KEY FACTORS INFLUENCING SUSTAINABILITY PERFORMANCE IN THE OIL AND GAS INDUSTRY IN MALAYSIA AND SELECTED WESTERN COUNTRIES (US, UK, CANADA, NORWAY)

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BY

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DECLARATION

I hereby declare that:

(1) This undergraduate FYP is the end result of my own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this FYP has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Sole contribution has been made by me in completing the FYP.

(4) The word count of this research report is 12192.

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LIST OF ABBREVIATIONS

O&G	Oil and Gas
GHG	Greenhouse Gas
TBL	Triple Bottom Line
ESG	Environmental, Social, Governance
CSR	Corporate Social Responsibility
UN	United Nations
SDGs	Sustainability Development Goals
ST	Stakeholder Theory
U.S.	United States
U.K.	United Kingdom
EU	European Union
IOCs	International Oil Companies
NOCs	National Oil Companies
CCU	Carbon Capture and Utilization
CCUS	Carbon Capture, Storage and Utilization
CO_2	Carbon Dioxide
KPIs	Key Performance Indicators
SEA	Southeast Asia
SP	Sustainability Performance
DS	Decarbonization Strategy
FP	Financial Performance
SR	Social Responsibility
GQ	Governance Quality

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ABSTRACTS

This study investigates the key factors influencing sustainability performance (SP) among the top 30 oil and gas (O&G) companies across five countries: the United States, Canada, the United Kingdom, Norway, and Malaysia. Using a quantitative, cross-country comparative design, secondary data from LSEG Workspace spanning 2020–2024 were analyzed. The study examines five independent factors: decarbonization strategy (DS), financial performance (FP), social responsibility (SR), governance quality (GQ), and company structure (CS), alongside country-level differences, to determine their impact on SP. Multiple linear regression analysis identified DS and GQ as the most significant predictors of SP, whereas FP, SR, CS, and country effects were largely insignificant. These findings highlight that proactive decarbonization initiatives and robust governance mechanisms are critical for enhancing SP in the O&G sector, while short-term financial outcomes and SR activities alone are insufficient. The study offers practical implications for O&G companies to embed sustainability into core operations and for policymakers to strengthen governance and reporting frameworks. Limitations include a small, uneven sample and reliance on secondary data, suggesting future research should expand cross-country coverage, include additional sustainability indicators such as scope 3 emissions, and consider mixed-method approaches to provide deeper insights. This research contributes to sustainability literature by providing cross-country empirical evidence on the drivers of SP in a high-impact industry, informing both theory and practice.

Keywords: Sustainability Performance, Oil and Gas Industry, Triple Bottom Line (TBL), Stakeholder Theory, Institutional Theory, Decarbonization Strategy, Financial Performance, Social Responsibility, Governance Quality, Company Structure, Cross-country.

CHAPTER 1: RESEARCH OVERVIEW

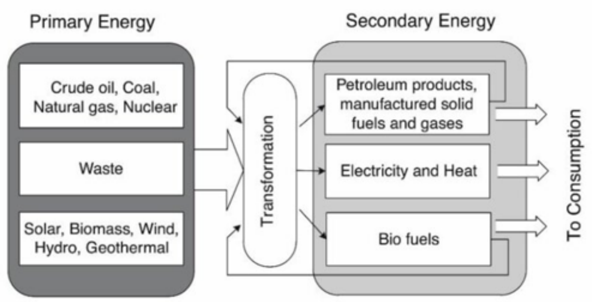
1.0 Chapter Introduction

Chapter 1 introduces the foundation of this study by outlining the research background of Oil and Gas (O&G) industry in the global sustainability commitments. It discusses the research background, research problems, research objectives, research questions, scope of study, and research significance.

1.1 Research Background

The O&G industry, as the primary source and hub of the energy industry, plays a crucial role in all aspects of daily life, industry, transport, and power. For the sake of world climate goals, its sustainability track record has been just as significant. Figure 1.1 illustrates the sources of energy. The natural energy that is readily usable or convertible is referred to as primary energy. The primary energy is converted into secondary energy in a more convenient form.

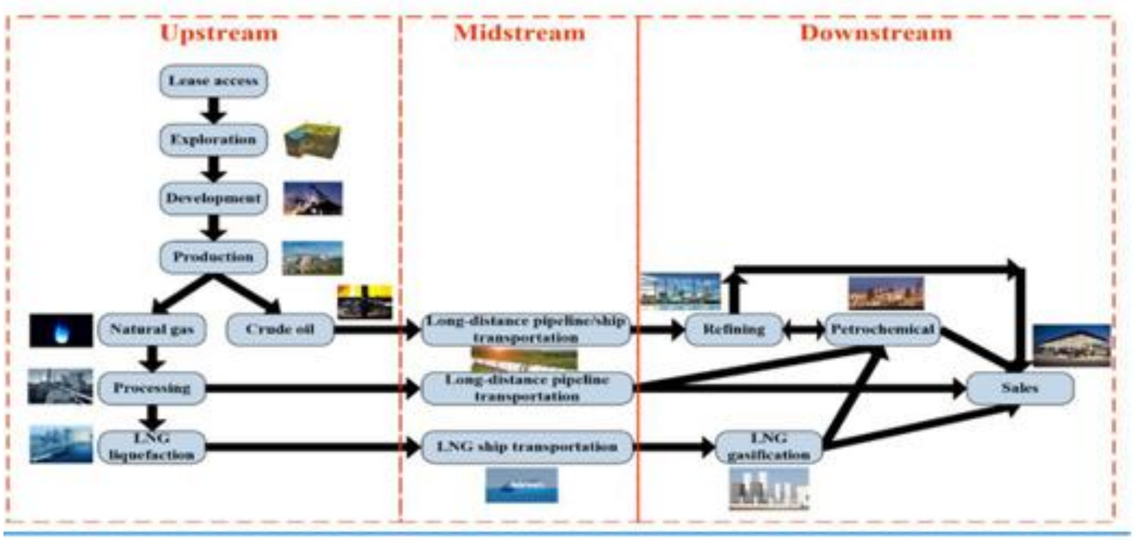
Figure 1.1 *Energy Sources*



Source: Yilgör et al. (2021)

As explained by Naji et al. (2022), the sector is divided into three core stages: upstream (exploration and production), midstream (transportation and storage), and downstream (refining and distribution). Although every part of the puzzle has its unique function, together they create a sophisticated energy system that influences all civilizations.

