%, and given the goal of gender equality, we apply the assumption that the higher the percentage of management positions occupied by women, the better the sustainable performance on this indicator. It should be noted, however, that this principle of *"the more the better"* only applies to the minority group and would be reversed if women were in the majority. The data used for this factor were collected from the latest GRI-compliant sustainability reports.

The highest mean is observed in the Health Care sector (M=43.6) and the lowest in the Energy sector (M=22.9). The Materials and Health Care sectors have right-skewed distributions. The IT, Financial, and Communication Services sectors, on the other hand, appear to have left-skewed distributions. Outliers are present in both types of distribution. Utilities (M=25.4 and Md=25.8), Real Estate (M=35.1 and Mdn=35.9), Industrials (M=26.8 and Mdn=26.0), Energy (M=22.9 and Mdn=22.4), Consumer Staples (M=41.1 and Mdn=41.0), and Consumer Discretionary (M=40.3 and Mdn=40.0) have averages almost identical to medians and show a rather symmetrical distribution of women in management positions. The highest level of heterogeneity is in the Consumer Discretionary sector (SD=15.3) and the most homogenous sector is the Energy sector (SD=5.92).

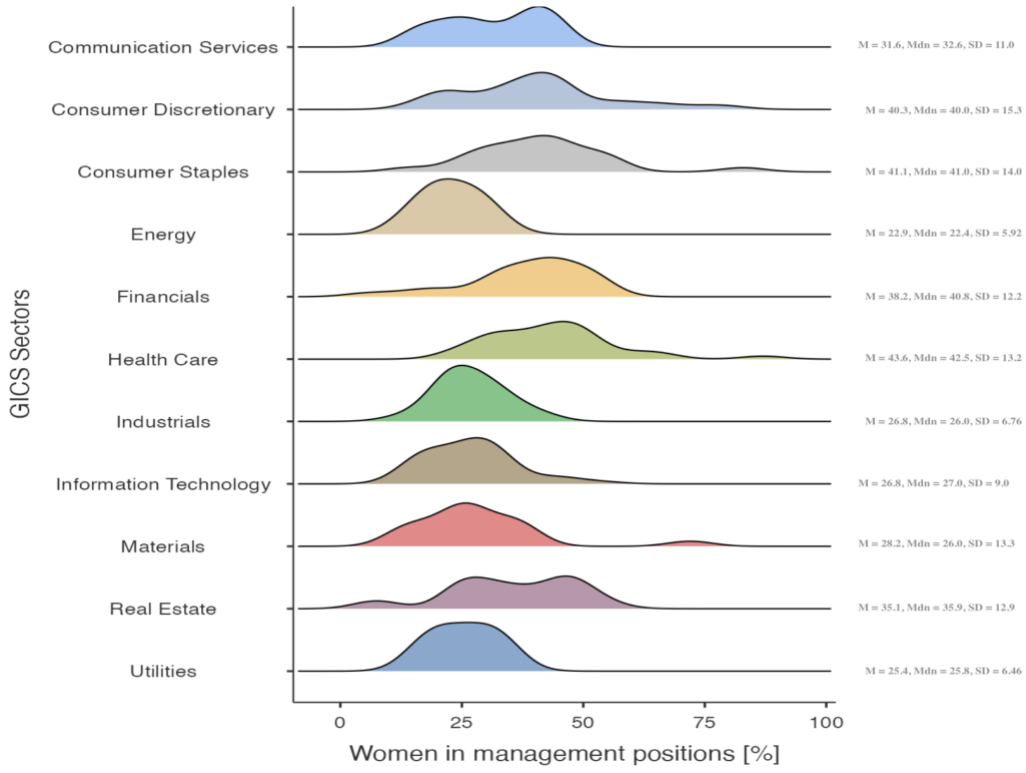

Figure 13. Women in management positions across sectors

Further analysis will be conducted on whether the percentage of women in management positions affects financial performance.

3.4.2.2 Affordable and Clean Energy -SDG 7

SDG 7 has the main goal of increasing the use of renewable sources. For this study, factors such as *Electricity Grid* and *Renewable Energy* were taken to examine to what extent SDG 7 affects companies with respect to their financial performance. Amidst the *Energy Crisis*, these factors could have a significant impact on future business competitiveness.

3.4.2.2.1 Percentage of Electricity taken from the Grid

Figure 14 serves to provide an overview of how much sectors depend on the grid electricity. The data used for this factor were collected from the latest GRI-compliant sustainability reports. Grid electricity is presented as a percentage of the total energy usage. As a higher percentage places a greater burden on the grid and negatively affects other grid users, and as grid electricity is rather unclean in most of the US where these companies are listed, the assumption applied is that a higher percentage indicates a worse sustainability performance.

The highest mean is observed in the Financials sector (M=87.5) and the lowest in the Materials sector (M=34.0). The Materials, Industrials, Energy, and Consumer Discretionary sectors have right-skewed distributions, while the distributions of all other sectors are left-skewed. There are outliers in both types of distribution. The highest SD is in the Energy sector (SD=49.2) indicating heterogeneity between companies with respect to the percentage of Grid Energy. The lowest SD value in the Materials sector (SD=22.1) indicates homogeneity between companies in this sector.

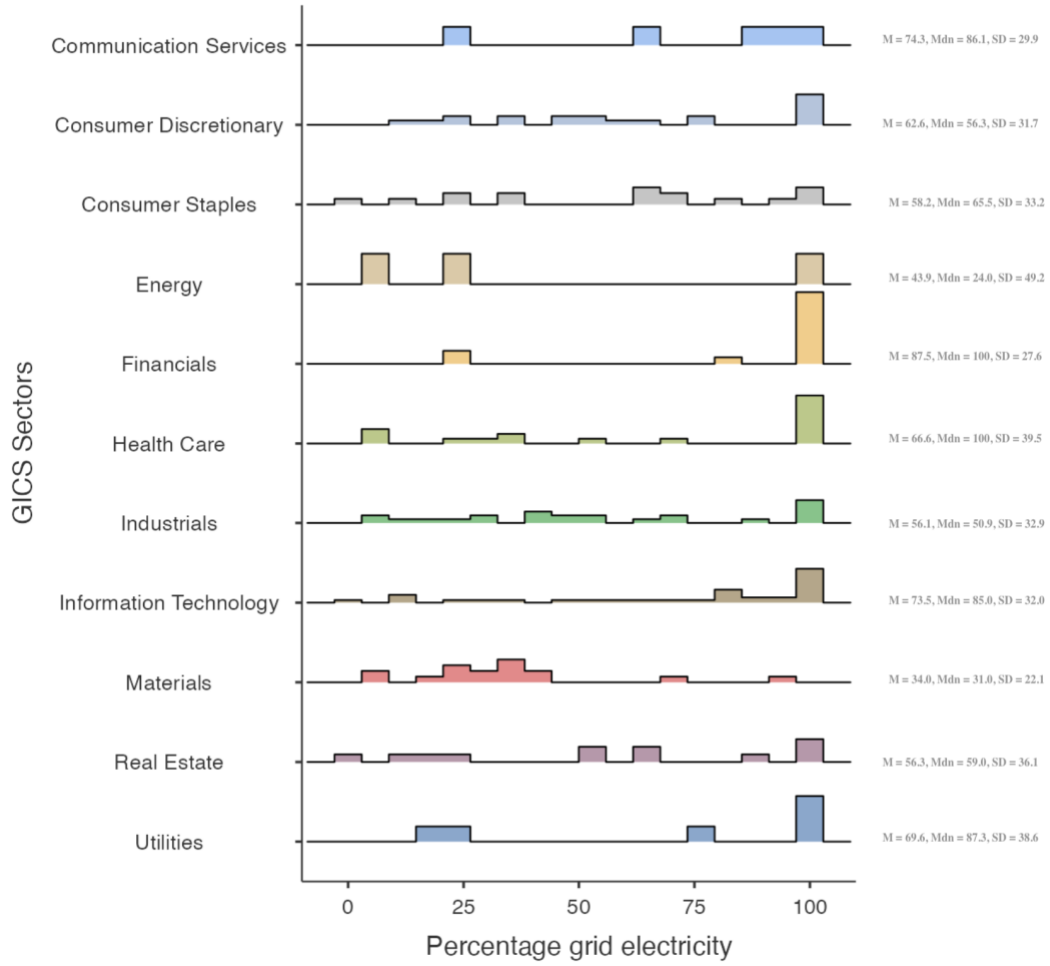

Figure 14. Percentage of grid electricity across sectors

Further analysis will determine whether dependence on the electricity grid positively or negatively affects the financial performance indicators.

3.4.2.2.2 Percentage of Energy coming from Renewable Sources

In line with SDG 7, the higher the proportion of energy sourced from renewable sources, the more sustainable the company is assessed to be. The distributions across sectors (Fig. 15) show that most companies fall below 50%, but there are exceptions. The data were taken from the companies' last published GRI-compliant sustainability reports.

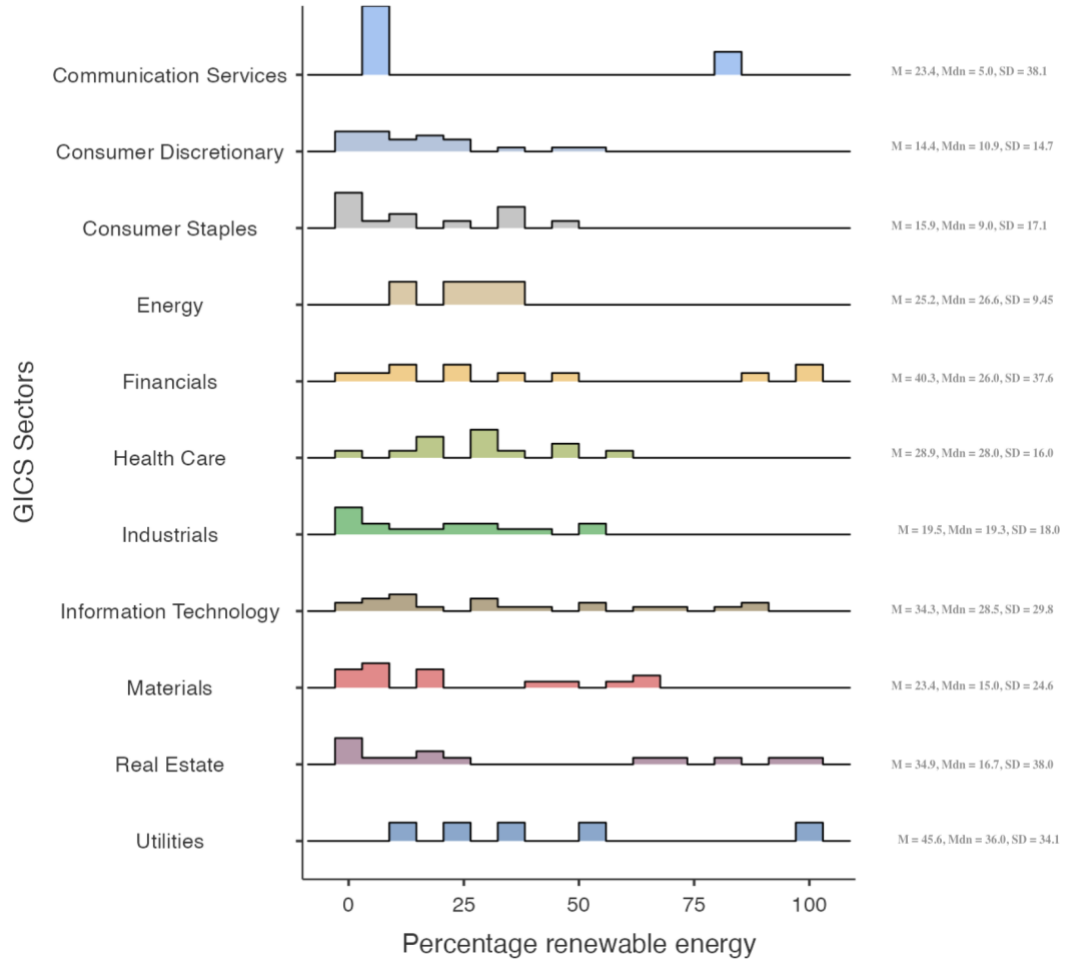

Figure 15. Percentage of renewable energy across sectors

The highest mean is observed in the Utilities sector (M=45.6) and the lowest in the Consumer Discretionary sector (M=14.4). Except for Energy, Health Care, and Industrials, all sectors have right-skewed distributions. There is a left-skewed distribution within the Energy sector and a symmetrical distribution of companies in the Health Care and Industrial sectors. When it comes to SD, the highest value in Real Estate (SD=38) indicates wide variations between companies in this sector in terms of the percentage of renewable energy used, while the lowest value in the Energy sector (SD=9.45) indicates relative uniformity between companies in this sector.

There is an interesting correlation between the use of grid electricity by sectors and the use of renewable energy sources by those sectors. Energy grid-dependent sectors use fewer renewable energy sources, and vice versa. There are, however, some sectors that reported equal use of grid electricity and renewable energy. Additionally, some companies in these sectors did not report using renewable energy sources.

Further analysis will determine whether this factor positively or negatively affects the financial performance of companies in GICS sectors.

3.4.2.3 Decent Work and Economic Growth -SDG 8

Developing a full and productive workforce for all is central to SDG 8. A way to improve economic productivity through labor intensity is part of the 2030 Agenda. The proportion of employees in a company or in a sector can be used to describe the impact of this SDG on a company or sector.

3.4.2.3.1 Assessing Labor Intensity through Employee Count

It has been assumed that companies with more employees are able to achieve higher economic productivity. Similarly, sectors with a higher average number of employees can be considered more economically productive. Thus, aligning with SDG 8.

Figure 16 represents the number of employees across sectors. The majority of sectors have approximately 100,000 people in employment. The data used for this factor were collected from the latest GRI-compliant sustainability reports. The total number of employees within and across sectors are based on data from 324 companies analyzed in this study.

Across all sectors, the highest mean is observed in the Consumer Staples sector (M=178955) and the lowest in the Real Estate sector (M=7296). Further, all sectors exhibit right-skewed distributions. These sectors have an outlier effect, in which some companies have a higher employee count than others. The highest mean is observed in the Consumer Staples sector (M=178955) and the lowest in the Real Estate sector (M=7296). The highest SD can be noted in the Consumer Discretionary sector (SD=110941) indicating the high level of heterogeneity between companies in this sector when it comes to the number of employees. The lowest value of SD can be seen in the Utilities sector (SD=5840) suggesting that companies in this sector homogenize when it comes to the number of employees.

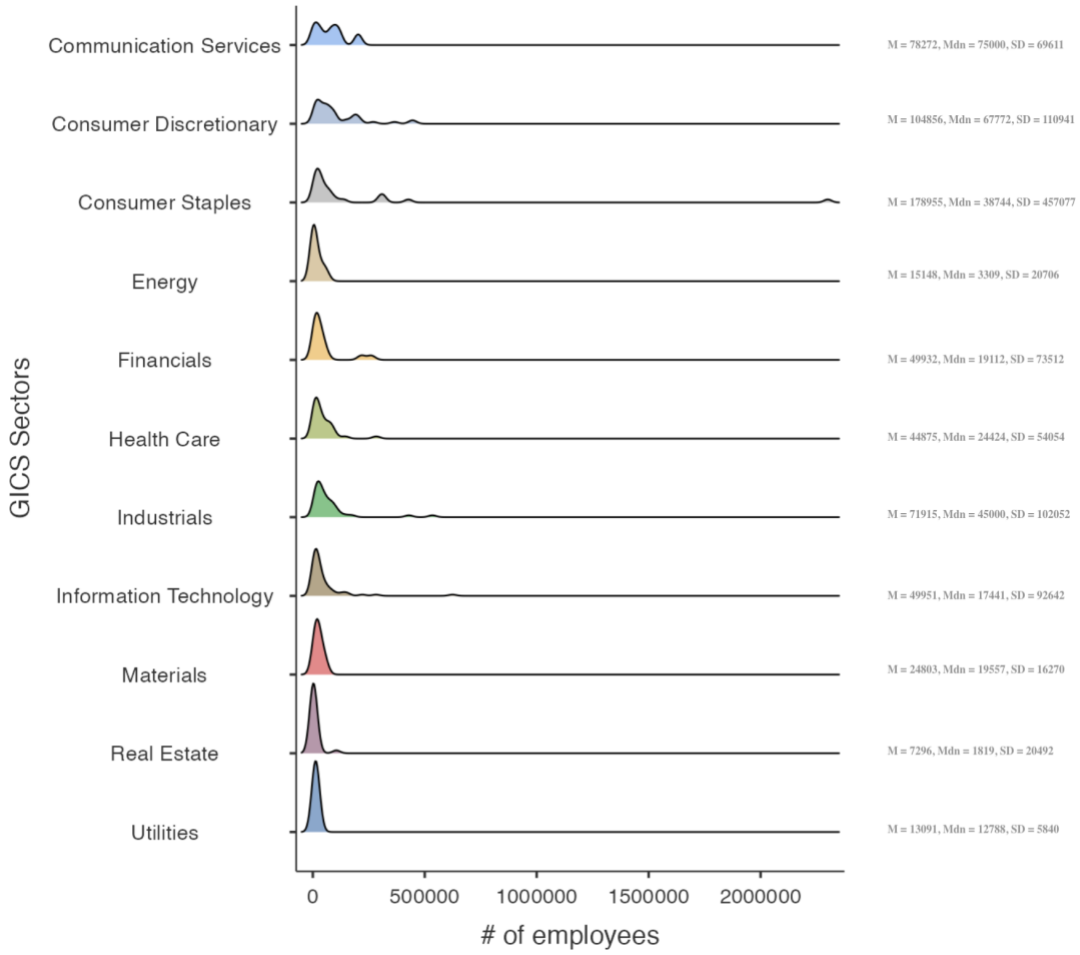

Figure 16. Number of employees across sectors

Further analysis will reveal how the employee count affects the financial performance of a company and whether it is sector dependent.

3.4.2.4 Good Health & Well-Being (SDG 3)/ Industry, Innovation, & Infrastructure (SDG 9)

Assuring the sustainable progress of a broader community is a task of many organizations in which businesses operate on a global level. SDG 3 main task is to promote well-being for all at all ages as well as ensure healthier lives via direct products or services or via education. As with SDG 3, whose primary objective is to ensure the well-being of a human, SDG 9 aims to create resilient infrastructure, promote sustainable industrialization, and foster innovation. The goal of SDG 9 is to ensure the well-being of entities that humans use.