Figure 1.2 *Upstream, Midstream, and Downstream Operations Flow in the O&G Sector*

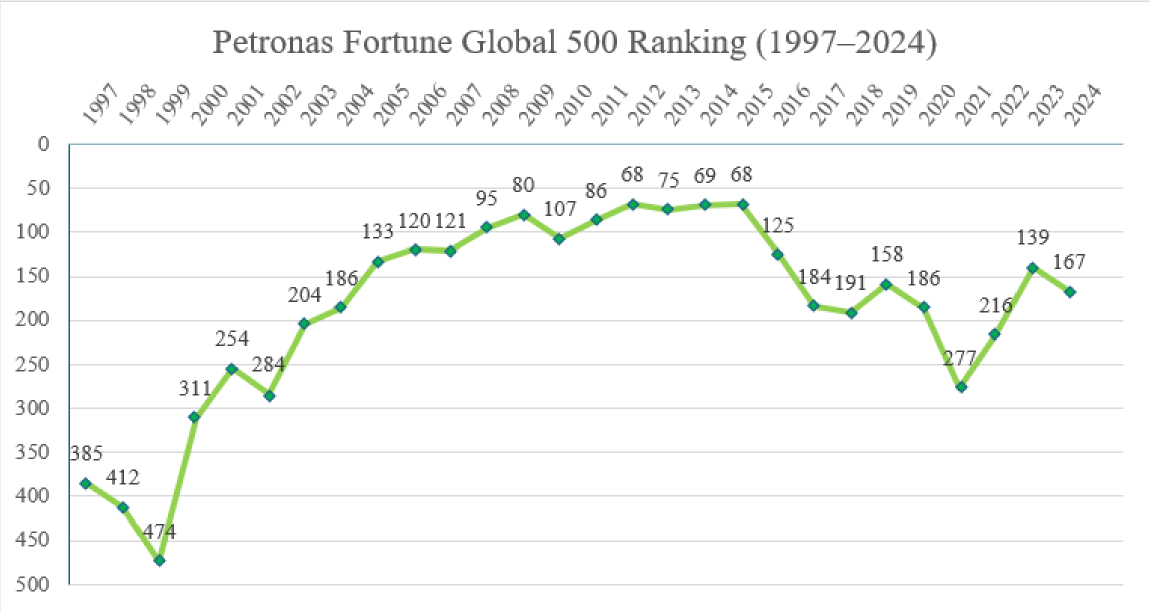


Source: Naji et al. (2022)

Long before the O&G sector was what it is today, humanity was already tapping these resources millennia ago. It was recorded that ancient Chinese drilled wells from bamboo in 347 AD by U. Ali and Ali (2019). The first commercial oil refinery was constructed in Scotland during the mid-1800s following chemist James Young's distillation of natural petroleum from coal to create lamp oil and lubricants. At about the same period, Abraham Gesner, a Canadian geologist, discovered kerosene, a cleaner-burning fuel that soon illuminated the houses and avenues of North America. The American oil boom began in 1859 when Edwin Drake drilled the first modern oil well in Pennsylvania. It transformed industrial giants like BP, Shell, and Standard Oil into global leaders and began to dominate the world markets. In order to manage their resources, oil-producing nations established OPEC in 1960. The industry has since then witnessed the shale boom, oversupply, and price shocks. Despite the advent of renewable energy, O&G remains an integral part of the global economy. The industry was initially dominated by Western multinational companies, collectively known as the "Seven Sisters"

(Exxon, Shell, BP, Chevron, Mobil, Gulf, and Texaco). However, National Oil Companies (NOCs) like Malaysia's Petronas (the region's first to be included in Fortune's Global 500 and has committed to being net-zero by 2050 and is renowned for its digitalization and project integration (*Our Brand Story | PETRONAS Global*, n.d.)) and other new entrants like Saudi Aramco and China National Petroleum Corporation (CNPC) are following too.

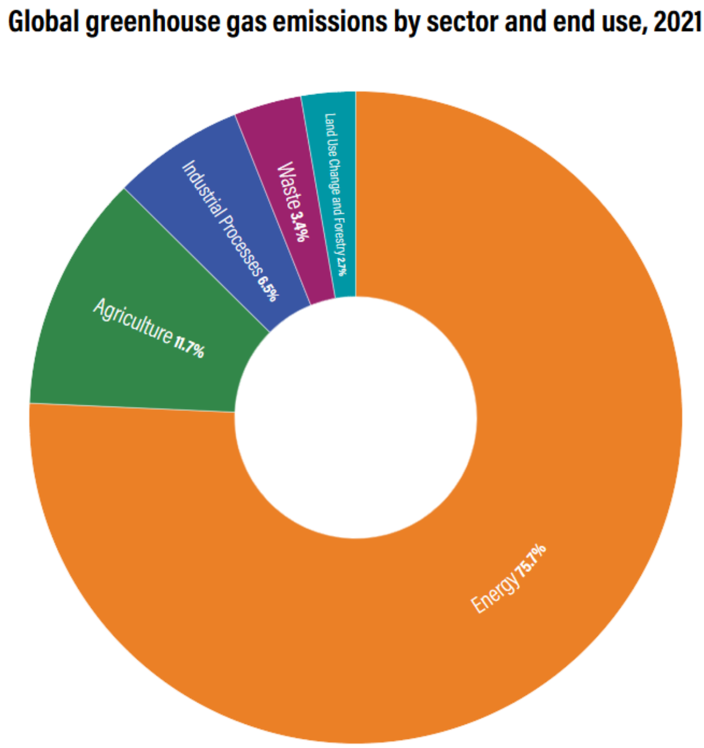
Figure 1.3 *Petronas' Fortune 500 Ranking Record*



Sources: Onn (2022); (*Petronas' 2022 Fortune Global 500 Rises to 216 From 277 in 2021*, n.d.); (*Accreditations | PETRONAS Global*, n.d.)

Without O&G in the current economy, transport systems would come to a halt, industries would be forced to close, and our energy security would be in serious jeopardy. But, as Li and Alharthi (2023) and Ge et al. (2024) have contended, the industry is also causing a high percentage of environmental degradation, responsible for 75.7% of global greenhouse gas (GHG) emissions, water contamination, and ecosystem disruption. Experts refer to this challenge as the "carbon paradox." It describes the struggle facing the O&G industry as it tries to balance rising energy demand with the carbon-emitting nature of its activities. Despite its importance, the industry faces two major concerns. The first is whether global O&G reserves will be sufficient to meet future demand. The second is that wastefulness and overconsumption can seriously damage both the economy and the environment, even when reserves are adequate. These issues have placed the industry's approach to sustainability under strong international scrutiny.

Figure 1.4 *GHG Emissions by Sector and End Use*



Source: Ge et al. (2024)

The sustainability concept was first introduced by the United Nations Brundtland Commission in 1987. It defined sustainable development as meeting the needs of the present without limiting the ability of future generations to meet their own needs. Since then, international conventions and agreements have continued to refine and expand sustainable development models. The Kyoto Protocol of 1997 was the first global, legally binding agreement requiring wealthy nations to reduce their GHG emissions. It was followed by the Doha Amendment in 2013. In 2015, the Paris Agreement established a worldwide framework to limit the global temperature increase to 1.5°C above pre-industrial levels. That same year, the United Nations adopted the Sustainable Development Goals (SDGs), which set specific targets, including climate action (SDG 13), affordable and clean energy (SDG 7), and life below water (SDG 14). The O&G

industry has often been slow to respond to these international initiatives, with much of its evolution driven by the impact of catastrophic natural disasters.

According to Scherr (2025), the O&G industry is responsible for nearly 90% of global CO_2 emissions, making it a leading driver of climate change. Markland (2023) and Nikše (2025) note that several high-profile disasters have intensified public scrutiny of the sector. Among the worst was the 2010 Deepwater Horizon explosion in the Gulf of Mexico, which killed 11 workers and caused the largest offshore oil spill in U.S. history. Nearly five million barrels of oil spilled into the ocean, resulting in billions of dollars in cleanup costs and fines, as well as severe ecological damage. Other incidents have also highlighted the risks inherent in O&G operations, including the 1988 North Sea Piper Alpha explosion, the 1982 Canadian Ocean Ranger rig collapse, the Song Doc Gulf of Thailand platform explosion in Vietnam, and the 2022 BP-Husky Ohio refinery fire.

Organizational responses to these pressures have varied. International Oil Companies (IOCs) such as BP, Shell, and Equinor have made notable contributions toward net-zero targets, invested in renewable energy, and advanced carbon capture technologies (Ye & Chaiyapa, 2023; Shammah et al., 2025). In contrast, National Oil Companies (NOCs) often prioritize profit for the government over sustainability (Al-Fattah, 2013). Petronas, for example, has announced a target of achieving net-zero emissions by 2050, though it remains unclear how this will be achieved compared with international peers.

Performance also varies significantly by country. Equinor's large investments in offshore wind and carbon capture and storage (CCS) projects, under strict government regulations, have positioned Norway as a trendsetter. The UK has made progress in establishing climate policies and reporting guidelines. While the U.S. and Canada host high-quality O&G businesses supplying much of the global market (McClay, 2024), they face criticism for excessive fossil fuel consumption. As a developing nation, Malaysia also faces the challenge of balancing climate responsibilities with economic growth and energy security.

1.2 Research Problems

The O&G sector faces increasing challenges due to its environmental impacts, tightening regulations, and crucial role in socioeconomic development. As a highly visible industry, it must balance the need to cut GHG emissions with economic growth and energy security (Khanna et al., 2025). These pressures from governments, international bodies, and society have driven the sector to adopt practical, measurable sustainability solutions.

However, the progress remains uneven. Many companies set high-level sustainability goals, such as investing in renewables or pursuing net-zero targets but often fail to translate these goals into concrete action (Chrysikopoulos et al., 2024). As a result, many initiatives are more aspirational than operational, raising doubts about the sincerity and effectiveness of corporate commitments. This purpose-implementation gap has led to questions about what truly drives SP in O&G sector.

N. J. Ali et al. (2021) note another gap in existing knowledge: the lack of cross-country comparative studies. Most published research focuses on a single country or relies on broad theoretical discussions without applying them to different national contexts. This gap is especially relevant for Malaysia. As a resource-rich economy, Malaysia must balance climate obligations with its dependence on O&G revenue. Yet little is known about how Petronas compares with leading firms in Western countries that operate under stricter regulations and more mature sustainability agendas.

This research addresses these gaps by linking business theory with industry practice. It aims to provide comparative insights, models, and strategies that can support companies and policymakers in shifting toward more sustainable operations. By focusing on Malaysia alongside selected Western nations, it contributes to cross-national empirical research and deepens evidence-based understanding of sustainability in the O&G sector.

1.3 Research Objectives

1.3.1 General Objective

- To explore the key factors influencing the sustainability performance of the top 30 O&G companies in selected Western countries and Malaysia through a comparative case study covering the years 2020 to 2024.

1.3.2 Specific Objectives

- **RO1:** To determine the impact of company structure (integrated vs upstream vs midstream vs downstream) and country differences on sustainability performance in O&G industry.
- **RO2:** To assess the influence of decarbonization strategies on the sustainability performance of O&G companies.
- **RO3:** To investigate the role of government and societal pressures in shaping the sustainability performance of O&G companies.
- **RO4:** To evaluate the relationship between financial performance and sustainability performance of O&G companies.

1.4 Research Questions

- **RQ1:** Do company structures (integrated/upstream/midstream/downstream) significantly affect sustainability performance of O&G companies?
- **RQ2:** Does decarbonization strategy influence sustainability performance of O&G companies?
- **RQ3:** Do the government and society affect sustainability performance of O&G companies?
- **RQ4:** What is the effect of financial performance on sustainability performance across countries of O&G companies?

1.5 Scope of Study

This study examines the top 30 O&G companies identified by *CompaniesMarketCap*, which ranks firms based on their market capitalization. From this global list, only companies headquartered in Malaysia, the US, the UK, Canada, and Norway are included. These five countries were selected because of their significant roles in global oil production and their more established sustainability disclosure practices.

After identifying the top 30 companies (as of 3 November 2025), the study collected their ESG scores from LSEG Workspace (formerly Refinitiv). These scores represent each company's SP from 2020 to 2024, a period marked by accelerated ESG reporting and shifts in the global energy landscape following COVID-19. Although large producers such as Saudi Arabia, China, and Russia have companies in the global top 30, they are excluded because they fall outside the defined research scope. This ensures that the analysis remains consistent to compare firms within the selected five countries. Missing ESG data will be left blank during analysis.

Some O&G companies from India, Indonesia, and Thailand rank higher than Malaysia's Petronas in market capitalization. However, these rankings may reflect differences in land area and resource availability, as larger countries typically possess wider zones for exploration. Petronas is included because of its strategic and influential position in Southeast Asia's (SEA) energy sector. It was the first company from the region to appear on the Fortune Global 500 list and continues to rank as the most valuable ASEAN brand in the Brand Finance Global 500 report, most recently placing 141st worldwide. These achievements reflect its global competitiveness, strong brand equity, and recognised leadership in governance and sustainability.

Limiting the scope to the top 30 companies ensures focus, comparability, and analytical consistency. Expanding beyond the top 29 global firms (with Petronas included as Malaysia's representative) would introduce unnecessary variation and weaken the comparative clarity of the study. Petronas is intentionally included to ensure representation from Malaysia and the broader ASEAN region, providing a balanced perspective between Western economies and an emerging market leader in SEA.

1.6 Research Significance

Above all, this study offers practical insights to help O&G companies understand and enhance their SP. Although many firms have announced ambitious commitments such as achieving net-zero emissions by 2050, there is often a gap between these public promises and what is actually implemented on the ground (Fam & Fam, 2024). By comparing the sustainability practices of major corporations in selected countries, this study highlights what works, what does not, and why. For example, Petronas has introduced digital innovation efforts and early carbon capture initiatives (Contributor, 2024), while Norway's Equinor has linked executive compensation to emissions reduction goals (Client Challenge, n.d.). Understanding such practices enables companies to avoid greenwashing and adopt measures that are both practical and effective.

The findings are also valuable for policymakers and political leaders guiding the energy transition. Governments around the world are increasingly implementing stricter disclosure requirements, carbon pricing mechanisms, and climate-related financial reporting standards (Amel-Zadeh & Tang, 2025). Yet the pace and scope of implementation vary significantly across jurisdictions, creating uncertainty for firms operating internationally. For example, Malaysia is only beginning to mandate ESG reporting, whereas the EU's Corporate Sustainability Reporting Directive (CSRD) and the proposed climate disclosure rules of the U.S. Securities and Exchange Commission require extensive reporting. By clarifying how these regulatory differences influence sustainability outcomes, this study supports the design of policies that are ambitious yet feasible and grounded in business realities. It also helps industry players anticipate regulatory changes and prepare for transition-related risks.

Finally, this study addresses a major gap in existing research by assessing O&G SP through cross-country, evidence-based analysis. Most recent studies focus on a single country or rely primarily on theoretical frameworks without grounding them in firm-level practice. This study bridges that gap by integrating company-level data across multiple national contexts with international sustainability frameworks. It encourages further scholarly discussion on how business culture, regulatory institutions, and economic structures shape sustainability outcomes. It also highlights opportunities for future research on regional differences and the transferability of effective practices in high-emission industries.

Overall, this research supports O&G companies in aligning sustainability goals with measurable performance, enriches academic understanding of cross-national industry practices, and offers actionable guidance for practitioners and policymakers working toward a lower-carbon future.

1.7 Chapter Summary

This chapter introduced the research by outlining the background, problem statement, objectives, scope, and significance of the study. It highlights the critical role of O&G industry globally alongside its substantial contribution to environmental degradation and GHG emissions, which have intensified regulatory and stakeholder pressure. Key research gaps were identified, including the lack of cross-country empirical studies and limited evidence on Malaysia's position relative to Western O&G companies. Lastly, the chapter outlined the research objectives, questions, scope, and significance of the study.