3.4.2.4.1 Company's alignment with Sustainable Development Goals (SDGs)

According to SDG 3 and SDG 9, a company's alignment with SDGs can be a measure of its commitment to promoting well-being of the society and in building a more resilient future.

The latest Sustainable Reports, under the GRI framework, provide data on a company's total SDG alignment. From the data can be observed that there are sectors where most companies are not aligned with any of the SDGs while reporting (22 out of 324) that they are only supporting external initiatives. Out of 324 companies, 74 did not specify any alignment with SDGs or supporting external initiatives.

Companies' alignment to SDGs across sectors is represented in Fig. 17. Sectors such as *Communications Services, Consumer Staples, Financials, Industrials, and Utility* exhibit right-skewed distributions. Additionally, there is an outlier effect in these sectors, with some companies aligned with more SDGs than others. The highest mean is observed in the Consumer Staples sector (M=9.12) and the lowest in the Communication Services sector (M=3.71). A bell-shaped distribution can be seen in the *Real Estate* sector (M=7.0 and Mdn=7.0), indicating that companies in this sector are more equally aligned with SDGs. According to their left-skewed distributions, other sectors aligned less with SDGs than others. SD is the highest in the Energy sector (SD=4.91) indicating the heterogeneity between companies with respect to number of SDG alignment. SD is the lowest in the Health Care sector (SD=2.88) indicating the level of homogeneity between companies when it comes to SDG alignment.

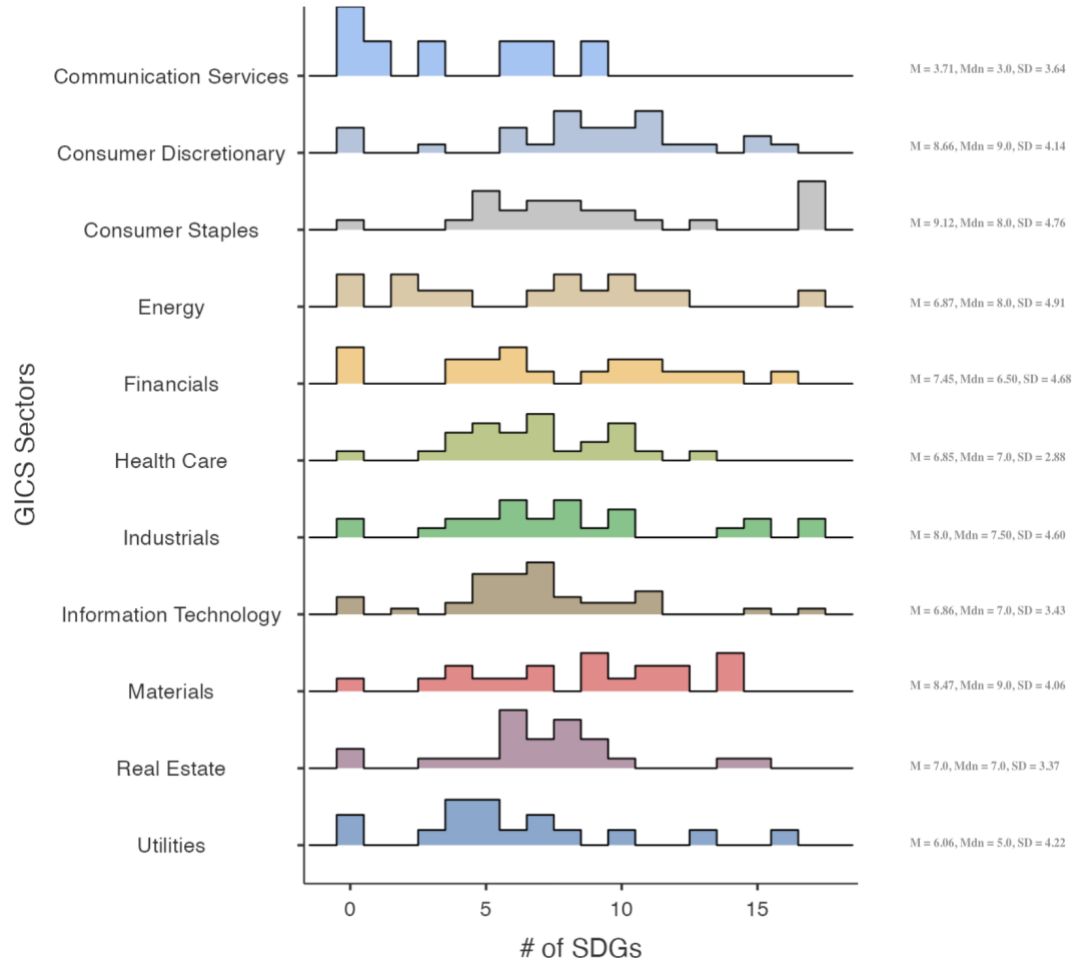

Figure 17. Number of SDGs across sectors

It is evident from the figure that the density of SDGs across sectors is sector-specific. The results section will expand on the importance of this factor to the financial performance of a company.

3.4.2.5 Reduced Inequalities -SDG 10

Reduced Inequality is a goal of the Sustainable Development Goal 10 and promotes an environment where equal opportunities are encouraged, and disparities are kept to a minimum. Income disparity is one of the issues that SDG 10 aims to address. *Pay-ratio* was taken as an indicator in this project to represent SDG 10.

3.4.2.5.1 Pay-Ratio as a measure of income disparity

The income disparity can be accessed via the Pay-Ratio. This indicator represents a crucial component of SDG 10 aiming to reduce inequalities. The Pay Ratio is the ratio of top salaries to bottom salaries. The difference between the incomes of top executives and median workers at a company. The lower the Pay-Ratio is, the lower will be income disparity between top executives and median worker pay. The data collected is sourced from AFL-CIO. (n.d.).

Figure 18 shows the density of pay-ratio across sectors. From the figure can be seen that most sectors, except *Consumer Discretionary* and *Consumer Staples* sectors, have bell-shaped distributions. One explanation for this trend is that these two sectors have been the most affected by COVID-19 and the post-COVID period, and navigating the business through the pandemic and its recovery afterward requires skills that few CEOs possess. Markets and shareholders consider executives worth more if they have a unique set of skills. The highest pay-ratio has the CEO of Expedia Group, Inc. and that is 2,897:1.

Statistics show that all sectors, except Health Care, have right-skewed distributions. The distribution of the Health Care sector is left-skewed. The highest mean is observed in the Consumer Discretionary sector (M=765) and the lowest in the Utilities sector (M=117). The SD value in the Consumer Discretionary sector (SD=671) is the highest, suggesting that companies have quite heterogeneous pay ratios. Utilities sector has the lowest SD value (SD=61.0), indicating a high degree of homogeneity among companies when it comes to pay ratios.

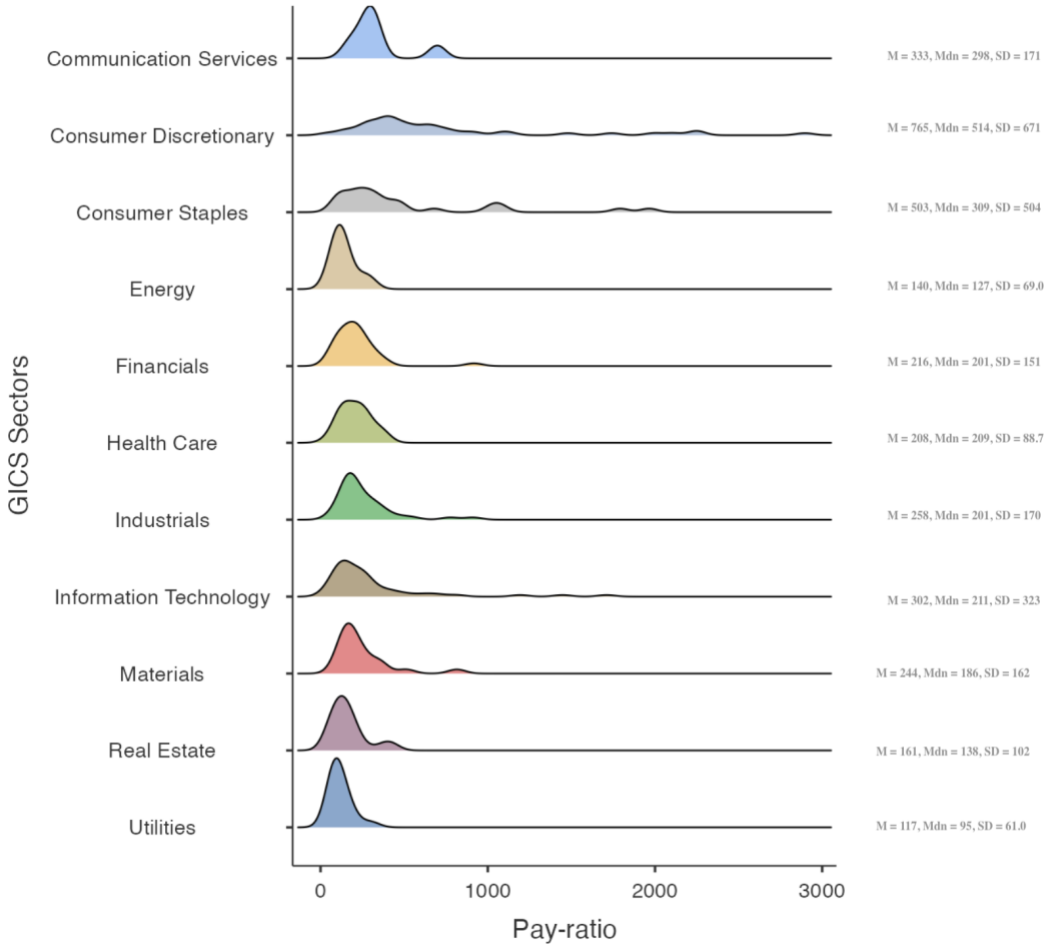

Figure 18. Pay-ratio across sectors

Additional analysis will be carried out to assess the impact that this ratio has on a company's financial performance, determining whether it has a positive or negative effect.

3.4.2.6 Responsible Consumption and Production -SDG 12

The goal of SDG 12 is to have responsible consumption and production aligned with international policy and more efficient management processes. The efficient use of energy, water resources, and proper waste management are indicators of more responsible production and consumption. Three factors are therefore taken into consideration for this sustainability goal: *Energy Intensity Ratio, Water Intensity Ratio,* and *Waste Intensity Ratio*.

3.4.2.6.1 Energy Intensity Ratio

The energy intensity ratio serves to provide an overview of how efficient a company is in using energy per dollar of its operating revenue. By assessing the company's level of responsible consumption and production, this ratio is directly aligning with SDG 12. The lower this ratio is, the more energy efficient is the company.

The energy intensity ratio is calculated by dividing the *Total Energy* (the unit used MWh)[42] reported in sustainability reports, under the GRI framework, by *Operating Revenue*[43] (measured in millions of dollars) from the official Yahoo Finance (n.d.) website, reports from 2021 of S&P 500 companies. *Operating Revenue* as a parameter was used due to the fact that companies report this type of revenue as revenue that comes from their primary business activities. Based on 324 companies across sectors, 36 companies did not report the *Total Energy* parameter in their sustainability reports.

All sectors, except Communication Services, indicate right-skewed distribution (Fig. 19). The highest mean is observed in the Utilities sector (M=2.62) and the lowest in the Health Care sector (M=0.0413). Additionally, there is an outlier effect in these sectors, indicating that some companies are less energy efficient than others. Energy intensity ratios in the Communication Services sector follow a symmetric pattern, indicating that companies in this sector are nearly equally efficient (M=0.0852 and Mdn= 0.0855). The IT sector has the highest value of SD (SD=7.20). This suggests that companies in this sector are quite heterogeneous when it comes to the energy intensity ratio. The Health Care sector has the lowest value of SD (SD=0.0375) reflecting the homogeneity between companies in this sector regarding energy efficiency ratio.

[42] There were some companies that did not report in MWh. Since the majority of companies reported in MWh, others had to be converted in MWh from their units. The Appendix 4 contains a table listing all units encountered during data collection.

[43] Part of Operating Revenue consists of 30 companies reported with different Total Revenue Structure out of which, 13 companies used Total Premiums Earned and 17 companies used Net Interest Income. All other companies (294) used Operating Revenue variables as given.

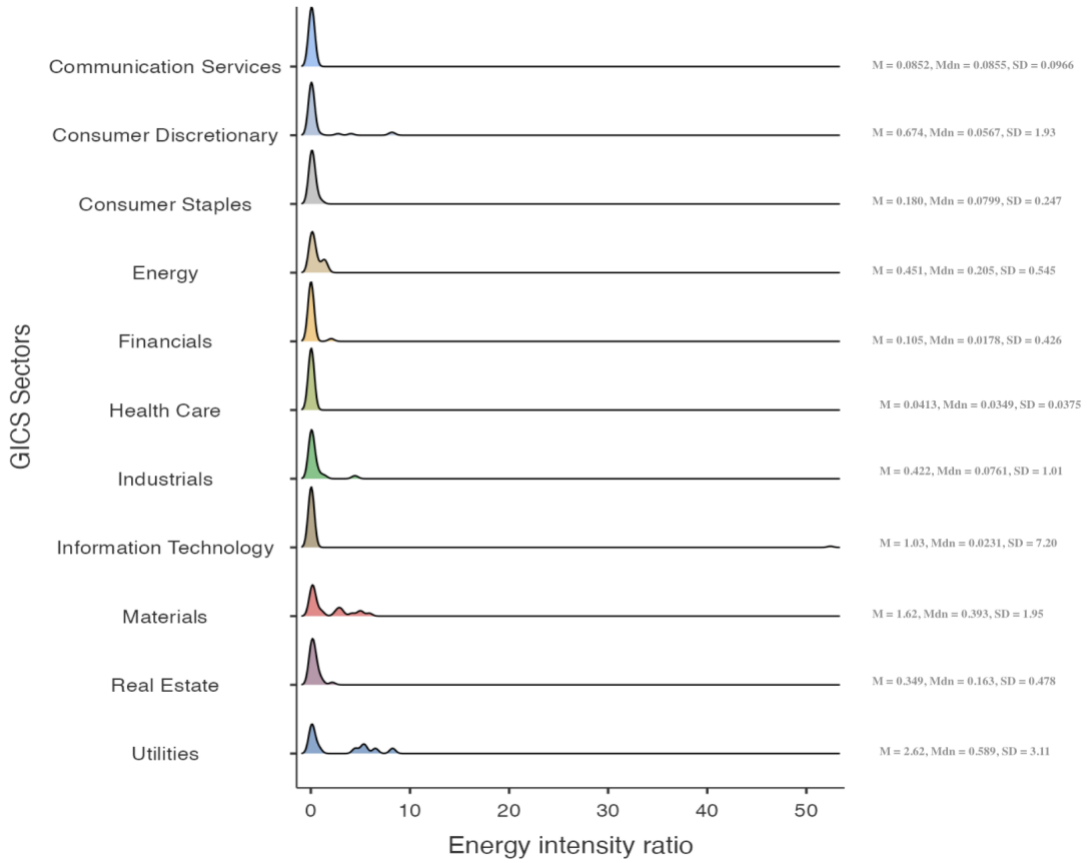

Figure 19. Energy intensity ratio across sectors

Further analysis will investigate how this ratio effects the financial performance of a company. There may be a correlation between the effect of this ratio as a sustainable initiative that lead to better financial performance or vice versa.

3.4.2.6.2 Water Intensity Ratio

The water intensity ratio provides an overview of how efficiently companies use water resources per dollar of operating revenue. Water efficiency increases as this ratio decreases. This factor aligns with SDG 12 when it comes to responsible consumption and production.

The water intensity ratio has been calculated by dividing *Total Water* (m^3)[44] reported in sustainability reports, within the GRI framework, by *Operating Revenue* (measured in million dollars) reported by S&P 500 companies on the official Yahoo Finance (n.d.) website, from 2021. The Operating Revenue parameter was used since companies report this type of revenue as income from their primary

[44] There were some companies that did not report in m^3. Since majority of companies reported in m^3, others had to be converted in m^3 from their units. The Appendix 5 contains a table listing all units encountered during data collection.

business activities. Based on 324 companies across sectors, 84 companies did not *report Total Water* in their sustainability reports.

Figure 20 provides an overview of how water efficient companies are across sectors. According to statistics, all sectors have right-skewed distributions. The highest mean is observed in the Materials sector (M=4.84) and the lowest in the Health Care sector (M=0.0819). With respect to standard deviation across sectors, the sector with the highest value of SD is Materials (SD=8.24) indicating the heterogeneity between companies in terms of water intensity ratio. The lowest SD value has the Health Care sector (SD=0.0773) suggesting the highest level of homogeneity between companies in this sector with respect to the water intensity ratio.

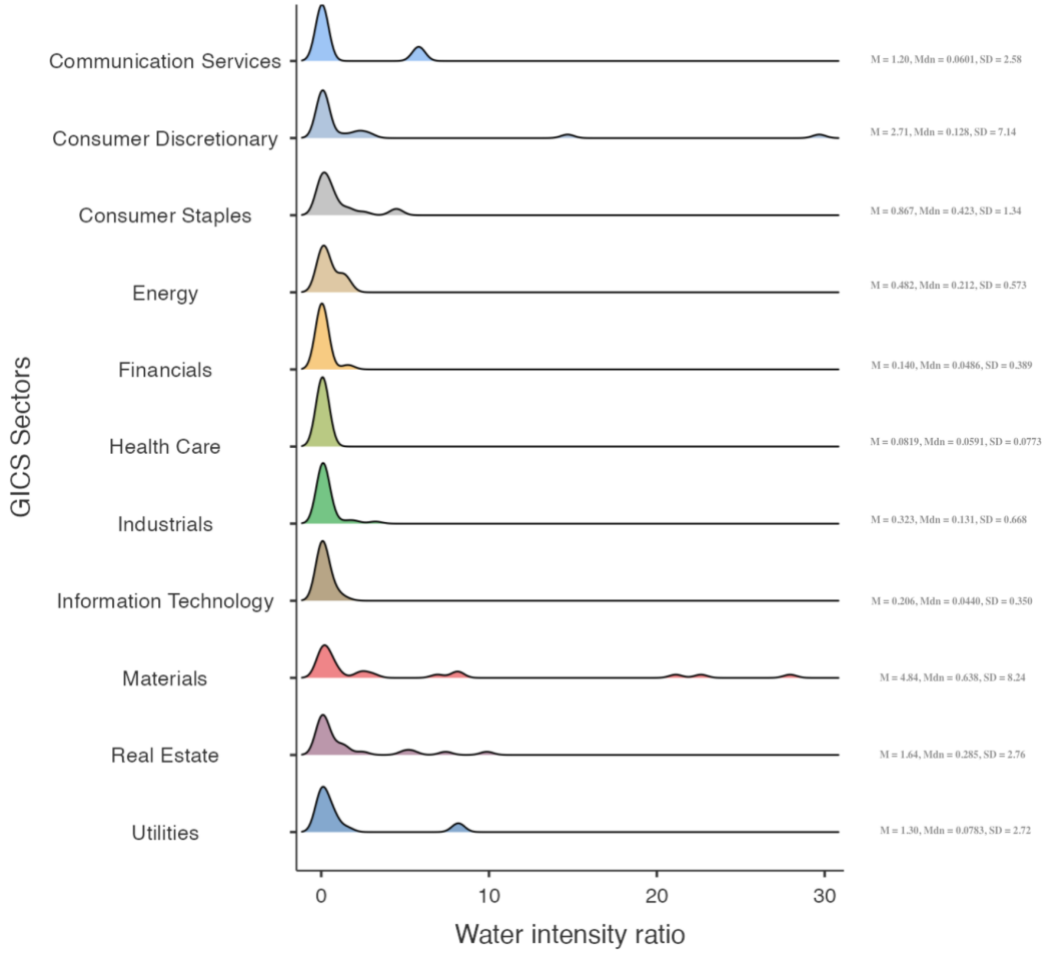

Figure 20. Water intensity ratio across sectors

The water intensity ratio is the subject of further analysis. Further analysis will be conducted to determine the effects this ratio has on financial performance.

3.4.2.6.3 Waste Intensity Ratio

The waste intensity ratio shows how efficient companies are at managing waste per dollar of operating revenue. The ratio decreases as waste efficiency increases. This factor aligns with SDG 12 when it comes to responsible consumption and production.

In order to calculate the waste intensity ratio, the *Total Waste* (MT)[45] reported in sustainability reports within the GRI framework has been divided by the *Operating Revenue* (measured in million dollars) reported by S&P 500 companies through 2021. The parameter *Total Waste* is reported in 224 companies in their sustainability reports. 100 companies did not report *Total Waste* in their sustainability reports.

In Fig. 21, the waste management performance in different sectors was analyzed. The figure shows a similar pattern to figure 20. Statistics indicate right-skewed distributions in all sectors. The highest mean is observed in the Utilities sector (M=0.0451) and the lowest in the Financials sector (M=4.22e-4). SD is the highest in the Consumer Discretionary sector (SD=0.209) and the lowest in the Communication Services sector (SD=4.56e-4). According to these results, the Consumer Discretionary sector is quite heterogeneous when it comes to waste management per dollar of operating revenue, while the Financials sector is quite homogeneous.

[45] There were some companies that did not report in MT. Since majority of companies reported in MT, others had to be converted into MT from their units. The Appendix 6 contains a table listing all units encountered during data collection.

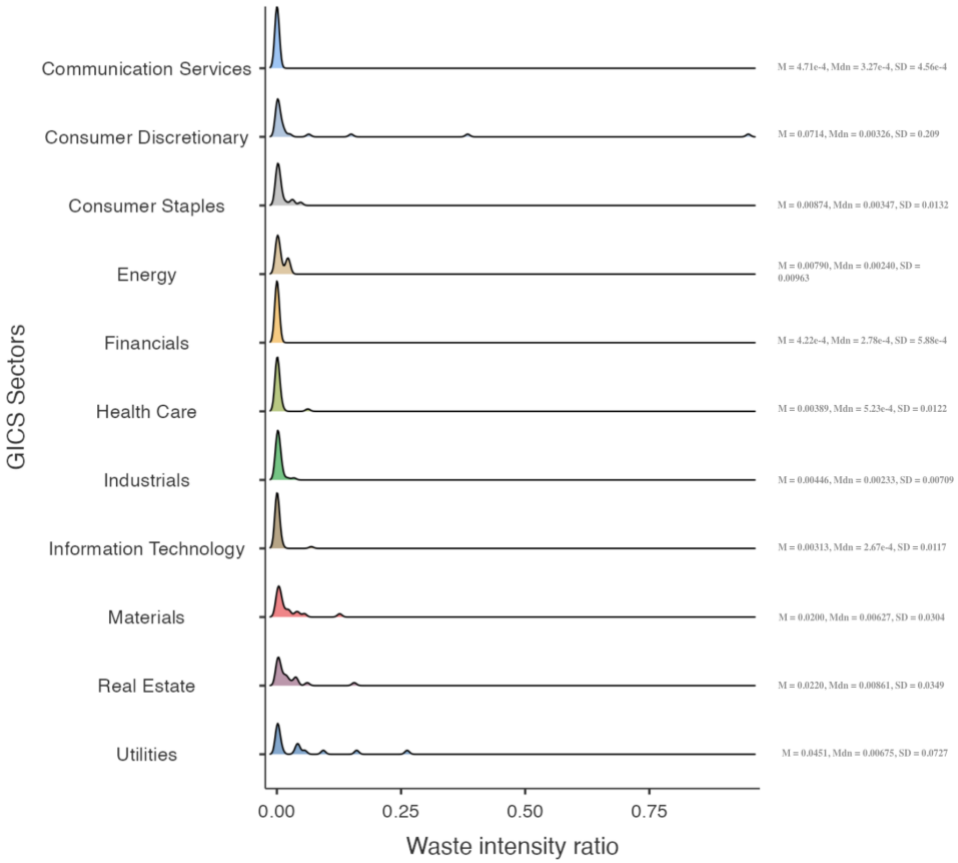

Figure 21. Waste intensity ratio across sectors

The waste intensity ratio will be further analyzed and its importance to financial performance among companies within and across sectors.

3.4.2.7 Climate Actions -SDG 13

The majority of companies analyzed in this project focus on SDG 13. Climate change and its impact are the main objectives of this goal. The majority of companies put effort into reducing the air pollution produced by their operations. Thus, in this project, *Scope 1, Scope 2.1 (market-based), Scope 2.2 (location-based),* and *Scope 3 as ratios* are considered to address this goal.

The figure (Fig. 22) depicts a range of activities and sectors contributing to greenhouse gas (GHG) emissions. These include energy-related emissions from power plants, vehicles, and industrial processes, industrial emissions from chemical reactions and manufacturing, agricultural emissions from rice cultivation and synthetic fertilizers, deforestation and land-use changes reducing carbon absorption, waste management emissions from landfills and waste treatment facilities, and transportation emissions from cars, trucks, airplanes, ships, and trains during fuel combustion.

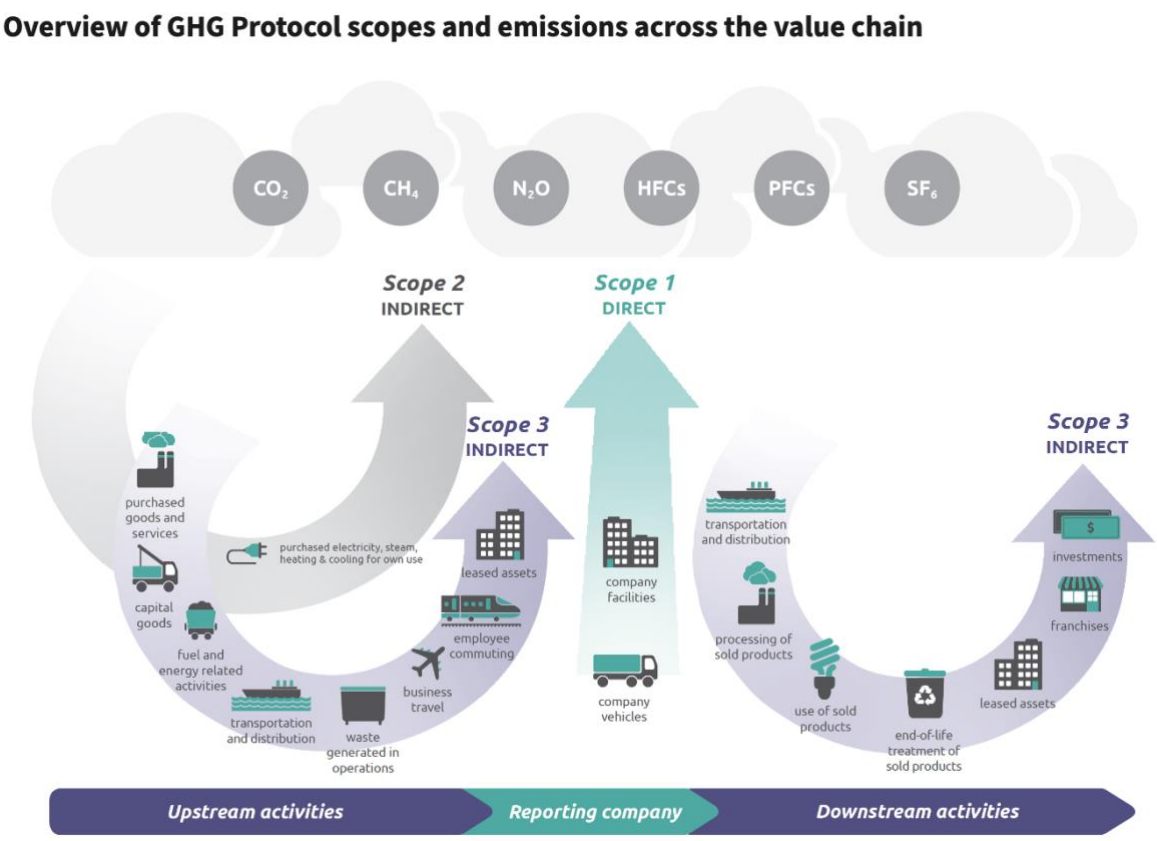

Figure 22. Different GHG Emission sources (Source: GHG Protocol (2013))

These ratios serve as important metrics for assessing and managing the impact of a company's direct and indirect operations on air pollution.

3.4.2.7.1 Scope 1 emissions intensity

A Scope 1 emission is a direct greenhouse gas (GHG) emission from a source controlled or owned by the company or organization (e.g., combustion of fuel in boilers, furnaces, and vehicles). Scope 1 is a crucial component of SDG 13 as it represents the level of direct emission that s company produces and releases in the air.

The Scope 1 in this project is presented as a ratio between the *Scope 1* measure in MT CO_2e[46] and *Operating Revenue* of a company. In relation to direct emissions, the lower the value of this ratio, the less impact a company has on air pollution. *Scope 1* is taken from companies' latest sustainability reports which use the GRI framework. 23 companies out of 324 did not report on this scope.

[46] There were some companies that did not report in MT CO_2e. Since majority of companies reported in MT CO_2e, others had to be converted in $MTCO_2e$ from their units. The Appendix 7 contains a table listing all units encountered during data collection.

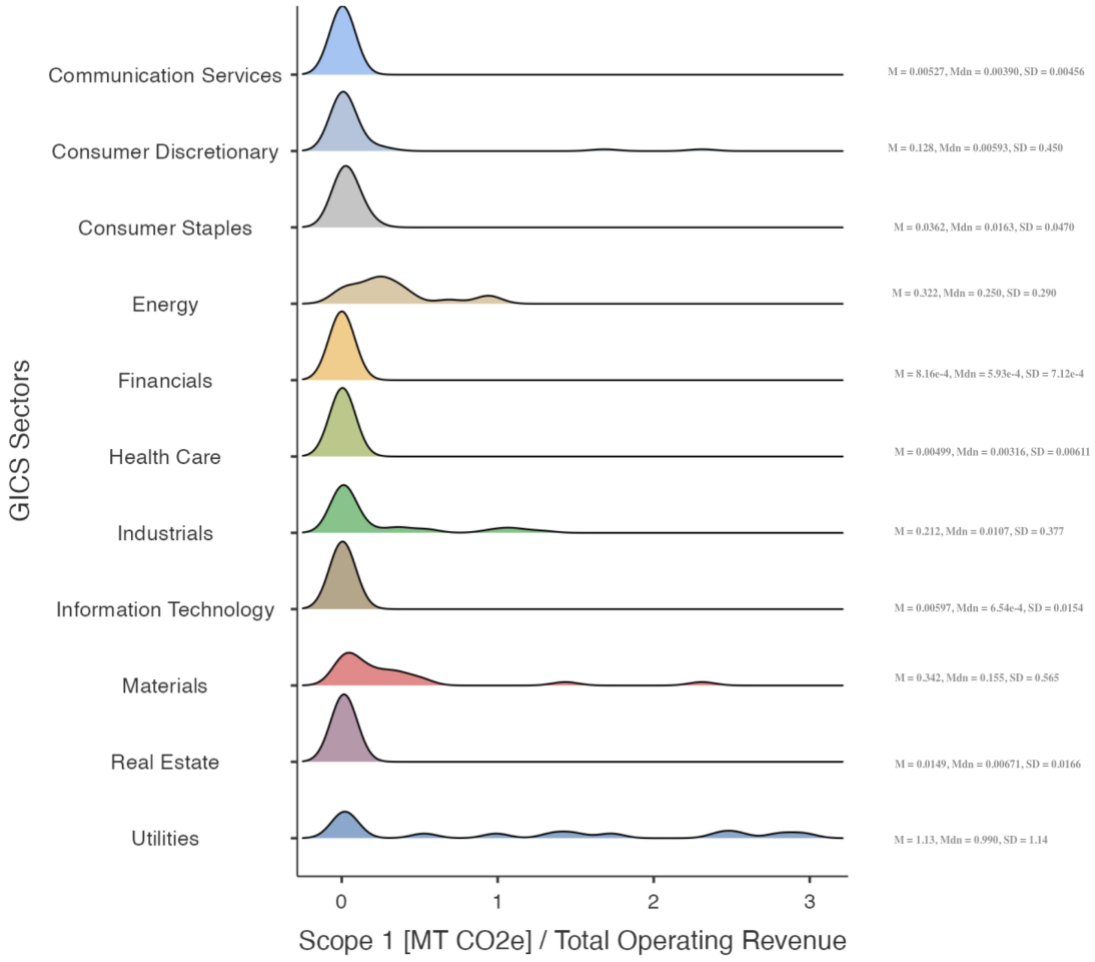

Figure 23. Scope 1 emissions intensity across sectors

Figure 23 represents an overview of the *Scope 1* ratio across different sectors. There is a right-skewed distribution in all sectors. The highest mean is observed in the Utilities sector (M=1.13) and the lowest in the Financials sector (M=8.16e-4). Standard deviation is the highest in Utilities sector (SD=1.14) indicating the highest level of heterogeneity between companies when it comes to Scope 1 emission per dollar of operating revenue. On the contrary, standard deviation is the lowest in Financials sector (SD=7.12e-4) indicating the high level of homogeneity between companies when it comes to Scope 1 emission per dollar of operating revenue.

Further studies will reveal how this factor affects the financial performance of a company and whether it is sector dependent.

3.4.2.7.2 Scope 2.1 (market-based) emissions intensity

GHG emissions resulting from the purchase of electricity, steam, heat, or cooling are classified as Scope 2. In spite of the fact that Scope 2 emissions are physically generated at the facilities where they are produced, they are accounted for in an organization's GHG inventory because they are a result of the organization's energy consumption. Market-based methods reflect emissions from electricity that

companies have purposely chosen. Scope 2 *(market-based)* is a crucial component of SDG 13 as it represents the level of indirect emission that s company produces and release in the air.

This project presents Scope 2.1 as a ratio between Scope 2.1 (in MT CO_2e)[48] and the *Operating Revenue* of a company. When it comes to indirect emissions, the lower this ratio, the less impact a company has on air pollution. *Scope 2.1* is taken from companies' latest sustainability reports which use the GRI framework. There were 58 companies out of 324 that did not report on this factor.

Figure 24 shows Scope 2.1 (market-based) GHGs across different sectors. All sectors have right-skewed distribution. The highest mean is observed in the Materials sector (M=0.130) and the lowest in the Financials sector (M=0.00293). The highest level of heterogeneity between companies with respect to Scope 2.1 per dollar of operating revenue has Consumer Discretionary sector (SD=0.240). The highest level of homogeneity between companies with respect to Scope 2.1 per dollar of operating revenue has Financials sector (SD=0.00329).