CHAPTER 2: LITERATURE REVIEW

2.0 Chapter Introduction

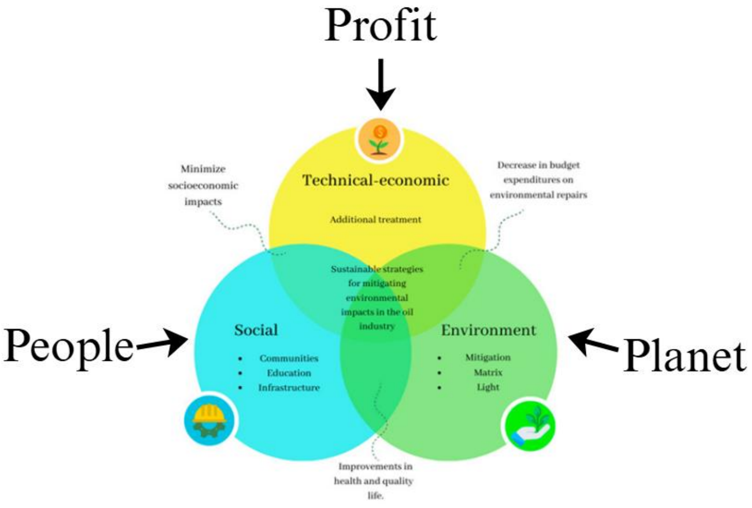
This chapter discusses the underlying theories, including Triple Bottom Line (TBL), Stakeholder Theory (ST), and Institutional Theory. It reviews factors, including Sustainability Performance in O&G Industry (SP), Decarbonization Strategy (DS), Financial Performance (FP), Company Structure (CS), Social Responsibility (SR), and Governance Quality (GQ). Country is included as the control factor. It also presents the proposed theoretical/conceptual framework and chapter summary.

2.1 Underlying Theories

2.1.1 Triple Bottom Line (TBL)

The Triple Bottom Line concept was introduced by John Elkington in 1994. It was created as an alternative to the traditional single bottom line that focused only on economic statements. Elkington argued that real sustainability requires success in three areas. These areas are profit, planet, and people. Companies must consider their impact on society and the environment, not only their financial results.

Figure 2.1 *A TBL Diagram*



Source: Guerrero-Martin et al. (2023)

Figure 2.1 shows the three elements of the TBL model. The People dimension represents the social aspect. It includes employee treatment, interaction with local communities, labor rights, and health and safety. The Planet dimension represents the environmental aspect. It considers environmental impacts such as resource use, waste, pollution, and GHG emissions. The Profit dimension still focuses on financial performance. However, it emphasizes long-term value creation that supports environmental stewardship and social well-being.

The O&G industry has a large environmental footprint. It also faces significant social risks related to resource extraction. Because of this, the TBL framework is very relevant to the industry. It is widely used to assess stakeholder engagement, emissions performance, regulatory requirements, and sustainability practices (Nica et al., 2025). Companies can use TBL to align their activities with growing regulatory pressure and rising societal expectations. This may include reducing emissions, improving safety, investing in cleaner technology, and supporting community development.

TBL is also closely aligned with ESG and CSR principles. Both concepts are often interpreted through the TBL framework. CSR focuses on a company's moral responsibility to society. ESG focuses on measurable performance metrics. Pt (2023) highlighted this relationship. Table 2.1 shows the comparison between the three concepts.

One strength of the TBL theory is its broad scope. It encourages companies to measure performance in economic, social, and environmental terms. It helps them identify risks and opportunities in all three areas. It also promotes transparency. This is important for governments, investors, and civil society. TBL also encourages long-term thinking. It pushes companies to consider how their decisions affect future generations.

However, there are also challenges. Social and environmental performance is more difficult to measure than financial outcomes. This makes comparison harder. Some companies also adopt TBL only in appearance. They may practice greenwashing without making meaningful changes (Kraska, 2024). Elkington updated the TBL concept in 2018 because he felt it had been misinterpreted or misused (Elkington, 2018). Table 2.2 explains the idea of greenwashing.

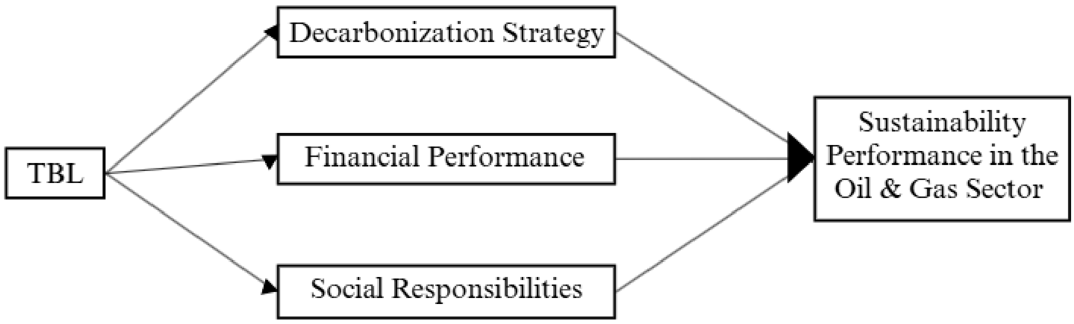
Table 2.2 *Explanation of Greenwashing*

Definition	When a company uses **misleading language, advertising, claims, or branding** to appear more environmentally friendly than it actually is.
Goal	To maintain profit, public approval, and delay real climate action
Common Tactics	• Rebranding (e.g., BP's "Beyond Petroleum" with sunflower logo) • Marketing natural gas and liquefied natural gas (LNG) as "clean" • Promoting renewable natural gas (RNG) despite it being mostly methane • Overusing terms like "net-zero" without action • Lobbying to label gas as green
Why It Matters (Why Is It Bad)	Misleads the public, diverts funds from real renewables, and slows climate progress
Impact on Sustainability	Weakens emission targets, continues fossil fuel use, and harms public health
Examples	• BP's rebrand without real change • Exxon & Shell expanding LNG • Ohio law labeling gas as green • EU greenlisting gas • Methane leaks from stoves and pipelines • Fracking linked to water and quake risks

Sources: Kraska (2024); Carrington (2022); Edwards (2024)

Despite these limitations, the TBL theory remains a strong foundation for sustainability practice and research. It is instrumental in high-impact industries such as O&G. In these industries, social and environmental concerns cannot be separated from business operations. The TBL framework helps companies measure and SP.

Figure 2.2 *Triple Bottom Line (TBL) Theory Framework*



Source: Developed by the author from multiple sources

2.1.2 Stakeholder Theory (ST)

R. Edward Freeman originally conceptualized the Stakeholder Theory (ST). The main premise is that firms should be accountable to a broader set of parties impacted by or interested in the operations of the firm, beyond just their shareholders. These parties include governments, communities, employees, suppliers, investors, and activist groups.

Effective management of these relationships is crucial for sustained economic success. Stakeholders have the potential to influence a company's reputation, social legitimacy, and access to resources (De Camargo Fiorini et al., 2018). Building on Freeman's work, other scholars have explored the theory's flexibility and the complexities of its application, particularly in multifaceted industries such as O&G (Mahajan et al., 2023). Table 2.3 summarizes the key milestones in the development of ST from 1984 to 2010.

The relevance of ST is particularly evident in the O&G industry. The industry operates in sensitive environments and is often subject to high public scrutiny. For example, fracking activities can expose nearby populations to noise, light pollution, and safety risks. These effects may lead to stress, reputational costs, and legal opposition (Sangaramoorthy et al., 2016). Investors increasingly demand disclosure on environmental hazards and human rights issues. At the same time, regulatory authorities enforce stricter safety and environmental standards. For instance, in March 2024, the U.S. EPA enacted tighter methane regulations for O&G activities. These rules increased compliance costs but improved environmental performance.

Stakeholder expectations significantly affect O&G operations. Failing to engage stakeholders appropriately may result in financial losses, project delays, or reputational damage. ST provides a structured framework for addressing corporate sustainability initiatives. It emphasizes that managing stakeholder concerns is as vital to organizational sustainability as complying with environmental regulations or maximizing profits. For example, a company addresses stakeholder needs when it invests in local health programs, ensures equitable working conditions, or consults Indigenous communities before initiating extraction processes (Tulaeva & Tysiachniouk, 2017). Internal pressures from stakeholders also drive firms to undertake essential emissions-reduction measures that enhance SP (Block et al., 2023). While these efforts are not always directly measurable in financial terms, they reduce risk and support long-term stability.

ST is closely connected to CSR and ESG concepts. CSR represents a firm’s moral obligations to its stakeholders. These obligations are often expressed through philanthropic initiatives, such as employee wellness programs or community welfare projects. Given the strong positive correlation between CSR initiatives, stakeholder engagement, and overall performance, Awa et al. (2024) argue that firms should maintain a commitment to green CSR (Figure 2.3). ESG performance, illustrated in Figure 2.4, is a more complex measure of a company's sustainability orientation. Its impact on economic performance is influenced by internal and external institutional factors, including government effectiveness and regulatory quality (Handoyo & Anas, 2024). Stakeholder expectations shape both ESG and CSR outcomes. Success depends on a company's ability to listen and communicate effectively with key stakeholders.

Despite its advantages, ST faces challenges because stakeholders often have diverse and sometimes conflicting interests (Pies & Valentinov, 2023). Investors may focus on short-term profits, while environmental groups push for lower emissions that increase costs (Bamishe & Adegbie, 2024). Moreover, ST lacks a clear methodology for assessing stakeholder satisfaction or prioritizing competing demands (Valentinov, 2024). This ambiguity can make it difficult for managers to implement the theory strategically and consistently. However, ignoring stakeholder concerns is increasingly viewed as a flaw rather than a viable alternative, particularly for high-profile firms like those in the O&G sector (Bessette et al., 2023).

Overall, ST provides a valuable framework for understanding how O&G companies address sustainability challenges. It underscores the importance of looking beyond profit and embracing responsible, inclusive decision-making. The theory recognizes the interdependence between company operations and stakeholder expectations.

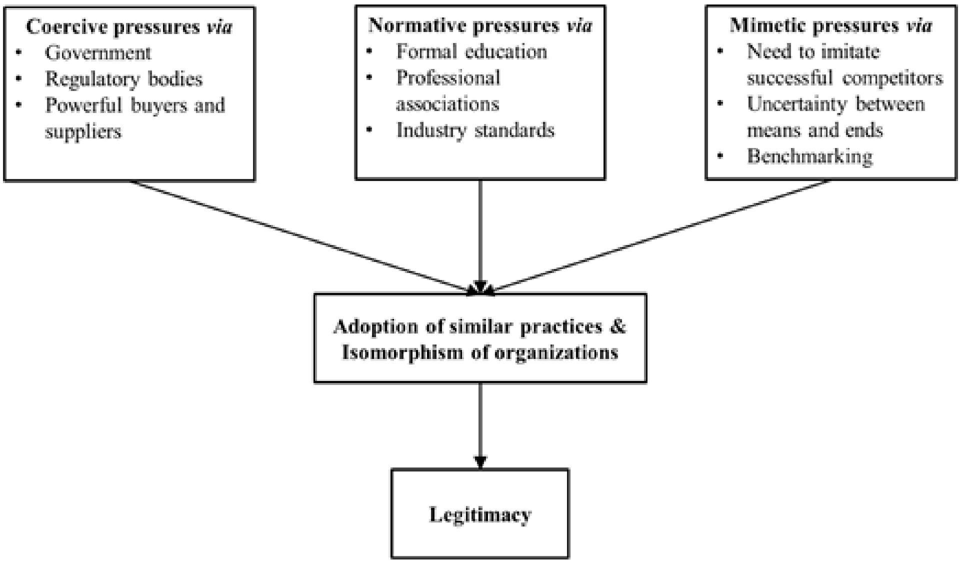
Figure 2.5 *Stakeholder Theory (ST) Framework*

Sources: Developed by the author from multiple sources

2.1.3 Institutional Theory

Institutional theory offers a framework for understanding how external forces influence organizational behavior, particularly in response to social demands that extend beyond economic efficiency (Balzano et al., 2024). It was initially proposed by Meyer and Rowan in 1977, and later refined by DiMaggio and Powell in 1983, as cited by Aksom and Tymchenko (2020). The theory argues that organizations are not isolated entities. Their activities and structures are shaped by broader institutional contexts, which include formal and informal regulations that define appropriate and acceptable behavior. These contexts encompass legal systems, cultural norms, and professional codes (Sahin & Mert, 2022).

Figure 2.6 *Overview of Three Pressures of Institutional Theory*



Source: Kauppi and Luzzini (2021)

As illustrated in Figure 2.6, DiMaggio and Powell identified three main types of institutional pressures. Coercive pressures arise from formal rules, laws, and official mandates. Normative pressures are shaped by professional norms, industry expectations, and ethical standards. Mimetic pressures occur when firms imitate the behaviors of more successful or respected organizations, particularly under uncertainty.

These mechanisms collectively drive organizations toward homogeneity as they seek legitimacy and societal approval.

The O&G industry, with its high-risk profile and environmental impact, is particularly sensitive to institutional pressures. Despite existing challenges and regulatory constraints, companies are increasingly compelled to adopt decarbonization measures. For example, Scope 3 CO_2 reporting is now expected by regulatory authorities such as the European Union (EU), which demands deeper carbon emissions reductions (Hettler & Graf-Vlachy, 2023). Normative expectations also play a key role. ESG reporting standards and stakeholder engagement guidelines have led firms to focus on broader performance metrics rather than narrower measures like earnings per share or book value (Cardillo & Basso, 2024). Mimetic behaviors are evident as well. In 2023, Petronas aligned its strategy with the SDGs by partnering with the UN Development Programme (Finance, 2023). This voluntary action reflects a growing trend of firms emulating rivals that successfully integrate innovation and sustainability into their business strategies.

Institutional theory also explains the shift from traditional CSR to more formalized and data-driven ESG systems. ESG reporting is standardized, quantifiable, and oriented toward investors and regulators. In contrast, CSR activities were often discretionary and ethics-based. ST and legitimacy theory are encompassed within institutional theory, which provides a holistic view of how firms navigate changing institutional contexts to gain social acceptance and meet stakeholder expectations (Benvenuto et al., 2023).