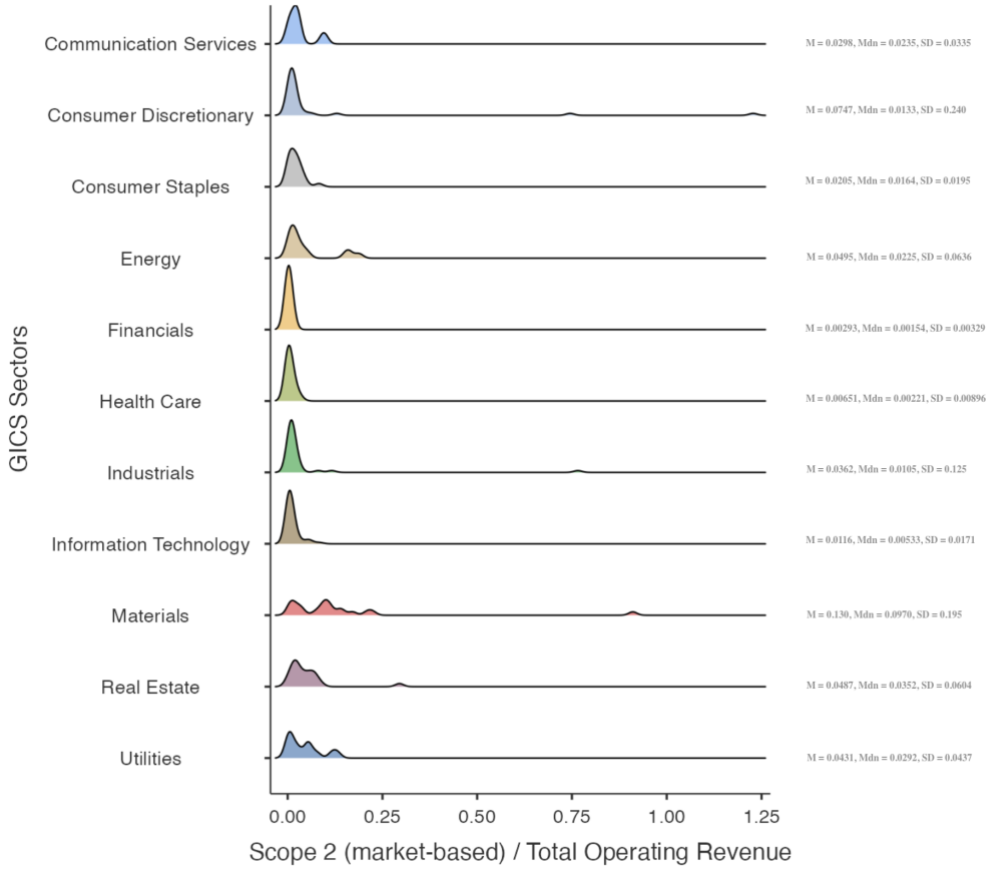

Figure 24. Scope 2.1 (market-based) emissions intensity across sectors

[48] There were some companies that did not report in MT CO_2e. Since majority of companies reported in MT CO_2e, others had to be converted to MT CO_2e from their units. The Appendix 7 contains a table listing all units encountered during data collection.

Scope 2.1 is subject to further analysis. Companies may achieve higher financial performance if they rely less on external contractors to run their businesses.

3.4.2.7.3 Scope 2.2 (location-based) emissions intensity

Based on the local grid area where the electricity is used, the Scope 2.2 (location-based) method calculates emissions. Using this method of calculation, we can obtain an average emissions intensity for the local electrical grid where the energy consumption occurs. The location-based method takes into account only the carbon intensity of the grid within the location of a company's operations. Scope 2 *(location-based)* is a crucial component of SDG 13 as it represents the level of indirect emission that a company produces and releases in the air.

The Scope 2.2 ratio is calculated as the ratio between *Scope 2.2* (in MT CO_2e)[49] and the *Operating Revenue* of a company. If a company has a low indirect emissions ratio, it will have less impact on air pollution. *Scope 2.2* is taken from companies' latest sustainability reports which use the GRI framework. Out of 324 companies, 86 companies did not report this factor. Compared to Scope 2.2 (location-based), Scope 2.1 (market-based) is the preferred reporting method among the sampled companies.

[49] There were some companies that did not report in MT CO_2e. Since majority of companies reported in MT CO_2e, others had to be converted in MT CO_2e from their units. The Appendix 7 contains a table listing all units encountered during data collection.

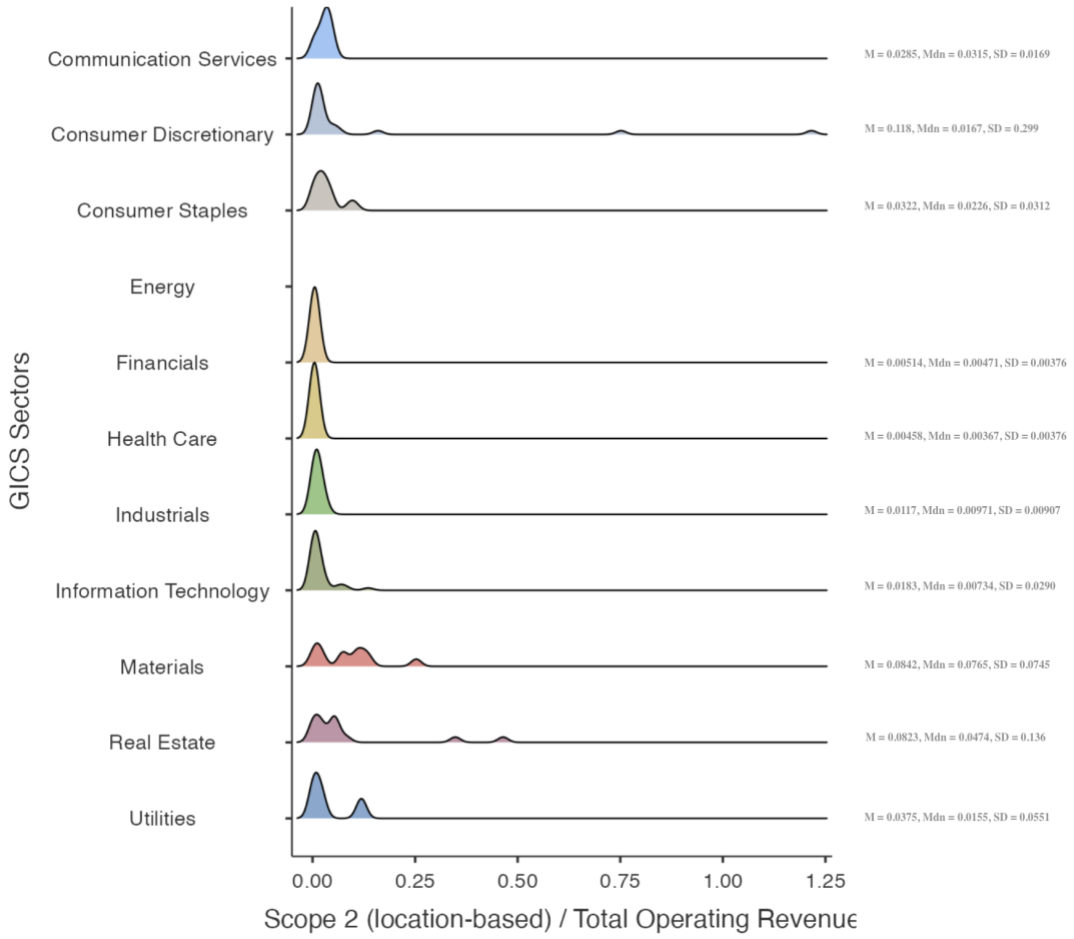

Figure 25. Scope 2.2 (location-based) emissions intensity across sectors

Figure 25 represents density distribution of Scope 2.2 (location-based) across different sectors. Except for Communication Services, all sectors have a right-skewed distribution. There is a left-skewed distribution in Communication Services. The highest mean is observed in the Consumer Discretionary sector (M=0.118) and the lowest in the Health Care sector (M=0.00458). SD is the highest in Consumer Discretionary sector (SD=0.299) and the lowest in Financials and Health Care sectors which reported identical values of 0.00376. In terms of Scope 2.2 per dollar of operating revenue, companies with smaller SDs are more homogeneous, while those with larger SDs are more heterogeneous. In addition, companies sampled in the Energy sector do not report Scope 2 using location-based method.

Since majority of sampled companies reported[50] on using the market-based method, this factor will not be further analyzed. It is important to note, however, that some companies report Scope 2 emissions using both methods (market-based and location-based). Further research could examine

[50] The market-based method was not used by 58 companies, and the location-based method was not used by 167 companies. Market-based method are therefore preferred by companies.

whether companies that report using both methods are more responsible financially and sustainably. Additionally, determining which method provides a more realistic picture of actual Scope 2 emissions, and how this relates to financial performance of a company could be a subject of the future study.

3.4.2.7.4 Scope 3 emissions intensity

Scope 3 emissions come from assets that do not belong to or are not controlled by the reporting organization but are indirectly impacted by the organization in its value chain. The Scope 3 emissions are those that do not fall within the Scope 1 and 2 boundaries of an organization. Value chain emissions, also referred to as Scope 3 emissions, account for the majority of greenhouse gas (GHG) emissions produced by an organization.[51] Scope 3 is a crucial component of SDG 13 as it represents the level of indirect emission that a company's products and/or services release in the air.

A company's Scope 3 ratio is calculated by dividing its *Scope 3* (in MT CO_2e)[52] by its *Operating Revenue*. Companies with low indirect (Scope 3) emissions ratio will have a lower impact on air pollution. A total of 86 companies out of 324 did not report on this scope. *Scope 3* is taken from companies' latest sustainability reports which use the GRI framework. The Scope 3 value was reported by some companies as a summed value, while by others as separate items in a table. Companies that reported as a separated items in a table, a total of 34, were manually summed.

[51] Taken from U.S. Environmental Protection Agency (n.d.)

[52] There were some companies that did not report in MT CO_2e. Since majority of companies reported in MT CO_2e, others had to be converted in MT CO_2e from their units. The Appendix 7 contains a table listing all units encountered during data collection.

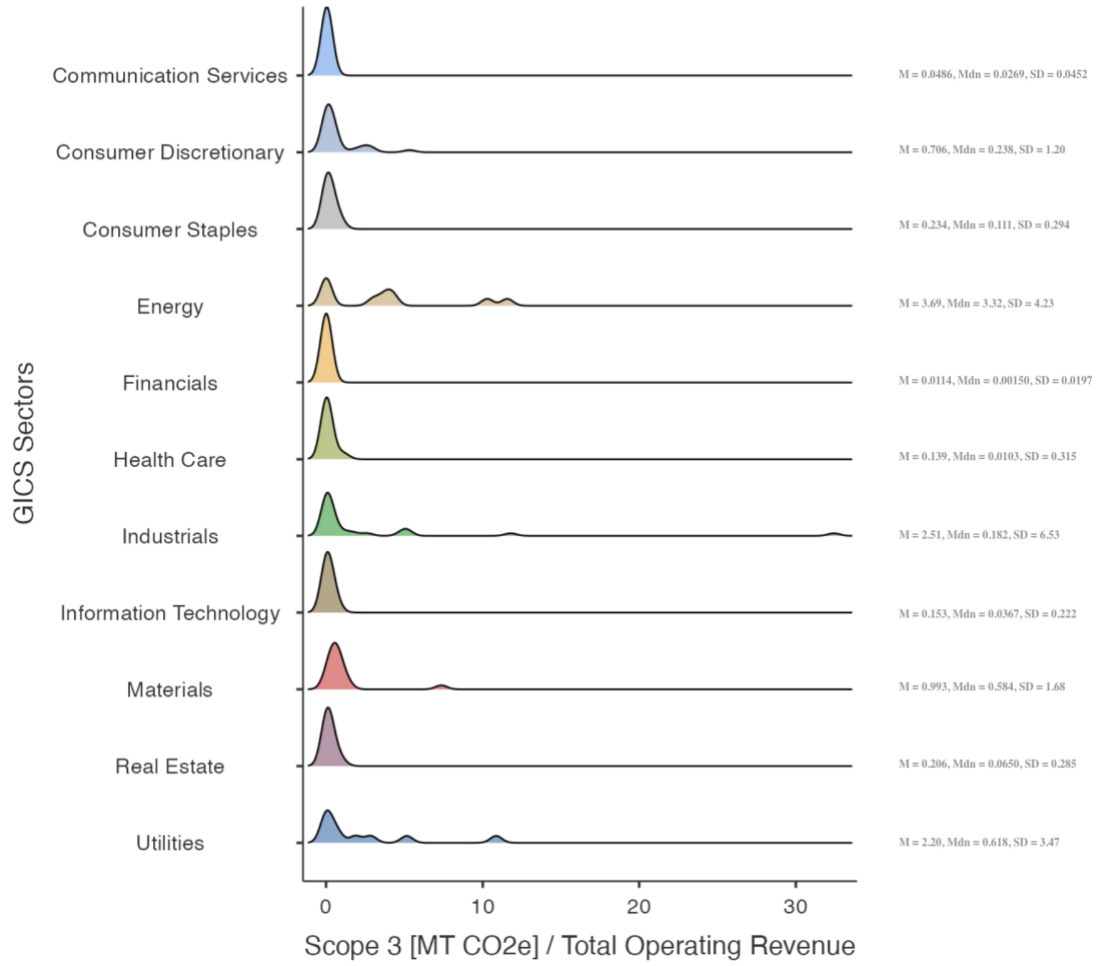

Figure 26. Scope 3 emissions intensity across sectors

All sectors have right-skewed distributions (Fig. 26). The highest mean is observed in the Energy sector (M=3.69) and the lowest in the Financials sector (M=0.0114). Among the sectors, the Industrials sector has the highest standard deviation (SD=6.53) and the Financials sector has the lowest (SD=0.0197). Regarding Scope 3, heterogeneity among companies is high in the Industrials sector and homogeneity is high in the Financials sector.

Further research will be conducted on how Scope 3 emission intensity affects a company's financial performance.

3.5 Data Analysis

In order to test whether sustainable performance is related to the financial performance of a company, 11 different GICS sectors were analyzed using three linear regression models.

To estimate how sustainable performance impacts financial performance, we employ the linear regression model. The basic model is presented as follows:

$$Y = b + m_1X + m_2X_1 + \ldots + m_nX_n$$

where, *Y* represents a dependent variable, *X* is an independent variable, *m* is the estimated slope (or the angle of the line on the X and Y coordinate), and *b* is the intercept. The following parameters taken from this model for further analysis are: p-value, adjusted R^2, and standard estimates (s.e).

By using linear regression analysis in *Jamovi* software (The Jamovi project, 2022), this study examines and analyzes the relationship between sustainable and financial performance by testing three different models. The following are descriptions of these models.

Dependent variables: CWI, ROA, ROE, TQ, WACC, FCF, GM, GP, YTD Return, and EBITDA.

Independent variables

SDGs = SDG	Energy Intensity Ratio = EIR
Number of Employees = En	Water Intensity Ratio = WIR
Pay-Ratio = PR	Waste Intensity Ratio = WsIR
Women in management = WM	Scope 1 ratio = S1R
Grid Electricity = GE	Scope 2 ratio = S2R
Renewable energy = RE	Scope 3 ratio = S3R

Linear regression formula for each dependent variable $= b + (m_1 \times SDGs) + (m_2 \times En) + (m_3 \times PR) + (m_4 \times WM) + (m_5 \times GE) + (m_6 \times RE) + (m_7 \times EIR) + (m_8 \times WIR) + (m_9 \times WsIR) + (m_{10} \times S1R) + (m_{11} \times S2R) + (m_{12} \times S3R)$

Various authors apply different approaches in handling multiple linear regression, by either simply reporting the results from the model as initially specified, or by augmenting the model through the removal of various predictors in order to improve the model parameters. In deciding which approach to apply in this study, three variations were tested to examine the variation in the results they produced.

The **first approach** was to keep all of the 12 predictors in the model, except where multicollinearity problems existed. The multicollinearity tests applied are explained below. 120 separate regression models were run using this approach: one for each of the 10 dependent variables, for each of the 11 GICS sectors as well as for the entire sample, 'overall'. This process resulted in 8 of 120 models (6.67%) being statistically significant at $p \leq 0.05$. Even in the significant models, many of the predictors were insignificant.

The **second approach** created the same 120 regression models as in the first approach, but then proceeded to remove predictors, one at a time, according to the highest predictor p value, until the overall model significance value fell below the $p \leq 0.05$ threshold. This approach, obviously, resulted in a higher proportion of the models reaching significance (76 of 120 or 63.33%), while many of the significant models still retained some insignificant predictors.

The **third approach** started as per the first approach and proceeded to remove predictors as per the second approach, but continued this process until all of the predictors remaining in the model were significant at the $p \leq 0.05$ level. It is methodologically interesting to note that proportion of the 120 models that reached significance did not change dramatically between the second (63.33%) and third approaches (65.83%, 79 of 120 models). Yet while the summary model statistics were similar, at the predictor level, the third approach has the benefit of only including significant predictors.

As a result of these comparative analyses, the third approach was applied throughout the regression analyses reported in the results section. Appendix 1, Appendix 2, and Appendix 3 present tables that provide detailed information of the results for each of the three approaches.

Model assumption checks

The strength of the linear model depends on the hypothesis that independent variables are not correlated (Buallay et al., 2019). Consequently, the analysis conducted two tests to ensure that the data in this study met the linearity assumptions.

The first test is the test for assessing multicollinearity. Multicollinearity tends to inflate the standard errors of estimated coefficients. VIF (variance inflation factor) is used to assess collinearity between independent variables. This test measures the effects of independent variables. According to Gujarati (2003), a VIF higher than 10 indicates serious problems with multicollinearity for the independent variable. In this study, VIF values in all models taken for further analysis are moderately correlated with VIF in the 1-2 range, which means the data do not suffer from serious collinearity issues.

The second test is the test for assessing autocorrelation. The Durbin–Watson (DW) test was used to test for autocorrelation in the study models. The DW statistic falls within a range of values, typically between 0 and 4. The range is important because it helps to interpret the results of the statistic. A DW value close to 2 suggests that there is no significant autocorrelation present in the data, indicating that the residuals are independent. If the DW value is less than 2, it indicates positive autocorrelation, meaning that there is a tendency for the residuals to be positively correlated with each other. On the

other hand, if the DW value is greater than 2, it suggests negative autocorrelation, implying that the residuals have a tendency to be negatively correlated with each other. In this study, DW values for the models are below 1. This indicates that there are no autocorrelation problems in the models that could affect the regression results. Therefore, standard estimates and p-values are used to test the hypotheses.

The results of these analyses are presented in the following section.

4 RESULTS AND DISCUSSION

4.1 Results by Sustainability Indicator

Each of the tables presented in this section show the aggregated results of 120 separate regression analyses. Specifically, 10 regression analyses, each one using a different measure of business performance as the dependent variable, were performed for each of the 11 sectors and for "all sectors": (10 dependent variables x 12 sector aggregates = 120). Each cell in the table, therefore, displays the outcome of a single regression analysis.

The section is structured by the sustainability indicators, rather than by sector or by the business performance measures. Accordingly, the cells in each table relate to the significance (p=) and the standardized estimate (s.e=) of the respective sustainability indicator in predicting each business outcome (rows) for each sector (columns):

- Blank cells indicate that the sustainability indicator in question was not a significant predictor of the respective business outcome in that sector.
- Populated cells indicate that the sustainability indicator was a significant predictor and show the p-value and the standardized estimate for the predictor from the model.
- The color-coding of the populated cells shows whether more sustainable performance is associated with better business performance (green) or worse business performance (red). This is determined by the valence of the standardized estimate, in consideration of the desirability of higher or lower values for both the sustainability indicator (discussed in the text) and the dependent variables (presented as + or – in the row headings).