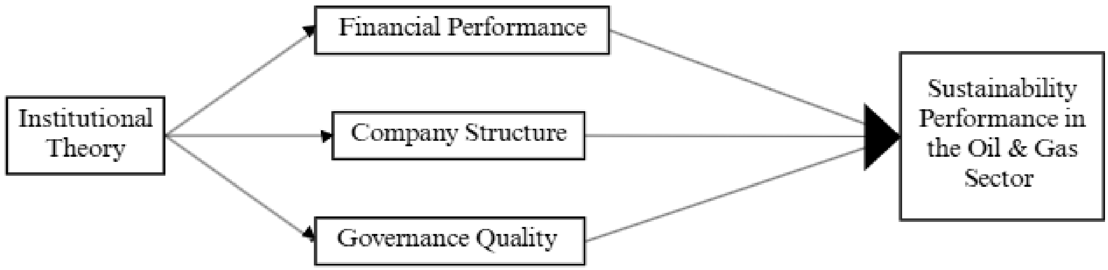
O&G firms frequently use ESG measures not only to comply with regulations but also to enhance legitimacy, build investor trust, and respond to evolving global expectations. For instance, as noted by Ojadi et al. (2023), firms invest in technological innovations such as carbon capture or AI-monitored systems both before regulatory requirements and in anticipation of peer benchmarking. These actions reflect a combination of mimetic and coercive pressures. Building internal ESG awareness and sustainability leadership has become a key differentiator in how firms operate across various institutional settings (Pham et al., 2024).

Traditional institutional theory is valuable in predicting organizational convergence under institutional pressures. Aksom and Tymchenko (2020) highlight that organizations tend toward homogeneity, even when short-term returns on investment are uncertain. This helps explain why firms invest in long-term sustainability projects or reorganizations (Peters & Simaens, 2020). Internally, such adaptations are often rationalized as aligning with the "rules of the game" in their institutional environment. These rules shape how organizations compete and operate, similar to teams following game regulations (Struckell et al., 2022).

However, it tends to emphasize conformity over proactive, strategic agency in ESG innovation (Ding & Wang, 2025). It can also overlook cultural variations in local norms or the implementation of rules, particularly in new markets (Barbar, 2025). For example, Nigeria’s EGASPIN and Petroleum Industry Act 2021 provide a regulatory framework, but weak enforcement often results in environmental degradation (Olujobi et al., 2025). Conversely, Norway enforces strict sustainability regulations. Saudi Arabia’s Vision 2030 promotes environmental conservation and renewable energy while ensuring strong government control. These examples demonstrate that institutions require not only strict formal rules but also effective enforcement and political commitment. Institutional pressures may also conflict. Companies in regions with limited infrastructure or incentives for renewable energy may still adopt global decarbonization practices (Hwang & Venter, 2024).

Despite these limitations, it remains a useful framework for explaining O&G firms’ responses to ESG pressures. It illustrates how external drivers, such as evolving legislation, industry standards, and advanced technologies, shape organizational decisions alongside internal strategy. In an era where sustainable development and efficiency are increasingly intertwined, institutional pressures often serve as the fundamental drivers pushing firms toward more robust and responsive business models.

Figure 2.7 *Institutional Theory Framework*



Source: Developed by the author from multiple sources

2.1.4 Summary of Underlying Theories

Table 2.4 *Summary of Underlying Theories*

Aspect	**Triple Bottom Line (TBL)**	**Stakeholder Theory (ST)**	**Institutional Theory**
Core Idea	Sustainability requires a balance of People, Planet, Profit beyond financial outcomes.	Firms must consider the interests of all stakeholders, not only shareholders.	Coercive, normative, and mimetic pressures from laws, norms, and industry standards shape firm behavior.
Relevance to O&G	Guides emissions reduction, safety, cleaner tech, and community development.	Addresses public scrutiny, legitimacy, risk, project delays, and sustainability actions.	Explains regulatory compliance, ESG adoption, legitimacy, and emulation of peers.
Strengths	• Broad scope, measure economic, social, and environmental performance • Encourages transparency and long-term thinking • Aligns with ESG and CSR	• Emphasizes stakeholder engagement • Links with CSR and ESG • Supports sustainability investment	• Explains convergence toward sustainability • Clarifies regulatory influence and industry trends
Limitations	• Hard to measure social or environmental impact • Risk of greenwashing • Misuse or misinterpretation	• Stakeholders have conflicting interests. • Lacks a clear methodology to prioritize demands • Difficult to implement consistently	• Emphasizes conformity over proactive ESG innovation • Overlooks cultural and local differences • Weak enforcement reduces impact

Source: Summarize by the author

2.2 Review of Factors

This section will review the factors that influence sustainability performance in the O&G industry, such as Decarbonization Strategy (DS), Financial Performance (FP), Company Structure (CS), Social Responsibility (SR), and Governance Quality (GQ). Country is included as the control factor. Hypotheses are developed for the relevant or necessary factor(s).

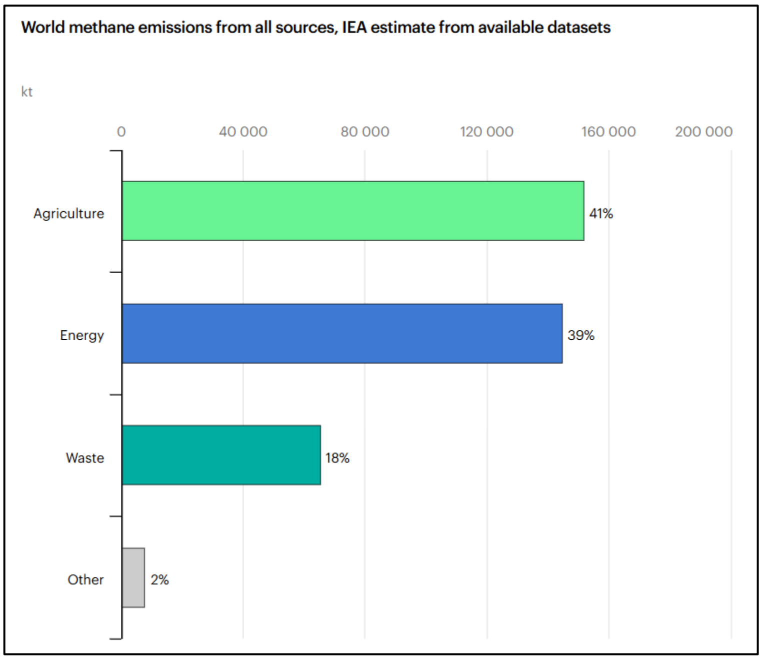
2.2.1 Sustainability Performance (SP) in the O&G Industry

Corporate culture, governance framework, and voluntary responsibility are all vital for SP beyond mere fulfillment (Shitsi, 2024). Early, emission reduction was already a hot topic. Yet, the recent strategy takes a more holistic approach to measuring sustainability with ESG factors. The tragic history event in 2010, the Deepwater Horizon explosion, has revealed obvious operational management and environmental protection failures.

To attract investors and stakeholders, ESG reporting and practices serve as evidence of SP, which helps create a positive reputation for global business opportunities. Since third-party organizations gather the majority of the ESG data for investors, the performance and quality of ESG data are always dubious. However, companies are also reporting ESG data either through their sustainability, ESG, or integrated reports. By incorporating sustainability into their business operations, they can gain a competitive edge in the market by increasing transparency, accountability, brand value, and legitimacy, while also improving their reporting (Aki, 2023).

ESG controversies have become critical in O&G research, ranging from contamination and unfair labor practices to serious issues such as fraud and distortion (Shakil et al., 2025). Ineffective environmental management often triggers public objection and amplifies governmental oversight. The International Energy Agency (IEA) estimated that around 39% of global methane emissions originated from the energy sector, as illustrated in Figure 2.8.

Figure 2.8 *World Methane Emissions*



Source: (IEA, 2025)

SP monitoring is a serious issue. Common key performance indicators (KPIs) adoption and evading technical measures, particularly offshore maintenance, are uncovered by Olugu et al. (2022). This gap in theory and practice prevents us from a full understanding of the impacts of sustainability. Furthermore, despite growth in the area of sustainability reporting, a gap remains between the figures presented and actual practice. For instance, BP has been accused of greenwashing when it reneged on public promises to achieve net-zero targets (Li et al., 2022). Overall, O&G industry's SP is complicated and multifaceted.

2.2.2 Decarbonization Strategy (DS)

Decarbonization is the process of lowering GHG emissions across the whole value chain, from upstream to downstream in the O&G sector. They mean eliminating carbon dioxide (CO_2) emissions by shifting to renewable or low-carbon energy sources (Oruwari & Itsekor, 2023). Figure 2.9 shows most of the O&G activities that contribute to carbon emissions.

Figure 2.9 *Activities Contribute to Carbonization*

Source: Developed by the author from multiple sources

Although decarbonization is mostly environmental, it does have an important social aspect, such as enhanced community well-being and safety, and economic effects in terms of carbon price, investor response, and regulatory obligations. These efforts include producing low-carbon fuels, preventing methane leakage, electrifying operations, using carbon capture, utilization, and storage, and reducing flaring (Cherepovitsyn et al., 2021).

To ensure the emissions are under control, stricter environmental and more net-zero pledges are being made. Following the 2015 Paris Agreement, where nations pledged to slow the rise in global temperature below 2°C compared to pre-industrial levels, with a target of 1.5°C by 2050, achieving net carbon neutrality is crucial.

According to IEA (Table 2.5), the global data shows that the US ranks at #2, as the worst emitter out of the selected countries, with its total segment contributing 20500.58 kt (kilotonnes) of emissions from 2022 to 2024. In contrast, Norway ranks at #81, as the best emitter here, with its total emissions at 30.99 kt. The overall highest-emitting segment is onshore O&G, especially vented methane. So, how were these emissions released? Vented emission is the worst, where the methane will be intentionally released to the atmosphere when pressure is released. It worsens the SP since methane has 80 times more warming power than CO_2.

2.2.3 Financial Performance (FP)

Sectors with a harmful nature have a greater burden on SP due to their environmental and social exposure. O&G companies tend to align their environmental and social responsibilities with the stakeholders' demands to gain financial return, minimize risk, and maximize market value (Christine et al., 2025).

Ramírez-Orellana et al. (2023) proposed mixed results on the relationship between sustainability efforts and FP. Some studies report a positive relationship, such as proactive environmental responsibility improving FP in the Chinese energy sector. In a sample of 219 O&G companies, the authors find a positive relationship between FP and the ESG index, with a p-value of 0.000, shown in Figure 2.10. The result suggests that stronger sustainability commitments are associated with higher financial returns and greater market value.

However, Shahbaz et al. (2020) find no clear positive association between ESG scores and FP, and they show that the impact varies over time. Short-term investments in clean energy may reduce FP in terms of market value and ROA, while long-term effects tend to be positive. With 414 companies' data, the overall average ROA was negative, at −0.78 ± 16.62. This result shows that higher SP does not assure higher FP.

According to Zhou et al. (2024), sustainability disclosure can influence a firm's FP, which in turn affects its reputation and social acceptance. Even when FP is weak, a strong reputation can increase stakeholder confidence and make them more willing to engage with the firm.

2.2.4 Company Structure (CS)

The O&G industry is structured into 3 segments (upstream, midstream, and downstream) based on the operations. Ewing et al. (2024) find that the relationship between upstream and midstream segments is the main resource of the energy supply chain. Both segments of companies are more specific in their operations, unlike downstream companies, which are usually integrated. Upstream firms are highly susceptible to O&G price fluctuations. Midstream firms operate capital-intensive transport and storage infrastructure, which has high fixed costs but low operating costs, and they typically earn revenue through tariff-based contracts that secure transportation volumes in advance.

Most papers do not directly address O&G company structures. Even fewer discuss the breakdown of operational segments into upstream, midstream, downstream, or integrated firms. It is implicitly presumed that most sustainability harm is caused by the upstream segment, given the nature of its exploration and drilling operations (Kaupke & Knyphausen-Aufseß, 2022).

However, based on what I have read, there is little evidence that cross-country studies differentiate between operational segments in measuring SP. Instead, most research focuses on a single country (usually India or the US) or takes a global perspective, yet fails to disaggregate the industry by segment. Among the few studies at the segment level, most focus mainly on upstream operations. As a result, midstream and downstream segments remain underexplored and lack systematic analysis. Formal hypotheses are developed only for categorical factors, namely CS and Country.

H_1: Sustainability Performance differs significantly across company types (Integrated, Upstream, Midstream, Downstream).

H_2: Sustainability Performance differs significantly across operating countries.

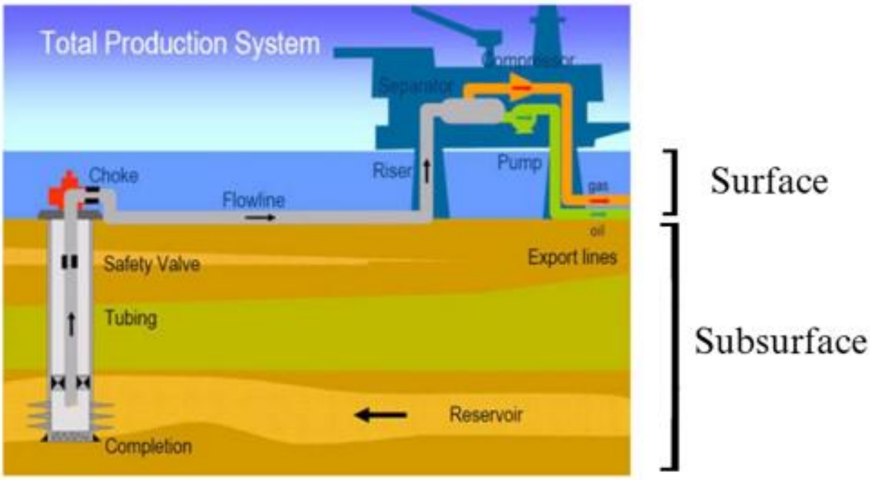
2.2.5 Social Responsibility (SR)

Social Responsibility in O&G is commonly known as CSR. It refers to a company's commitment to operate an ethical and responsible business that contributes to societal well-being. According to Frynas (2009), CSR among Malaysian firms is partly motivated by religious values, especially around Muslim and Chinese religious holidays. Unlike Europe, philanthropy is not typically viewed as part of CSR since it falls outside a firm's core operational impact.

The drive for an energy transition has placed energy businesses on the frontline of stakeholder expectations and governmental legislation. These place them under close public scrutiny to ensure that they address a wider range of social duties and environmental performances. However, CSR in O&G often neglects governance issues and creates meaningless community development; this makes companies vulnerable to criticism. Meanwhile, larger businesses are more visible and subject to more public scrutiny, and generally see an increase in profitability influenced by ESG factors (Yucel & Yucel, 2024).

O&G activities are usually located offshore, where rigs are built on the sea surface. According to Mehta (2020), oil rig work is one of the most hazardous jobs, with a fatal injury rate of 46 per 100,000 workers. Such incidents can negatively affect a company's social score. They drill and install pipes down to the subsurface reservoir so that O&G can flow into the wells. The hydrocarbons are then transported via pipelines to onshore facilities for processing and production, as shown in Figure 2.12.