4.1.1 The effect of Women in Management on sector performance

Higher female representation in management positions is associated with higher sustainable performance. As better financial performance is generally reflected by higher values of the dependent variables, positive coefficients in regression analyses indicate that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Table 4 summarizes the effect of women in management positions on financial performance across sectors. The proportion of women in management positions was not found to be a significant predictor of any business outcomes for any sectors except for sector 10 (Real Estate), where a positive effect was found on GP (Gross Profit). There was no effect of this sustainability indicator detected in the analysis of ALL sectors.

Table 4. The effect of Women in Management position on sector performance

Women in Manag.	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI												
FCF												
ROE												
TQ												
WACC												
YTD R												
GM												
GP										s.e = 0.196 p = 0.006		
ROA												
EBITDA												

In general, only one regression model indicated that having more women in management positions would lead to better business outcomes. Across all sectors, the effect was insignificant.

4.1.2 The effect of Grid Electricity on sector performance

Higher sustainable performance is associated with a lower percentage of grid electricity. As better financial performance is generally reflected by higher values of the dependent variables, negative coefficients in regression analyses indicate that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Table 5 summarizes the effect of grid electricity on financial performance across sectors. The percentage of grid electricity was not found to be a significant predictor of any business outcomes within sectors 1, 3, 4, 6, 7, 8, 9, and 11.

In the economywide analysis of ALL sectors, the analysis shows an unambiguously negative result: the use of less grid electricity negatively affects CWI, TQ, GM, and ROA.

On the other hand, a significant positive effect of being less dependent on grid electricity was found in sector 5 (Financials) on WACC.

In the other sectors, however, the use of less grid electricity has a mixed effect, with some metrics positively impacted and others negatively. In sector 2 (Discretionary), there is a positive effect on FCF, GP, and EBITDA but a negative effect on TQ. In sector 10 (Real Estate), there is a positive effect on WACC and GM but a negative effect on GP.

Table 5. The effect of grid electricity on sector performance

Grid Electricity	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI												s.e = 0.153 p = 0.046
FCF		s.e = - 0.443 p = 0.044										
ROE												
TQ		s.e = 0.567 p = 0.007										s.e = 0.175 p = 0.023
WACC					s.e = 0.787 p = 0.001					s.e = 0.960 p = 0.002		
YTD R												
GM										s.e = -0.687 p = 0.014		s.e = 0.224 p = 0.012
GP		s.e = - 0.497 p = 0.022								s.e = 0.847 p = 0.002		
ROA												s.e = 0.175 p = 0.025
EBITDA		s.e = - 0.541 p = 0.011										

At the individual sector level, a total of 6 regression models found a positive effect on business outcomes of using less grid electricity, while 2 models showed a negative impact on business outcomes. Across ALL sectors, using less grid electricity is associated with a clearly negative impact on business outcomes.

4.1.3 The effect of Renewable Energy on sector performance

In accordance with the SDGs, a higher proportion of energy sourced from renewable sources reflects more sustainable performance. As better financial performance is generally reflected by higher values of the dependent variables, positive coefficients in the regression analyses indicate that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Table 6 summarizes the effect of renewable energy use on financial performance across sectors. The empty columns for sectors 1, 2, 3, 4, and 11 indicate that renewable energy use was not found to be a significant predictor of any business outcomes in those sectors, nor in the economywide analysis of ALL sectors. While this result suggests that businesses in these sectors are not rewarded by the market for using renewable energy, it also suggests that shifting to renewable energy is not detrimental to business outcomes.

Two sectors show an unambiguously negative result: the use of renewable energy negatively affects GM in sector 9 (Materials) and WACC in sector 10 (Utilities).

The other sectors show somewhat mixed results, in that the use of renewable energy impacts some business metrics positively and others negatively. In sector 5 (Financials), there is a positive effect on ROA but a negative effect on ROE. In sector 7 (Industrials), there is a positive effect on WACC but a negative effect on ROA. Finally, the use of renewable energy proved to be a significant predictor for many business outcomes in the regression models for sector 8 (IT): the impact was positive for CWI, FCF, GP, and EBITDA, but negative for YTD Return.

Table 6. The effect of renewable energy on sector performance

Renewable Energy	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI								s.e = 0.535 p = 0.006				
FCF								s.e = 0.549 p = 0.008				
ROE					s.e = - 0.624 p = 0.040							
TQ												
WACC							s.e = - 0.483 p = 0.050			s.e = 0.505 p = 0.022		
YTD R								s.e = - 0.426 p = 0.048				
GM									s.e = - 0.532 p = 0.041			
GP								s.e = 0.605 p = 0.003				
ROA					s.e = 0.844 p = 0.001		s.e = - 0.689 p = 0.003					
EBITDA								s.e = 0.538 p = 0.010				

Overall, 6 regression models found the use of renewable energy to have a positive effect on business outcomes, and 5 models found negative impacts. Outside of IT, however, negative effects (4 cases) dominate over positive effects (2 case). Across all sectors, the effect was insignificant.

4.1.4 The effect of Employees on sector performance

Having more employees is associated with more sustainable performance according to SDG 8. A positive coefficient in the regression analyses therefore indicates that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Across sectors, Table 7 summarizes that the number of employees was not found to be a significant predictor of any business outcomes in sectors 1, 3, 4, 5, 6, 7, 8, 9, and 11.

Two sectors show positive results: having more employees positively impacts CWI and GP in sector 2 (Consumer Discretionary) and GP in sector 10 (Real Estate).

In the economywide analysis of ALL sectors, the results show an unambiguously negative result: having more employees negatively effects GM.

Table 7. The effect of the number of employees on sector performance

# of Employees	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI		s.e = 0.649 p = <.001										
FCF												
ROE												
TQ												
WACC												
YTD R												
GM												s.e = - 0.175 p = 0.011
GP		s.e =0.494 p = 0.006								s.e = 0.280 p = 0.009		
ROA												
EBITDA												

For individual sectors, the 3 significant findings were unambiguously positive: having more employees positively affects business outcomes. When considering the economywide of all sectors, having more employees negatively affects business outcomes.

4.1.5 The effect of SDGs on sector performance

Aligning with more SDGs is associated with higher sustainable performance. A positive coefficient in regression analyses therefore indicates that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Across sectors, Table 8 summarizes the effect of aligning with SDGs on financial performance. Aligning with SDGs was not found to be a significant predictor of business outcomes in sectors 1, 3, 4, 6, 7, 8, 9, and 11.

One sector shows positive results: aligning with more SDGs positively effects ROA and EBITDA in sector 5 (Financials). In the economywide analysis of ALL sectors and in sector 2 (Consumer Discretionary), the results show an unambiguously negative result: aligning with more SDGs negatively effects GM and GP in sector 2 (Consumer Discretionary). In the economywide analysis of all sectors, the negative effect is detected on GM.

Mixed results are found in sector 10 (Real Estate), where aligning with more SDGs has positive effect on YTD Return, but a negative effect on GP.

Table 8. The effect of SDGs on sector performance

# of SDGs	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI												
FCF												
ROE												
TQ												
WACC												
YTD R										s.e = 0.421 p = 0.036		
GM		s.e = - 0.557 p = 0.003										s.e = - 0.173 p = 0.008
GP		s.e = - 0.341 p = 0.049								s.e = - 0.571 p = 0.004		
ROA					s.e = 0.519 p = 0.023							
EBITDA					s.e = 0.999 p = 0.021							

There were 3 regression models that found that aligning with more SDGs positively effects business outcomes and 4 models that found that aligning with more SDGs negatively effects business outcomes. Negative effects (4 cases) dominate over positive effects (3 cases). Across all sectors, the effect was negative.

4.1.6 The effect of Pay-Ratio on sector performance

Having a lower Pay-Ratio is associated with higher sustainable performance. A negative coefficient in the regression analyses therefore indicates that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Across sectors, Table 9 summarizes the effect of Pay-Ratio on financial performance. Pay ratio was not found to be a significant predictor of any business outcomes in any sectors (nor in the economywide analysis of ALL sectors) except sector 10 (Real Estate).

One sector shows negative results: having a lower pay-ratio negatively effects GP in sector 10 (Real Estate).

Table 9. The effect of Pay-Ratio on sector performance

Pay-Ratio	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI												
FCF												
ROE												
TQ												
WACC												
YTD R												
GM												
GP										s.e = 0.284 p = 0.008		
ROA												
EBITDA												

Only one regression model found that having a lower pay-ratio negatively affects business outcomes. Across all sectors, the effect was insignificant.

4.1.7 The effect of Energy Intensity Ratio on sector performance

Lower energy intensity ratios are associated with higher sustainable performance. As better financial performance is generally reflected by higher values of the dependent variables, negative coefficients in regression analyses indicate that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Across sectors, Table 10 summarizes the effects of energy intensity ratios on financial performance. Energy intensity ratios were not found to be a significant predictor of business outcomes in sectors 1, 5, 10, and 11.

Four sectors and the economywide analysis of ALL sectors show positive results: lower energy intensity ratios positively impact YTD Return in sector 6 (Health Care), ROA in sector 7 (Industrials), ROE in sector 8 (IT), and GM in sector 9 (Materials). The positive result in the economywide analysis of ALL sectors is documented to affect GM favorably.

The other sectors show somewhat mixed results, in that a lower energy intensity impacts some business metrics positively and others negatively. There is a positive effect on FCF in sector 2 (Consumer Discretionary), but a negative impact on ROE. There is a positive effect on GM in sector 3 (Consumer Staples), but a negative effect on YTD Return. A positive impact is seen on GM in sector 4 (Energy), but negative effects are seen on CWI, FCF, GP, and EBITDA.

Table 10. The effect of the energy intensity ratio on sector performance

Energy Intensity	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI				s.e = 0.704 p = 0.003								
FCF		s.e = - 0.381 p = 0.017		s.e = 0.682 p = 0.005								
ROE		s.e = 0.667 p = <.001						s.e = - 0.643 p = 0.020				
TQ												
WACC												
YTD R			s.e = 0.602 p = 0.002			s.e = - 0.477 p = 0.014						
GM			s.e = - 0.461 p = 0.023	s.e = - 0.563 p = 0.029					s.e = - 0.533 p = 0.011			s.e = - 0.248 p = 0.001
GP				s.e = 0.723 p = 0.002								
ROA							s.e = - 0.324 p = 0.047					
EBITDA				s.e = 0.698 p = 0.004								

There were 8 regression models that found that lower energy intensity ratio positively effects business outcomes, and 6 models that found that the low energy intensity ratio negatively effects business outcomes. Excluding the Energy sector, a positive effect dominates. Across all sectors, the effect was positive.

4.1.8 The effect of Water Intensity Ratio on sector performance

The lower water intensity ratio reflects higher sustainable performance. As better financial performance is generally reflected by higher values of the dependent variables, negative coefficients in the regression analyses indicate that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Table 11 summarizes the effect the water intensity ratio has on business performance across sectors. The empty columns for sectors 1, 3, 5, and 6 indicate that the water intensity ratio was not found to be a significant predictor of any business outcomes in those sectors.

Six sectors show unambiguously negative results: lower water intensity ratios negatively affect ROE in sector 1 (Consumer Discretionary), YTD Return in sector 4 (Energy), GM in sector 7 (Industrials), ROE in sector 8 (IT), YTD Return in sector 9 (Materials), and YTD Return in sector 11 (Utilities).

Positive results were seen in one sector: being more water efficient positively affects GP in sector 10 (Real Estate).

In the economywide analysis of ALL sectors, a lower water intensity impacts some business metrics positively and others negatively. The positive impact is recorded on GM, while the negative impact is recorded on YTD Return.

Table 11. The effect of Water Intensity Ratio on sector performance

Water Intensity	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI												
FCF												
ROE		s.e = 0.865 p = <.001						s.e = 0.581 p = 0.032				
TQ												
WACC												
YTD R				s.e = 0.636 p = 0.011					s.e = 0.583 p = 0.004		s.e = 0.557 p = 0.025	s.e = 0.129 p = 0. 047
GM							s.e = 0.376 p = 0.029					s.e = - 0.148 p = 0.027
GP										s.e = - 0.393 p = 0.003		
ROA												
EBITDA												

For individual sectors, lower water intensities benefitted business outcomes in one regression model, but negatively impacted business outcomes in six models. The number of negative effects (6 cases) outweighs the number of positive effects (1 case). Mixed results were found in the analysis of ALL sectors.

4.1.9 The effect of Waste Intensity Ratio on sector performance

Lower waste intensity ratios reflect better sustainable performance. As better financial performance is generally reflected by higher values of the dependent variables, negative coefficients in the regression analyses indicate that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Table 12 summarizes the effect the waste intensity ratio has on business performance across sectors. The empty columns for sectors 2, 3, 5, 6, 9, and 10 indicate that the waste intensity ratio was not found to be a significant predictor of any business outcomes in those sectors.

Two sectors (as well as the economywide analysis of ALL sectors) show unambiguously negative results: lower values of waste intensity ratio negatively affect ROE and TQ in sector 8 (IT) and GM in sector 11 (Utilities). In the economywide analysis of ALL sectors, the negative effect of the waste intensity ratio was recorded on GM.

It was found that a lower waste intensity ratio can positively affect TQ in sector 1 (Communication Services), WACC in sector 4 (Energy), and YTD Return in sector 7 (Industrials).

Table 12. The effect of Waste Intensity Ratio on sector performance

Waste Intensity	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI												
FCF												
ROE								s.e = 0.728 p = <.001				
TQ	s.e = - 0.951 p = 0.049							s.e = 0.413 p = 0.015				
WACC				s.e = 0.757 p = 0.007								
YTD R							s.e = - 0.363 p = 0.045					
GM											s.e = 0.673 p = 0.004	s.e = 0.159 p = 0.038
GP												
ROA												
EBITDA												

For individual sectors, three regression models showed an improvement in business outcomes from greater waste efficiency, while three regression models showed a negative impact. Across all sectors, the effect was negative.

4.1.10 The effect of Scope 1 (as a ratio) on sector performance

A lower Scope 1 ratio indicates more sustainable performance. As better financial performance is generally reflected by higher values of the dependent variables, negative coefficients in the regression analyses indicate that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Table 13 summarizes the effect the Scope 1 ratio has on business performance across sectors. The empty columns for sectors 1, 4, 5, and 11 indicate that the Scope 1 ratio was not found to be a significant predictor of any business outcomes in those sectors.

One sector shows an unambiguously negative results: lower values of Scope 1 ratio negatively affect YTD Return in sector 9 (Materials).

Three sectors show an unambiguously positive effect, in that lower Scope 1 ratios have a positive effect on WACC and YTD return in sector 6 (Health Care), ROA in sector 7 (Industrials), and WACC in sector 8 (IT).

The other sectors have somewhat mixed results, as lower Scope 1 ratios have a positive impact on some business metrics and a negative impact on others. In sector 2 (Consumer Discretionary), there is a positive effect on FCF but a negative effect on ROE and ROA. In sector 3 (Consumer Staples), there is a positive effect on YTD Return but a negative effect on GM. In sector 10 (Real Estate), there is a positive effect on GP but a negative effect on CWI, TQ, and EBITDA. Finally, the lower Scope 1 ratios were found to be a significant predictor of many business outcomes in the economy-wide regression models: the impact was positive for TQ, GM, and ROA, but negative for YTD Return.

Table 13. The effect of Scope 1 ratio on sector performance

Scope 1 ratio	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI										s.e = 0.451 p = 0.036		
FCF		s.e = - 0.455 p = 0.004										
ROE		s.e = 0.680 p = <.001										
TQ										s.e = 0.712 p = 0.004		s.e = - 0.142 p = 0.014
WACC						s.e = 0.504 p = 0.006		s.e = 0.307 p = 0.023				
YTD R			s.e = 0.492 p = 0.013			s.e = - 0.589 p = <.001			s.e = 0.458 p = 0.042			s.e = 0.170 p = 0.003
GM			s.e = - 0.529 p = 0.007									s.e = - 0.133 p = 0.029
GP										s.e = - 0.635 p = 0.003		
ROA		s.e = 0.864 p = 0.007					s.e = - 0.416 p = 0.009					s.e = - 0.143 p = 0.016
EBITDA										s.e = 0.491 p = 0.031		

For individual sectors, seven regression models showed a positive effect of lower Scope 1 ratios on business outcomes, while seven regression models showed a negative impact. In the economywide analysis of ALL sectors, the three positive findings outweigh the one negative finding.

4.1.11 The effect of Scope 2 (as a ratio) on sector performance

Having a lower Scope 2 ratio (market-based) indicates better sustainable performance. As better financial performance is generally reflected by higher values of the dependent variables, negative coefficients in the regression analyses indicate that sustainable performance corresponds to better financial performance (the reverse is true for WACC).

Table 14 summarizes the effect the Scope 2 ratio has on business performance across sectors. The empty columns for sectors 1, 3, 4, 5, 6, 7, 8, 9, and 11, as well as the economy-wide analysis of ALL sectors indicate that the Scope 2 ratio was not found to be a significant predictor of any business outcomes in those sectors.

However, two sectors show positive results: lower values of Scope 2 ratio positively affect ROA in sector 2 (Consumer Discretionary) and TQ in sector 10 (Real Estate).

Table 14. The effect of Scope 2 ratio (market-based) on sector performance

Scope 2 ratio	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI												
FCF												
ROE												
TQ										s.e = - 0.950 p = 0.010		
WACC												
YTD R												
GM												
GP												
ROA		s.e = - 1.108 p = 0.001										
EBITDA												

Two regression models showed an increase in business outcomes when the Scope 2 ratio (market-based) was lower. Scope 2 ratio (market-based) had no negative effects on business outcomes. Across all sectors, the effect was insignificant.

4.1.12 The effect of Scope 3 (as a ratio) on sector performance

Lower Scope 3 ratios indicate more sustainable performance. Since better financial performance is generally reflected by higher values of the dependent variables, negative coefficients in regression analyses indicate that sustainable performance is associated with better financial performance (the reverse is true for WACC).

Table 15 summarizes the effect of the Scope 3 ratio on business performance across sectors. The empty columns for sectors 1, 4, 5, 6, 7, and 11 indicate that the Scope 3 ratio was not found to be a significant predictor of any business outcomes in those sectors.

Four sectors, as well as the economy-wide analysis of ALL sectors, show unambiguously negative results: lower Scope 3 ratios negatively affect ROE and ROA in sector 2 (Consumer Discretionary), YTD Returns in sector 3 (Consumer Staples), and YTD Returns in sector 9 (Materials). Multiple negative effects of the Scope 3 ratio were recorded in sector 10 (Real Estate) on CWI, TQ, GM, and EBITDA. In the economy-wide analysis of ALL sectors, the Scope 3 ratio negatively impacted YTD returns.

Another sector appears to have mixed results, with a lower Scope 3 ratio positively affecting some business metrics and negatively affecting others. Sector 8 (IT) has a positive effect on WACC and YTD Return, but a negative effect on ROA.

Table 15. The effect of Scope 3 ratio on sector performance

Scope 3 ratio	1	2	3	4	5	6	7	8	9	10	11	ALL
CWI										s.e = 0.491 p = 0.038		
FCF												
ROE		s.e = 0.539 p = 0.007										
TQ										s.e = 0.468 p = 0.020		
WACC								s.e = 0.399 p = 0.005				
YTD R			s.e = 0.470 p = 0.032					s.e = - 0.340 p = 0.018	s.e = 0.488 p = 0.047			s.e = 0.133 p = 0.040
GM										s.e = 0.539 p = 0.021		
GP												
ROA		s.e = 0.558 p = 0.004						s.e = 0.406 p = 0.005				
EBITDA										s.e = 0.465 p = 0.040		

For individual sectors, two regression models showed a positive effect of lower Scope 3 ratios on business outcomes, while nine regression models showed a negative impact. Outside of the IT sector, only negative effects were recorded as significant. Eight regression models showed a negative effect on business outcomes. In the economywide analysis of ALL sectors, the only significant effect was negative.

4.1.13 Summary of the results by Sustainability Indicators

Table 16 presents a concise overview of the results based on Sustainability Indicators, offering valuable insights into the impacts observed across the 11 sectors under analysis. Within this table, a comprehensive breakdown is provided for each indicator, encompassing a holistic account of the positive, negative, and insignificant results that emerged.

By meticulously documenting the outcomes, this summary enables a comprehensive understanding of the effects that sustainability indicators have on the sectors. The net effect, derived from the difference between positive and negative impacts, is also included, providing a consolidated measure that reveals the overall outcome for each indicator.

Table 16. Summary of the results by Sustainability Indicators (11 sectors)

Sustainability Indicator (11 sectors)	Insignificant	Positive	Negative	Net Effect
Women in Management	109	1	/	1
Grid Electricity	102	6	2	4
Renewable Energy	99	6	5	1
Number of Employees	107	3	/	3
Alignment to SDGs	104	3	3	0
Pay-Ratio	109	/	1	-1
Energy Intensity Ratio	97	7	6	1
Water Intensity Ratio	103	1	6	-5
Waste Intensity Ratio	104	3	3	0
Scope 1 emissions intensity	96	7	7	0
Scope 2 emissions intensity	108	2	/	2
Scope 3 emissions intensity	99	2	9	-7
	93.7 %	3.12 %	3.18 %	

The data encompassed in this analysis is derived from a comprehensive study involving a total of 110 models, which yielded a total of 1320 results. Among these results, 41 (3.12%) were identified as positive, indicating the beneficial influence of sustainability indicators on the sectors. Conversely, 42 (3.18%) were deemed negative, highlighting potential challenges or adverse effects associated with specific sustainability indicators. The majority of the results, amounting to 1237 (93.7%), were determined to be insignificant, suggesting a potential for improvement of these indicators.

Furthermore, an additional summary is provided in the table (Table 17) which focuses on the economy-wide results across all sectors. This summary highlights the aggregate findings from a total of 120 models, generating 1400 results. Within this dataset, 5 (4.16%) results were categorized as positive, indicating favorable outcomes at the macroeconomic level. Conversely, 10 (8.33%) results were identified as negative, suggesting potential drawbacks or challenges arising from certain sustainability indicators. The remaining 87.5 % of the results were deemed insignificant, indicating a lack of

substantial impact on the economy-wide level, yet suggesting a potential for improvement of these indicators.

Table 17. Summary of the results by Sustainability Indicators (economy-wide across all sectors)

Sustainability Indicator (across all sectors)	Insignificant	Positive	Negative	Net Effect
Women in Management	120	/	/	0
Grid Electricity	116	/	4	-4
Renewable Energy	120	/	/	0
Number of Employees	119	/	1	-1
Alignment to SDGs	119	/	1	-1
Pay-Ratio	120	/	/	0
Energy Intensity Ratio	119	1	/	0
Water Intensity Ratio	118	1	1	0
Waste Intensity Ratio	119	/	1	-1
Scope 1 emissions intensity	116	3	1	2
Scope 2 emissions intensity	120	/	/	0
Scope 3 emissions intensity	119	/	1	-1
	87.5%	4.16 %	8.33 %	

These comprehensive summaries offer a valuable overview of the diverse impacts and significance of sustainability indicators across sectors and the broader economy. The findings serve as a foundation for further exploration and analysis, allowing for informed decision-making and strategic planning regarding sustainability practices.

4.2 Results by GICS Sector

This section summarizes the results presented on a sector-by-sector basis. The effect of each sustainability indicator on business performance is categorized as being either positive, negative, or neutral. The effect is deemed positive if the number of positively affected financial metrics outnumber those negatively affected. Conversely, the effect is deemed negative if the number of negatively affected financial metrics outnumber those positively affected. For this reason, a positive (negative) categorization should not be interpreted as unanimously positive (negative) effect, but rather a net positive (negative) effect. The neutral category contains those sustainability indicators which either had no significant effect on any financial metrics or which affected an equal number of financial metrics positively as negatively. The specific financial metrics affected by the respective sustainability indicator are given in parentheses. Where both positive and negative effects occur, the positively affected financial metrics are presented first, with the negatively affected ones following 'vs.'.

4.2.1 Communication Services (sector 1)

No significant effect:

Women in management	Energy intensity	Water intensity
Grid electricity	Employees	Scope 1 intensity
Renewable electricity	SDG alignment	Scope 2 intensity
	Pay ratios	Scope 3 intensity

Positive effect:

Waste intensity (TQ)

Negative effect: none

The Communication Services sector showed a positive effect of one sustainability indicator on financial performance and no negative effects. While it would be desirable to find more positive effects, as this would suggest that businesses in the sector are incentivized to act sustainably, the more important finding is the lack of any financial impediments to sustainable performance. In this context, the finding of no relationship between financial performance and most of the sustainable performance indicators can be interpreted as meaning that there is no reason for Communication Service companies not to perform more sustainably.

4.2.2 Consumer Discretionary (sector 2)

No significant effect:

Women in management	Renewable electricity	Waste intensity
Pay ratios	Energy intensity (FCF vs. ROE)	

Positive effect:

Grid electricity (FCF, GP, EBITDA vs. TQ)	Employees (CWI, GP)	Scope 2 intensity (ROA)

Negative effect:

SDG alignment (GM, GP)	Scope 1 intensity (FCF vs. ROA, ROE)	Scope 3 intensity (ROA, ROE)
Water intensity (ROE)		

The Consumer Discretionary sector showed a positive effect of three sustainability indicators on financial performance and no effect by a further five sustainability indicators. This suggests that firms in this sector can work towards these eight societal objectives without impediment. Unfortunately, it appears that sustainable performance related to four indicators negatively affects the financial performance of firms in the Consumer Discretionary sector. As these include important environmental metrics such as water efficiency and GHG emissions, it appears that regulatory and/or market reforms will be needed to incentivize the responsible behavior of firms on these issues.

4.2.3 Consumer Staples (sector 3)

No significant effect:

Women in management	Employees	Waste intensity
Grid electricity	SDG alignment	Water intensity
Renewable electricity	Pay ratios	Scope 2 intensity
Energy intensity (GM vs. YTD Return)	Scope 1 intensity (GM vs. YTD Return)	

Positive effect: none

Negative effect:

Scope 3 intensity (YTD Return)

The analysis of the Consumer Staples sector revealed an absence of any discernible impact on eleven sustainability indicators, implying that firms operating within this sector can actively pursue and strive towards these objectives without facing significant barriers or constraints. This suggests that there are no financial obstacles preventing companies in the Consumer Staples sector from adopting and implementing sustainable practices that align with these eleven indicators. However, it is important to note that sustainable performance related to one specific indicator has been found to have a negative influence on the financial performance on firms in the Consumer Staples sector. This negative effect is evident in relation to Scope 3 emissions, which encompass indirect greenhouse gas emissions that occur throughout a company's value chain, including the activities of suppliers and customers. The presence of this adverse impact indicates that addressing Scope 3 emissions may pose challenges to the financial performance of companies in the sector. Despite this isolated negative correlation between financial performance and one sustainability indicator, it is significant to interpret the overall finding of no relationship between financial performance and the majority of the sustainability indicators. This interpretation suggests that there is no inherent reason for companies in the Consumer Staples sector to refrain from implementing more sustainable practices.

4.2.4 Energy (sector 4)

No significant effect:

Women in management	Employees	Scope 1 intensity
Grid electricity	SDG alignment	Scope 2 intensity
Renewable electricity	Pay ratios	Scope 3 intensity

Positive effect:

Waste intensity (WACC)

Negative effect:

Energy intensity (GM vs. CWI, FCF, GP, EBITDA)

Water intensity (YTD Return)

When analyzing the Energy sector, the study reveals that one specific sustainability indicator has a positive impact on financial performance, while no significant effects are observed for nine other sustainability indicators. This finding implies that companies operating within the Energy sector can actively pursue and work towards these ten societal objectives without encountering substantial obstacles or hindrances. The absence of any discernible impact on most of the sustainability indicators suggests that firms in this sector have the freedom to focus on these objectives without compromising their financial performance. However, it is important to note that sustainable performance related to two specific indicators within the Energy sector has been found to have a negative influence on the

financial performance of firms. These indicators encompass significant environmental metrics such as energy and water efficiency, highlighting their critical role in sustainability efforts. The negative impact on financial performance suggests that addressing these indicators requires attention and action, as they pose challenges to the profitability and economic success of companies in the Energy sector. Given the importance of these indicators and their impact on both sustainability and financial performance, it becomes evident that fostering responsible behavior among firms in the Energy sector will necessitate the implementation of regulatory and/or market reforms. These reforms should aim to incentivize and encourage companies to prioritize and proactively address energy and water efficiency, among other related issues. By establishing appropriate regulations and market mechanisms, policymakers and stakeholders can create an environment that promotes responsible behavior and supports the achievement of these critical sustainability objectives.

4.2.5 Financials (sector 5)

No significant effect:

Women in management	Employees	Scope 1 intensity
Energy intensity	Pay ratios	Scope 2 intensity
Renewable electricity (ROA vs ROE)	Water intensity	Scope 3 intensity

Positive effect:

SDG alignment (ROA, EBITDA)

Grid electricity (WACC)

Negative effect: none

The analysis of the Financials sector reveals that two specific sustainability indicators have a positive impact on financial performance and no negative effects are observed. While it would be desirable to identify more positive effects, the absence of negative indicators suggests that businesses within the Financials sector are incentivized to prioritize sustainable practices. This finding highlights the sector potential to contribute to broader sustainability objectives. However, it is important to note that the more significant finding lies in the absence of any financial impediments to sustainable performance within the Financials sector. This implies that businesses in this sector are not facing financial obstacles or constraints when pursuing sustainability objectives. Further, this interpretation holds significant implications, as it suggests that Financials companies have the freedom and opportunity to integrate sustainable practices into their operations without compromising their financial viability. This finding provides a compelling rationale and encouragement for Financials companies to prioritize sustainable performance.

Although the Financials sector shows a positive impact of two sustainability indicators on financial performance and no negative effects, the absence of financial impediments to sustainable performance is the more noteworthy finding. It emphasizes the importance of embracing sustainability practices in the sector and indicates that there is no inherent reason for Financials companies to refrain from prioritizing sustainability.

4.2.6 Health Care (sector 6)

No significant effect:

Women in management	Employees	Waste intensity
Renewable electricity	Pay ratios	Scope 2 intensity
Grid electricity	Water intensity	Scope 3 intensity
SDG alignment		

Positive effect:

Energy intensity (YTD Return)

Scope 1 intensity (WACC, YTD Return)

Negative effect: none

The analysis of the Health Care sector reveals that two specific sustainability indicators have a positive impact on financial performance, while no significant effects are observed for ten other sustainability indicators. This indicates that firms operating within the Health Care sector can actively pursue and work towards these twelve societal objectives without encountering substantial obstacles or hindrances. While it would be desirable to identify more positive effects, the absence of negative indicators is an encouraging sign. This finding highlights the sector's potential to further advance its sustainable performance.

Similar to the Financial sector, the absence of financial impediments to sustainable performance within the Health Care sector is a noteworthy finding. This suggests that Health Care companies have the opportunity to perform more sustainably without facing significant financial obstacles or constraints. It emphasizes the importance of embracing sustainability practices in the sector and highlights that there is no inherent reason for Health Care companies to refrain from prioritizing sustainability.

4.2.7 Industrials (sector 7)

No significant effect:

Women in management	Employees	Scope 2 intensity
Grid electricity	Pay ratios	Scope 3 intensity
Renewable electricity	SDG alignment	
(WACC vs. ROA)		

Positive effect:

Energy intensity (ROA)
Waste intensity (YTD Return)
Scope 1 intensity (ROA)

Negative effect:

Water intensity (GM)

The analysis of the Industrials sector reveals that three specific sustainability indicators have a positive impact on financial performance, while no significant effects are observed for eight other sustainability indicators. This finding suggests that companies operating within this sector have the opportunity to actively pursue and work towards these eleven societal objectives without facing substantial obstacles or hindrances. The lack of discernible impact on most of the sustainability indicators further implies that firms in the Industrials sector have the flexibility to concentrate on these objectives without compromising their overall performance.

However, it is crucial to note that sustainable performance related to one specific indicator within the Industrials sector has been found to negatively influence the financial performance of firms. This particular indicator encompasses significant environmental metrics, such as water efficiency. The adverse impact on financial performance highlights the need to address this indicator diligently, as it poses challenges to the profitability and economic success of companies in the sector. Given the importance of this indicator and its dual impact on sustainability and financial performance, it becomes apparent that fostering responsible behavior among firms in the Industrials sector will require the implementation of regulatory and/or market reforms. These reforms should aim to incentivize and encourage companies to prioritize and proactively address water efficiency issue. By establishing appropriate regulations and market mechanisms, policymakers and stakeholders can create an environment that promotes responsible behavior and facilitates the achievement of crucial sustainability objectives within the Industrials sector.

4.2.8 Information Technology (sector 8)

No significant effect:

Women in management	Employees
Grid electricity	Pay ratios
SDG alignment	Scope 2 intensity

Positive effect:

Energy intensity (ROE)	Scope 1 intensity (WACC)
Renewable electricity	Scope 3 intensity
(CWI, FCF, GP, EBITDA vs. YTD Return)	(WACC, YTD Return vs. ROA)

Negative effect:

Water intensity (ROE)

Waste intensity (ROE, TQ)

The analysis of the IT sector reveals that four specific sustainability indicators positively influence business performance, while the results for six other sustainability indicators are not significant. This discovery suggests that companies operating within this sector have the opportunity to actively pursue and contribute to these ten societal objectives without encountering significant obstacles or barriers. The absence of notable impacts on most of the sustainability indicators further indicates that IT firms have the flexibility to prioritize these objectives without compromising their financial performance.

However, it is important to emphasize that two specific indicators within the IT sector negatively affect firms' financial performance. These indicators encompass significant environmental metrics, specifically water and waste intensity ratios. The adverse impact on financial performance underscores the need to address these indicators diligently, as they pose challenges to company's' profitability and economic success. It is evident that encouraging responsible behavior among IT firms requires the implementation of regulatory and/or market reforms when considering the significance of these indicators and the dual impact they have on sustainability and financial performance. By addressing these issues proactively, these reforms should motivate and incentivize companies to prioritize water and waste efficiency. By establishing suitable regulations and market mechanisms, policymakers and stakeholders can foster an environment that promotes responsible behavior and facilitates the achievement of critical sustainability objectives within the IT sector.

4.2.9 Materials (sector 9)

No significant effect:

Women in management	Employees	Waste intensity
SDG alignment	Pay ratios	Scope 2 intensity
Grid electricity		

Positive effect:

Energy intensity (GM)

Negative effect:

Renewable electricity (GM)	Scope 1 intensity (YTD Return)
Water intensity (YTD Return)	Scope 3 intensity (YTD Return)

Analyzing the Materials sector reveals that one sustainability indicator positively affects financial performance, while seven other sustainability indicators have no significant influence. This discovery indicates that companies operating within this sector possess the opportunity to actively pursue and advance toward these eight societal objectives without encountering significant hurdles or impediments. The absence of a noticeable impact on the majority of sustainability indicators further suggests that firms in the Materials sector have the freedom to prioritize these objectives without compromising their financial performance.

Nevertheless, it is essential to underscore that sustainable performance associated with four specific indicators within the Materials sector demonstrates a detrimental effect on the financial performance of firms. These indicators encompass crucial environmental metrics, including water efficiency, greenhouse gas (GHG) emissions, and the utilization of renewable sources for electricity generation. Companies in the sector need to conscientiously address these indicators in order to maintain profitability and economic prosperity, since these factors adversely affect financial performance.

Considering the significance of these indicators and their dual impact on both sustainability and financial performance, it becomes evident that promoting responsible behavior among firms in the Materials sector will necessitate the implementation of regulatory and/or market reforms. These reforms should be designed to incentivize and motivate companies to prioritize and proactively tackle issues related to water efficiency, GHG emissions, and renewable electricity generation.

By establishing appropriate regulations and implementing effective market mechanisms, policymakers and stakeholders can foster an environment that fosters responsible behavior and facilitates the attainment of critical sustainability objectives within the Materials sector.

4.2.10 Real Estate (sector 10)

No significant effect:

Energy intensity	Waste intensity
SDG alignment (YTD Return vs. GP)	

Positive effect:

Women in management (GP)	Employees (GP)	Scope 2 intensity (TQ)
Grid electricity	Water intensity (GP)	
(WACC, GM vs. GP)		

Negative effect:

Pay ratios (GP)	Scope 1 intensity (GP vs. CWI, TQ, EBITDA)
Renewable electricity (WACC)	Scope 3 intensity (CWI, TQ, GM, EBITDA)

The Real Estate sector showed a positive effect of five sustainability indicators on financial performance and no effect by a further three sustainability indicators. This suggests that firms in this sector can work towards these eight societal objectives without impediment. Unfortunately, it appears that sustainable performance related to four indicators negatively affects the financial performance of firms in the Real Estate sector. Given that these indicators encompass significant environmental metrics like generating electricity from renewable sources and greenhouse gas (GHG) emissions, it becomes evident that fostering responsible behavior among firms concerning these matters will necessitate the implementation of regulatory and/or market reforms.

4.2.11 Utilities (sector 11)

No significant effect:

Women in management	Pay ratios	Scope 3 intensity
Renewable electricity	Grid electricity	Scope 1 intensity
SDG alignment	Energy intensity	Scope 2 intensity
Employees		

Positive effect: none

Negative effect:

Water intensity (YTD Return)	Waste intensity (GM)

The analysis of the Utilities sector revealed an absence of any discernible impact on ten sustainability indicators, implying that firms operating within this sector can actively pursue and strive towards these objectives without facing significant barriers or constraints. This suggests that there are no inherent obstacles preventing companies in the Utilities sector from adopting and implementing sustainable practices that align with these ten indicators. However, it is important to note that sustainable performance related to two specific indicators has been found to have a negative influence on the financial performance of firms in the Utilities sector. This negative effect is specifically evident in relation to water and waste intensity ratios. Despite two negative correlations between financial performance and two sustainability indicators, it is significant to interpret the overall finding of no relationship between financial performance and the majority of the sustainability indicators. This interpretation suggests that there is no inherent reason for companies in the Utilities sector to refrain from implementing more sustainable practices. However, it is important to note that fostering responsible behavior among the Utilities firms concerning water and waste efficiency matters will necessitate the implementation of regulatory and/or market reforms.

4.2.12 Across all sectors (ALL)

No significant effect:

Women in management	Pay ratios	Scope 2 intensity
Renewable electricity	Water intensity (GM vs. YTD Return)	

Positive effect:

Energy intensity (GM)	Scope 1 intensity (TQ, GM, ROA vs. YTD Return)

Negative effect:

SDG alignment (GM)	Scope 3 intensity (YTD Return)
Employees (GM)	Waste intensity (GM)
Grid electricity (CWI, TQ, GM, ROA)	

The findings of the study of economy-wide analysis of ALL sectors indicate a positive effect of two sustainability indicators on financial performance and no effect by a further five sustainability indicators. Consequently, it suggests that companies operating across all these sectors can actively pursue and align themselves with these seven sustainability indicators without facing any significant obstacles or hindrances. However, the study also reveals that five other sustainability indicators had no discernible effect on the business performance of firms in the economy-wide analysis of ALL sectors. These negative effects are specifically evident in relation to SDG alignment, waste intensity, employees, grid electricity, and GHG emissions.

In order to foster the adoption of sustainable practices and mitigate the adverse impact on financial performance, it becomes apparent that a combination of regulatory measures and market-based

incentives will be necessary. By implementing appropriate reforms, policymakers and stakeholders can create an environment that encourages firms across all 11 sectors to prioritize and proactively address the important environmental challenges associated with SDG alignment, waste intensity, employees, grid electricity, and GHG emissions. Such actions would not only benefit individual companies but also contribute to broader societal objectives related to sustainability and environmental conservation.

4.2.13 Summary of the results by GISC sectors

A comprehensive overview of the outcomes based on GICS sectors is presented in Table 18. This table offers a succinct summary that highlights the positive and negative effects associated with each sector. A thorough account of both the favorable and unfavorable impacts is provided, allowing for a balanced assessment of the sector-specific outcomes. Additionally, the net effect resulting from the difference between positive and negative effects is also included, providing a consolidated measure of the overall impact within each sector.

Table 18. Summary of the results by GISC sectors

Sector	Positive	Negative	Net Effect
Sector 1 (Communication Services)	1	0	1
Sector 2 (Consumer Discretionary)	8	9	-1
Sector 3 (Consumer Staples)	2	3	-1
Sector 4 (Energy)	2	5	-3
Sector 5 (Financials)	4	1	3
Sector 6 (Health Care)	3	0	3
Sector 7 (Industrials)	4	2	2
Sector 8 (IT)	8	5	3
Sector 9 (Materials)	1	4	-3
Sector 10 (Real Estate)	8	11	-3
Sector 11 (Utilities)	0	2	-2
ALL Sectors	5	10	-5

From the net effect can be seen that the IT sector had the highest number of positive effects compared to negative, whereas the Real Estate sector had the highest number of negative effects compared to positive ones.

4.3 Results of Hypothesis Testing

Results discussed in the previous sections indicate the impact of each sustainability performance metric the various financial performance measure across each of the GICS sectors. In light of that information, this section provides answers on the hypotheses stated in 3.1.

Female representation in management positions

H_0: Female representation in management is not associated with financial performance

H_1: Female representation in management is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology (IT), Materials, and Utilities sectors. Nor can the null hypothesis be rejected for the economy as a whole: 'ALL sectors'. Based on the statistical analyses conducted, there is insufficient evidence to support the idea that female representation in management is associated with financial performance in these sectors. Thus, any observed patterns or differences in financial performance are deemed more likely to be influenced by factors other than gender representation.

The null hypothesis (H_0) is rejected for the Real Estate sector, however, where H_1 is accepted given the evidence of an association between female representation in management and financial performance. In this specific sector, the available data suggests that companies with higher female representation in management tend to exhibit better financial performance.

It is crucial to note that these conclusions drawn at the sector-level of aggregation, and therefore may not hold for individual firms with distinctive organizational cultures and which face specific market dynamics. Therefore, generalizations about the relationship between gender representation in management and financial performance should be made cautiously, and further research is required in order to interpret the effect sizes, and to understand the reasons for the variable findings across different sectors.

Reliance on grid electricity

H_0: Reliance on grid electricity is not associated with financial performance

H_1: Reliance on grid electricity is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Consumer Staples, Energy, Health Care, Industrials, Information Technology (IT), Materials, and Utilities sectors. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that reliance on grid electricity is associated with financial performance in these sectors.

However, in the Consumer Discretionary, Financials, and Real Estate sectors, as well as economy-wide across all sectors, the null hypothesis is rejected, and H_1 is accepted. This suggests that the statistical analysis conducted in these sectors, as well as the overall economy across all sectors, provided evidence supporting the association between reliance on grid electricity and financial performance. In the Consumer Discretionary and Real Estate sectors, as well as economy-wide across all sectors, and based on the available data, companies that have a lower dependency on grid electricity display a combination of positive and negative impacts on financial performance. Only in the Financials sector, the available data indicate that companies with lower reliance on grid electricity tend to exhibit better financial performance.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as industry characteristics, energy policies, technological advancements, and specific operational practices may influence the relationship between reliance on grid electricity and financial performance. Further research may be required to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

The energy sourced from renewable sources

H_0: The energy sourced from renewable sources is not associated financial performance

H_1: The energy sourced from renewable sources is associated financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Consumer Discretionary, Consumer Staples, Energy, Health Care, and Utilities sectors. Nor can the null hypothesis be rejected for the economy as a whole: 'ALL sectors'. Based on the statistical analysis conducted, there is insufficient evidence to support the assertion that the energy sourced from renewable sources is associated with financial performance in these sectors. Thus, it can be concluded that the energy sourced from renewable sources is not significantly associated with financial performance in these sectors. Other factors, such as market conditions, industry dynamics, specific business strategies, or operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Financials, Industrials, IT, Materials, and Real Estate sectors, the null hypothesis is rejected, and H_1 is accepted. This suggests that the statistical analysis conducted in these sectors provided evidence supporting the association between the energy sourced from renewable sources and financial performance. Within the Financials, Industrials, and IT sectors, companies that rely more on renewable energy sources demonstrate a mixed influence on financial performance, as indicated by the available data. In the Materials and Real Estate sectors, the available data indicate that companies that rely more on renewable energy sources tend to exhibit worse financial performance.

It is important to note that these conclusions are sector-specific and are based on the available data and statistical analysis conducted. Factors such as industry characteristics, energy policies, technological advancements, and specific operational practices may influence the relationship between the energy sourced from renewable sources and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

The number of employees

H_0: The number of employees is not associated with financial performance

H_1: The number of employees is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Consumer Staples, Energy, Health Care, Financials, Industrials, Information Technology (IT), Materials, and Utilities sectors. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that the number of employees is associated with financial performance in these sectors. Therefore, it can be concluded that the number of employees is not significantly associated with financial performance in these sectors. Other factors, such as industry dynamics, market conditions, management practices, or specific operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Consumer Discretionary, Real Estate sectors, and economy-wide across all sectors, the null hypothesis is rejected, and H_1 is accepted. This suggests that the statistical analysis conducted in these sectors and across the broader economy provided evidence supporting the association between the number of employees and financial performance. In the Consumer Discretionary and Real Estate sectors, the available data indicates that companies with a higher number of employees tend to exhibit better financial performance. Across all sectors, a higher number of employees tend to exhibit worse financial performance.

It is important to recognize that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as industry characteristics, company size, labor market conditions, productivity levels, or specific business models may influence the relationship between the number of employees and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

Reporting on SDGs

H_0: Reporting on SDGs is not associated with financial performance

H_1: Reporting on SDGs is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Consumer Staples, Energy, Health Care, Industrials, Information Technology (IT), Materials, and Utilities sectors. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that reporting on Sustainable Development Goals (SDGs) is associated with financial performance in these sectors. Therefore, it can be concluded that reporting on SDGs is not significantly associated with financial performance in these sectors. Other factors, such as industry dynamics, market conditions, specific business strategies, or operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Consumer Discretionary, Financials, and Real Estate sectors, as well as economy-wide across all sectors, the null hypothesis is rejected, and H_1 is accepted. This suggests that the statistical

analysis conducted in these sectors and across the broader economy provided evidence supporting the association between reporting on SDGs and financial performance. In the Consumer Discretionary, and Real Estate sectors, as well as economy-wide across all sectors, the available data indicates that companies actively reporting on their alignment with the SDGs tend to exhibit worse financial performance. In the Financials sector, companies actively reporting on their alignment with the SDGs tend to exhibit better financial performance on some indicators.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as industry characteristics, company values, and practices, stakeholder expectations, or specific sustainability initiatives may influence the relationship between reporting on SDGs and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

Pay-ratio

H_0: Pay-ratio is not associated with financial performance

H_1: Pay-ratio is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Consumer Discretionary, Financials, Consumer Staples, Energy, Health Care, Industrials, Information Technology (IT), Materials, and Utilities sectors. Nor can the null hypothesis be rejected for the economy as a whole: 'ALL sectors'. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that pay-ratio is associated with financial performance in these sectors. Therefore, it can be concluded that pay-ratio is not significantly associated with financial performance in these sectors. Other factors, such as industry dynamics, market conditions, management practices, or specific operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Real Estate sector, the null hypothesis is rejected, and H_1 is accepted. This suggests that the statistical analysis conducted in the Real Estate sector provided evidence supporting the association between pay-ratio and financial performance. In this case, the available data indicates that companies with lower pay disparities between executives and employees in the Real Estate sector tend to exhibit worse financial performance.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as industry characteristics, company culture, corporate governance practices, or specific compensation policies may influence the relationship between pay-ratio and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

Energy intensity

H_0: Energy intensity is not associated with financial performance

H_1: Energy intensity is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Financials, Real Estate, and Utilities sectors. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that energy intensity is associated with financial performance in these sectors. Therefore, it can be concluded that energy intensity is not significantly associated with financial performance in these sectors. Other factors, such as market conditions, industry dynamics, specific business strategies, or operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Consumer Discretionary, Consumer Staples, Energy, Health Care, Industrials, IT, and Materials sectors, as well as economy-wide across all sectors, the null hypothesis is rejected, and H_1 is accepted. This suggests that the statistical analysis conducted in these sectors and across the broader economy provided evidence supporting the association between energy intensity and financial performance. In the Health Care, Industrials, IT, and Materials sectors, as well as economy-wide across all sectors, the available data indicates that companies with lower energy intensity, indicating higher energy efficiency, tend to exhibit better financial performance. In the Consumer Discretionary, Consumer Staples, and Energy sectors, the available data indicates that companies with lower energy intensity, indicating higher energy efficiency, tend to exhibit worse financial performance.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as industry characteristics, energy costs, technological advancements, sustainability initiatives, or specific operational practices may influence the relationship between energy intensity and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

Water intensity

H_0: Water intensity is not associated with financial performance

H_1: Water intensity is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Consumer Staples, Financials, and Health Care sectors. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that water intensity is associated with financial performance in these sectors. Therefore, it can be concluded that water intensity is not significantly associated with financial performance in these sectors. Other factors, such as market conditions, industry dynamics, specific business strategies, or operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Consumer Discretionary, Energy, Industrials, IT, Materials, Real Estate, and Utilities sectors, as well as economy-wide across all sectors, the null hypothesis is rejected, and H_1 is accepted.

This suggests that the statistical analysis conducted in these sectors and across the broader economy provided evidence supporting the association between water intensity and financial performance. In the Consumer Discretionary, Energy, Industrials, IT, Materials, and Utilities, the available data indicates that companies with lower water intensity, indicating higher water efficiency, tend to exhibit worse financial performance. In the Real Estate sector as well as in economy-wide across all sectors, the available data indicates that companies with lower water intensity, indicating higher water efficiency, tend to exhibit better financial performance.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as industry characteristics, water availability, water costs, technological advancements, sustainability initiatives, or specific operational practices may influence the relationship between water intensity and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

Waste intensity

H_0: Waste intensity is not associated with financial performance

H_1: Waste intensity is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: the Consumer Discretionary, Consumer Staples, Materials, Real Estate, Financials, and Health Care sectors. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that waste intensity is associated with financial performance in these sectors. Therefore, it can be concluded that waste intensity is not significantly associated with financial performance in these sectors. Other factors, such as market conditions, industry dynamics, specific business strategies, or operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Communication Services, Energy, Industrials, Information Technology (IT), Utilities sectors, as well as economy-wide across all sectors, the null hypothesis is rejected, and H_1 is accepted. This suggests that the statistical analysis conducted in these sectors and across the broader economy provided evidence supporting the association between waste intensity and financial performance. In the Communication Services, Energy, and Industrials sectors, the available data indicates that companies with lower waste intensity, indicating better waste management practices, tend to exhibit better financial performance. In the Information Technology (IT) and Utilities sectors, as well as economy-wide across all sectors, the available data indicates that companies with lower waste intensity, indicating better waste management practices, tend to exhibit worse financial performance.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as industry characteristics, waste management regulations, sustainability initiatives, operational practices, or specific waste reduction strategies may influence the relationship between waste intensity and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

Scope 1 emissions intensity

H_0: Scope 1 emissions intensity is not associated with financial performance

H_1: Scope 1 emissions intensity is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Energy, Financials, and Utilities sectors. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that Scope 1 emissions intensity is associated with financial performance in these sectors. Therefore, it can be concluded that Scope 1 emissions intensity is not significantly associated with financial performance in these sectors. Other factors, such as market conditions, industry dynamics, specific business strategies, or operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Consumer Discretionary, Consumer Staples, Health Care, Industrials, Information Technology (IT), Materials, and Real Estate sectors, as well as economy-wide across all sectors, the null hypothesis is rejected, and H_1 is accepted. This indicates that the statistical analysis conducted in these sectors and across the broader economy provided evidence supporting the association between Scope 1 emissions intensity and financial performance. In the Consumer Discretionary, Consumer Staples, Materials, and Real Estate sectors, as well as economy-wide across all sectors, the available data suggests that companies with lower emissions intensity tend to exhibit worse financial performance. However, the available data shows that in Health Care, Industrials, and IT sectors, companies with lower emissions intensity tend to exhibit better financial performance.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as industry characteristics, regulatory frameworks, consumer preferences, sustainability initiatives, or specific emission reduction strategies may influence the relationship between Scope 1 emissions intensity and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

Scope 2 emissions intensity

H_0: Scope 2 emissions intensity is not associated with financial performance

H_1: Scope 2 emissions intensity is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Consumer Staples, Health Care, Industrials, Information Technology (IT), Materials, Energy, Financials, Utilities sectors. Nor can the null hypothesis be rejected for the economy as a whole: 'ALL sectors'. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that Scope 2 emissions intensity is associated with financial performance in these sectors. Therefore, it can be concluded that Scope 2 emissions intensity is not significantly associated with financial performance in these sectors. Other factors, such as market conditions, industry dynamics, specific business strategies, or operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Consumer Discretionary and Real Estate sectors, the null hypothesis is rejected, and H_1 is accepted. This indicates that the statistical analysis conducted in these sectors provided evidence supporting the association between Scope 2 emissions intensity and financial performance. In these sectors, companies with lower Scope 2 emissions intensity tend to exhibit better financial performance.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as energy sourcing, renewable energy adoption, emission reduction initiatives, regulatory frameworks, or specific industry dynamics may influence the relationship between Scope 2 emissions intensity and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

Scope 3 emissions intensity

H_0: Scope 3 emissions intensity is not associated with financial performance

H_1: Scope 3 emissions intensity is associated with financial performance

The null hypothesis (H_0) cannot be rejected for the following sectors: Communication Services, Energy, Financials, Health Care, Industrials, and Utilities sectors. Based on the statistical analysis conducted, there is insufficient evidence to support the claim that Scope 3 emissions intensity is associated with financial performance in these sectors. Therefore, it can be concluded that Scope 3 emissions intensity is not significantly associated with financial performance in these sectors. Other factors, such as market conditions, industry dynamics, specific business strategies, or operational variables, may have a more substantial impact on financial performance within these sectors.

However, in the Consumer Discretionary, Consumer Staples, IT, Materials, and Real Estate sectors, as well as economy-wide across all sectors, the null hypothesis is rejected, and H_1 is accepted. This indicates that the statistical analysis conducted in these sectors and across the broader economy provided evidence supporting the association between Scope 3 emissions intensity and financial performance. In the Consumer Discretionary, Consumer Staples, Materials, and Real Estate sectors, as well as economy-wide across all sectors, companies with lower emissions intensity in their value chains tend to exhibit worse financial performance. The IT sector is the only sector where companies with lower Scope 3 emissions intensity in their value chains tend to exhibit better financial performance.

It is important to note that these conclusions are sector-specific and economy-wide, based on the available data and statistical analysis conducted. Factors such as supply chain management, sustainable procurement practices, stakeholder engagement, emission reduction initiatives, or specific industry dynamics may influence the relationship between Scope 3 emissions intensity and financial performance. Further research may be necessary to gain a more comprehensive understanding of these associations in different sectors and across the broader economy.

5 LIMITATIONS AND RESEARCH RECOMMENDATIONS

The study has certain limitations that should be acknowledged, and which lead to recommendations for future research:

1. For reasons of data accessibility, this study focuses solely on companies reporting in compliance with the GRI framework, which restricted the sample from considering all of the S&P 500 firms. The inclusion of companies reporting according to alternative sustainability frameworks such as SABS and/or TCFD would enlarge the sample and provide for a more comprehensive analysis. As different frameworks have different reporting requirements, it is possible that certain types of firms are attracted to GRI, rather than others, and that these qualitative differences between firms could impact the findings of the analyses performed.
2. The S&P 500 companies are large, American-listed companies. This observation leads to two recommendations. First, the results for large companies may be different in other regions with distinct regulatory frameworks and market dynamics: hence the need for further investigations in other regions. Second, the results for large companies may be different from those of SMEs: hence, the conclusions drawn herein should not be interpreted as applying to the whole sector (in America), but just to large firms. This study had the ambitious goal of examining relationships both within and across sectors. It is recommended that future research be sector-specific in order to include greater variety in the scale of firms in that sector. This would also overcome a further limitation of this study, namely the sometimes small sample sizes in the sector-specific analyses, which may have resulted in failure to detect significant relationships where they actually exist.
3. In terms of the variables used, both the financial measures and the sustainability measures can be critiqued. With respect to the former, the literature review acknowledges that no single financial metric can encompass business success. While the comprehensive analyses in this study looked at the effects on ten different financial metrics, it is recommended that future studies derive composite measures that take account of the complex relations between these metrics to better represent the concept of business success. Due to data accessibility, this study also uses a combination of accounting-based and market-based measures, yet without a solid theoretical foundation for these decisions. The selection of sustainability measures was guided by the availability of data as well as their meaningful interpretation across the diversity of the GICS sectors. More focussed sector-specific analyses, as recommended above, would relax the second requirement and allow for the inclusion of many more predictors, potentially encompassing all of the SDGs, and for each to be specified with greater sector-specific relevance. Furthermore, the exclusive use of sustainability metrics and the omission of other drivers of financial performance as predictors preclude the interpretation of effect sizes.
4. When it comes to data analysis, the causality assumed by the applied regression models may not hold, and may, in fact, be reversed: financial performance may impact sustainability performance. Qualitative investigations into the motivations for firms to engage in sustainable practices, as well as the barriers to responsible production, may be required to determine the actual causal relationships at play.
5. Finally, this study relied on cross-sectional data taken from the most recent sustainability reports and annual reports for the sample companies. This is considered less of an issue for the sustainability variables, whose values are assumed to be rather stable over short periods, than the financial metrics, whose values can fluctuate with market conditions – particularly in recent times. It is recommended that future research adopt a longer-term perspective, with

time series data collected over several years. Not only would this allow for more reliable results by accounting for short-term fluctuations, it can also help address the causality issue discussed above, and it opens the possibility for alternative analysis techniques, such as Data Envelopment Analysis (DEA).

6 CONCLUSION

This study examined the relationship between sustainable performance and financial performance for S&P 500 firms. Specifically, data from the 324 GRI-compliant S&P 500 companies were subjected to regression analysis in order to predict 10 different financial metrics at two levels of aggregation: individually for each of the 11 GICS categories, and for the full 'economy-wide' sample. The 120 resulting regression models applied a range of sustainability metrics as predictors.

The analysis of different sectors reveals varying impacts of sustainability indicators on financial performance. The sectors of Communication Services and Health Care experience positive financial effects from better performance on at least one sustainability criterion without any negative effects from more sustainable performance on any dimension. The positive impacts imply a financial incentive for further action in those specific areas. The fact that the vast majority of the sustainability indicators proved insignificant in the 10 regression models for each sector implies that there is no financial incentive for firms to take further action toward these SDGs. A more salient interpretation, however, is that there is no reason for them not to take action, given the social and environmental benefits they could generate.

The sectors of Financials, Industrials, and IT also show a net positive impact of sustainable performance on business performance, albeit resulting from a sector-specific combination of positive and negative impacts on various financial metrics by specific sustainability metrics. While the positive results imply incentive for further action and the greater number of insignificant findings suggest no reason for inaction, the detection of several negative impacts in these sectors suggest a need for regulatory and/or market reforms to ensure that more sustainable firms are not punished for responsible behaviour. This is particularly true in the sectors of Consumer Discretionary, Consumer Staples, Energy, Materials, Real Estate, and Utilities, which face a net negative impact of sustainable performance on financial performance. In each of these sectors, a greater number of financial metrics are impacted negatively than positively by the various sustainability metrics. Overall, these findings underscore the significance of implementing regulatory and/or market reforms to promote responsible behaviour and mitigate the adverse effects on financial performance. Due to the differential impacts across sectors this should be investigated further at the sector level to develop sector-specific remedies.

The impacts discussed above also vary by the sustainability indicator. For the individual sectors, 'Women in management', 'Scope 2 emissions intensity', and 'Number of employees' show an unambiguously positive effect, yet 'Grid electricity' exhibited the most positive net impact. Net positive outcomes were also found for 'Renewable energy' and 'Energy intensity'. A neutral impact was detected for 'SDG alignment', 'Waste intensity', and 'Scope 1 emissions intensity'. A net negative impact was found for 'Water intensity' and 'Scope 3 emissions intensity', as well as 'Pay-ratio', which was unambiguously negative. The pattern of negative effects across sectors for these last three sustainability dimensions suggest that economy-wide regulatory reforms might be more suitable than sector-specific solutions for these issues.

Looking at the economy as a whole, the situation appears bleaker. Only 'Scope 1 emissions intensity' has a net positive impact on financial performance across the entire sample. Meanwhile, five sustainability indicators had a net negative effect: 'Scope 3 emissions intensity', 'SDG alignment', 'Waste intensity', 'Number of employees', and 'Grid electricity'. The other six indicators showed a net neutral effect. The concerning implication of the economywide analysis is that sector-agnostic investors, ceteris paribus, will be attracted to the less sustainable sectors of the economy.

Overall, this study highlights the importance of considering multiple sustainability indicators when assessing their impact on financial performance, and the need for sector-specific analyses. Clear guidance for future research is provided in section 5 of this paper to address the various limitations of the study, which should also be considered in the interpretation of the findings.

The findings provide valuable insights for companies aiming to enhance their sustainability practices without harming their financial outcomes by illustrating the average effect of each sustainability initiative on a range of financial metrics across their sector. This information can guide firms towards those specific actions for which they might be rewarded in the market, as well as the wider range of actions for which they should expect to suffer no negative consequences.

The findings are also instructive for policy makers, who should rather concentrate on the range of negative effects detected. The research suggests that both sector-specific and sustainability topic-specific reforms are needed to transform the economy from one that punishes certain sustainability initiatives to one that rewards the sustainable performance of firms.

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Appendix 1

Analyzing the data based on the first approach in which all independent variables were considered ($p \leq 0.05$).

		Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7	Sector 8	Sector 9	Sector 10	Sector 11	All Sectors
CWI	*Adjusted R^2*	0.121	(0.569)	(1.60)	0.569	0.979	0.999	(0.0508)	0.610	(0.581)	0.819	0.771	(0.0877)
	p-value	0.500	0.774	0.891	0.050	0.017	0.019	0.672	0.446	0.774	0.304	0.343	0.660
YTDR	*Adjusted R^2*	0.720	0.741	0.999	0.0796	0.263	0.998	0.428	(1.83)	0.533	0.970	0.601	0.112
	p-value	0.178	0.366	0.026	0.333	0.472	0.029	0.524	0.907	0.477	0.125	0.444	0.283
Q	*Adjusted R^2*	(1.15)	0.976	0.390	0.372	0.190	(0.804)	0.949	(1.45)	(0.0677)	(1.04)	(1.89)	(0.0378)
	p-value	0.920	0.115	0.532	0.068	0.507	0.807	0.166	0.879	0.673	0.836	0.912	0.564
WACC	*Adjusted R^2*	0.713	(0.0294)	(0.409)	0.235	0.566	0.982	0.957	(4.71)	0.679	0.352	0.998	(0.0302)
	p-value	0.353	0.522	0.742	0.486	0.458	0.098	0.153	0.990	0.402	0.547	0.032	0.546
GP	*Adjusted R^2*	0.723	(2.30)	0.794	(0.153)	0.904	0.696	(3.09)	0.943	0.123	1.000	0.775	0.0813
	p-value	0.176	0.935	0.324	0.650	0.207	0.389	0.965	0.178	0.623	0.003	0.340	0.363
EBITDA	*Adjusted R^2*	0.581	(1.14)	(0.616)	0.133	0.693	0.498	(2.42)	0.954	0.0209	0.860	0.736	(0.0577)
	p-value	0.260	0.849	0.778	0.533	0.364	0.489	0.940	0.160	0.651	0.269	0.367	0.592
FCF	*Adjusted R^2*	0.798	(1.88)	(0.687)	0.211	0.353	0.993	(2.61)	0.959	0.287	0.321	(1.95)	0.0267
	p-value	0.130	0.911	0.789	0.497	0.542	0.060	0.949	0.151	0.573	0.557	0.916	0.444
ROA	*Adjusted R^2*	0.302	0.885	0.937	(3.16)	0.789	(1.41)	0.865	0.797	0.920	0.888	0.973	(0.364)
	p-value	0.411	0.248	0.182	0.970	0.327	0.875	0.266	0.328	0.207	0.241	0.118	0.936
ROE	*Adjusted R^2*	(1.10)	0.886	0.928	(2.37)	(0.207)	(1.22)	0.597	0.188	0.548	0.884	0.926	(0.653)
	p-value	0.910	0.243	0.195	0.940	0.702	0.855	0.449	0.396	0.470	0.242	0.194	0.987
GM	*Adjusted R^2*	0.781	0.999	0.0347	0.811	(0.317)	0.684	0.213	(0.459)	0.538	0.991	(1.30)	0.312
	p-value	0.309	0.022	0.644	0.143	0.702	0.396	0.599	0.758	0.474	0.068	0.864	0.091

Appendix 2

Analyzing the data based on the second approach in which a combination of independent variables where the overall score has a significant p-value ($p \leq 0.05$) was considered.

		Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7	Sector 8	Sector 9	Sector 10	Sector 11	All Sectors
CWI	*Adjusted R^2*	0.851	0.395	0.249	0.629	0.802	0.999	0.466	0.481	NA	0.547	0.780	0.156
	p-value	0.088	<.001	0.034	0.006	<.001	0.019	0.001	0.011	NA	0.004	0.083	0.014
YTDR	*Adjusted R^2*	NA	NA	0.308	0.408	NA	0.998	NA	0.293	0.298	0.149	NA	0.321
	p-value	NA	NA	0.012	0.029	NA	0.029	NA	0.030	0.013	0.065	NA	<.001
Q	*Adjusted R^2*	NA	0.301	0.302	0.377	0.364	NA	0.478	0.228	NA	0.426	NA	0.0483
	p-value	NA	0.007	0.097	0.043	0.033	NA	0.053	0.018	NA	0.079	NA	0.006
WACC	*Adjusted R^2*	NA	0.730	NA	0.485	0.823	0.347	0.268	0.253	NA	NA	0.998	0.266
	p-value	NA	0.064	NA	0.029	0.035	0.007	0.049	<.001	NA	NA	0.032	<.001
GP	*Adjusted R^2*	0.731	0.342	0.875	0.661	NA	0.535	0.649	0.965	NA	0.579	0.481	0.622
	p-value	0.032	0.009	0.001	0.004	NA	0.004	<.001	0.029	NA	<.001	0.006	<.001
EBITDA	*Adjusted R^2*	0.723	0.329	0.484	0.683	NA	0.546	0.552	0.954	NA	0.846	0.605	0.204
	p-value	0.034	0.036	0.010	0.003	NA	<.001	<.001	0.038	NA	0.050	0.002	0.006
FCF	*Adjusted R^2*	0.879	0.301	0.476	0.638	NA	0.993	0.357	0.974	NA	0.215	NA	0.347
	p-value	0.007	0.004	0.011	0.005	NA	0.060	0.014	0.022	NA	0.045	NA	<.001
ROA	*Adjusted R^2*	NA	0.573	0.326	NA	0.470	0.366	0.527	0.199	NA	NA	NA	0.0268
	p-value	NA	0.054	0.084	NA	0.010	0.083	0.009	0.010	NA	NA	NA	0.025
ROE	*Adjusted R^2*	NA	0.977	NA	NA	0.715	NA	0.244	0.514	NA	0.275	0.822	NA
	p-value	NA	<.001	NA	NA	0.036	NA	0.085	<.001	NA	0.032	0.028	NA
GM	*Adjusted R^2*	NA	0.999	0.390	0.222	NA	0.830	0.238	0.155	0.213	0.991	0.595	0.347
	p-value	NA	0.022	0.030	0.088	NA	0.047	0.029	0.028	0.040	0.068	0.016	0.006

Appendix 3

Analyzing the data based on the third approach in which all independent variables that produced significant p-value ($p \leq 0.05$) within the model were considered.

		Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7	Sector 8	Sector 9	Sector 10	Sector 11	All Sectors
CWI	*Adjusted R^2*	NA	0.407	0.150	0.458	NA	NA	0.193	0.251	0.355	0.364	0.386	0.0176
	p-value	NA	<.001	0.038	0.003	NA	NA	0.002	0.010	0.041	0.013	0.081	0.046
YTDR	*Adjusted R^2*	0.716	NA	0.999	0.359	0.176	0.323	0.102	0.0966	0.307	0.142	0.261	0.0256
	p-value	0.099	NA	0.026	0.011	0.076	<.001	0.045	0.018	0.004	0.036	0.025	0.003
Q	*Adjusted R^2*	0.857	0.285	0.169	0.475	0.247	NA	0.0617	0.144	NA	0.836	NA	0.0169
	p-value	0.049	0.007	0.029	0.043	0.003	NA	0.069	0.015	NA	0.008	NA	0.014
WACC	*Adjusted R^2*	0.640	NA	0.334	0.526	0.585	0.226	0.182	0.253	0.270	0.891	NA	0.00598
	p-value	0.035	NA	0.009	0.007	0.001	0.006	0.050	<.001	0.040	0.005	NA	0.094
GP	*Adjusted R^2*	0.768	0.353	NA	0.487	NA	0.144	0.0943	0.335	0.174	0.489	NA	NA
	p-value	0.033	0.004	NA	0.002	NA	0.063	0.029	0.003	0.077	<.001	NA	NA
EBITDA	*Adjusted R^2*	NA	0.256	0.101	0.448	0.998	0.103	0.130	0.254	0.173	0.244	NA	0.0142
	p-value	NA	0.011	0.072	0.004	0.021	0.075	0.012	0.010	0.048	0.006	NA	0.094
FCF	*Adjusted R^2*	0.432	0.362	NA	0.424	0.207	NA	0.388	0.266	0.227	0.111	0.150	0.0150
	p-value	0.065	0.002	NA	0.005	0.090	NA	0.006	0.008	0.049	0.097	0.085	0.083
ROA	*Adjusted R^2*	0.584	0.628	NA	0.213	0.680	NA	0.437	0.182	NA	NA	0.189	0.0169
	p-value	0.077	0.003	NA	0.055	0.001	NA	0.003	0.005	NA	NA	0.068	0.016
ROE	*Adjusted R^2*	NA	0.512	NA	0.148	0.322	NA	NA	0.612	NA	NA	0.291	NA
	p-value	NA	<.001	NA	0.079	0.040	NA	NA	<.001	NA	NA	0.027	NA
GM	*Adjusted R^2*	0.972	0.281	0.248	0.265	0.804	NA	0.114	NA	0.365	0.419	0.623	0.182
	p-value	0.009	0.003	0.007	0.029	0.068	NA	0.029	NA	0.005	0.014	0.005	<.001

Appendix 4

Various measurements for the aggregated 'Total Energy' data extracted from the sustainability reports.

Total Energy

Unit	Occurrence
GJ	91
KWh	30
BTUs	1
MWh	154
TWh	1
kJ	1
MJ	3
GWh	8
NA	35

Appendix 5

Various measurements for the aggregated 'Total Water' data extracted from the sustainability reports.

Total Water

Unit	Occurrence
m^3	100
kGal.	14
Gal.	62
ML	48
khl	1
L	6
MMGal	1
Barrels used	1
KL	3
MBBL	1
Cubic feet	1
Bbl	1
MT	1
NA	84

Appendix 6

Various measurements for the aggregated 'Total Waste' data extracted from the sustainability reports.

Total Waste

Unit	Occurrence
MT	124
T	56
Kt (metric kiloton)	1
P	14
ST	7
lbs	8
kg	6
llb	1
kt	1
m^3	3
NA	100

Appendix 7

Various measurements for the aggregated 'Scope 1', 'Scope 2.1',' Scope 2.2', and 'Scope 3' data extracted from the sustainability reports.

Scopes

	Scope 1	Scope 2.1	Scope 2.2	Scope 3
Tones	32	34	23	28
Short Tones	1	1	/	1
Kt	/	1	1	1
Kg	1	1	/	1
NA	23	58	167	86
MT	267	229	133	207

Note: Scope 3 emissions can be categorized into two parts: Firstly, 203 companies disclosed their total Scope 3 emissions. Secondly, 34 companies furnished a list of specific parameters that are encompassed within Scope 3. For the companies that submitted a list, the Scope 3 emissions had to be calculated manually.