Figure 2.12 *Surface and Subsurface in O&G Operation*



Source: Saadawi (2016)

According to Kgi-Admin and Kgi-Admin (2023), 47 out of 100 companies in ocean economy are O&G sector-based, which means that activities of O&G industry have great potential for influencing marine habitats, calling for high importance of good SR practices.

2.2.6 Governance Quality (GQ)

Governance is often neglected in O&G sustainability discussions, which are usually dominated by environmental and social issues. However, governance quality (GQ) is essential as it affects sustainable practices and how resources are allocated to green projects. It encompasses transparency, accountability, efficiency, and full participation in decision-making processes. Strong GQ establishes the institutional setting necessary for formulating and implementing policies that manage resources with a view to ensuring long-term ecological sustainability.

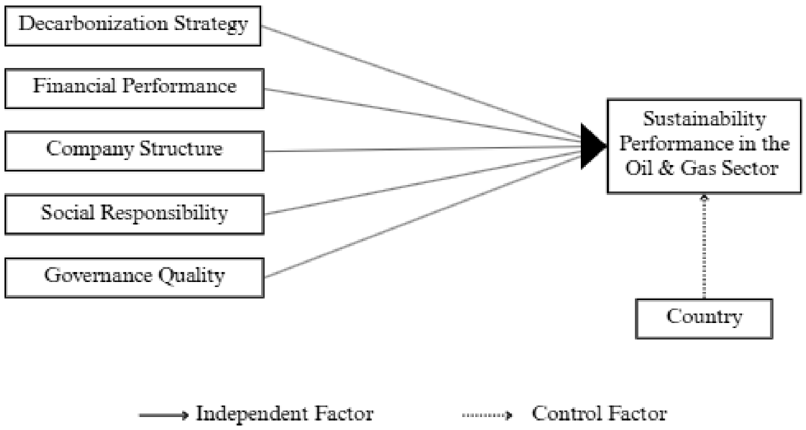
According to Liu and Zhang (2024), good GQ negatively impacts carbon production and positively impacts sustainability. Strong governance boosts investments and resources in renewable energy and environmentally friendly technology. High GQ countries attract more significant investment in renewable energy and accelerate the shift towards a low-carbon economy. Furthermore, transparent government builds stakeholder trust and facilitates sustainable development projects by reducing corruption and inefficiencies.

O&G activities are directly linked with national policies and government regulations (Moghani & Loni, 2024). NOCs are influenced or controlled by the government as a shareholder, resource owner, or regulator. They can either support fossil-fuel expansion or drive sustainable transitions through legislation. Government political and regulatory pressure is among the strongest tools for improving corporate SP.

The Russia-Ukraine War brought back Europe's concern for energy security and increased the call for stricter regulation of fossil fuels (Austvik, 2024). In the US, political fluctuations-for instance, the "drill, baby, drill" position taken by Trump and withdrawal from climate agreements-created policy instability. This type of uncertainty impacts firm strategies, investment decisions, and general performance in governance (Fisher, 2025).

2.3 Proposed Theoretical/Conceptual Framework

Figure 2.14 *Proposed Framework*



Source: Developed for this Research

2.4 Chapter Summary

This chapter reviews existing literature to identify the key factors that influence the SP in the O&G industry. Theories, including TBL, ST, and Institutional Theory, are discussed. By analysing prior studies and papers, this chapter establishes the foundation for building the research's conceptual framework.

CHAPTER 3: METHODOLOGY

3.0 Chapter Introduction

This chapter outlines the research methodology used for this research, including research design, content, research sampling, research instrument, research procedure, data collection method, and data analysis tools.

3.1 Research Design

This research adopts a quantitative cross-country comparative design with explanatory-exploratory elements to test the factors influencing SP in the O&G sector. Leppink (2017) said research topics should specify the research methodology to be adopted, rather than use specific qualitative or quantitative labels. While mixed-methods studies combine the strengths of mixed-method approaches, the choice depends on the study's objectives (Roberts et al., 2021). Although qualitative benefit exploratory studies by diving into deeper information, quantitative studies are best for quantifying relationships like correlation. Thus, this study adopts a quantitative method.

Exploratory design is used when no hypothesis is formed. It discovers unclear phenomena and creates potential questions later. It applies to continuous predictors (DS, FP, SR, and GQ). In contrast, explanatory design seeks to understand the cause-and-effect correlation between identified factors and the desired outcome. It is often performed after an initial exploratory analysis (Firera et al., 2024). It applieds to categorical group differences (CS and Country) where formal hypotheses are specified. Quasi-experimental design is often employed within explanatory design to increase causal inference when random assignment is not feasible

(Sovacool et al., 2018). Combining both designs enables a holistic understanding of the RQ by first identifying relevant factors and then investigating the causal effects on SP.

A cross-country comparative approach is utilized to ensure internationalized outcomes. As O&G resources extraction occurs in marine environments, which is globally shared, using this approach captures the global nature and enables wider insight. Thus, this study covers regions in ASEAN, Europe, and North America.

3.2 Case Study Content

This section justifies the selection of countries, industry, companies, and time frame from a methodological perspective.

3.2.1 Why These Countries

(a) Malaysia

Among SEA economies, Malaysia stands out due to its large share of O&G reserves and its commitment to GHG emissions. Although its territory area is much smaller than countries like Indonesia or India; Malaysia has favourable geographical conditions located between the South China Sea and the border of the Malacca Strait, which are both vital energy trading routes. This makes Malaysia a major exporter in the ASEAN region. Figure 3.1 shows Malaysia's total energy supply in different energy types (Yahoo et al., 2024).

According to EIA (2024), Malaysia has the second-largest oil reserves in SEA with 2.7 billion barrels and the world's fifth-highest exports of LNG in 2023. Petronas

(Malaysian NOC) was positioned as the world's strongest O&G brand in 2024 (Sukoco, 2025). It was the first SEA country ranked on the Fortune Global 500 in 1997. Petronas continues to invest in education by establishing Universiti Teknologi PETRONAS (UTP) to nurture O&G field talents. UTP partners with the Malaysian government to build Malaysia's first private 5G R&D lab named PER5ONA, allowing students to gain real-world experiences (Petronas, 2025).

Overall, Malaysia's solid foundation in O&G reserves, situated strategically along major global energy routes, and significant investments in technological and talent make it an interesting country to explore (Bee et al., 2025). Its efforts to balance the abundant O&G resources with proactive efforts to achieve decarbonization show important insights into how it navigates the transition toward a sustainable low-carbon future.

(b) United States (US) and Canada

Both the US and Canada are in North America. Being the top producers in O&G, the US and Canada rank #1 and #4, respectively (Richter, 2025). The US has a strong influence on managing the world supply. It has more influence over geopolitical forces and market expectations despite growing Chinese economic power. The US-China relationship remains central to the oil market's future, although China's growing demand is becoming increasingly substantial (Cai et al., 2022).

Canada is the world's second-largest country, the fourth-largest producer, the fifth-largest exporter, and the country with the fourth-largest oil reserves. According to Canada Action (2025), the O&G industry generates the most for Canada's exports, making up 25% of all Canadian exports worth $177 billion. The Canadian O&G sector is in a unique position since it combines broad and concentrated O&G reserves, particularly in Alberta and British Columbia, with an established structure, cutting-edge technology, and a highly skilled workforce (Plourde, 2010). Yet, the US has imposed

10% tariffs on Canada's energy imports, although Canada exports 63% of crude oil to the US. This reduces Canadian export competitiveness, harming the GDP and employment rate (CONGRESS.GOV, n.d.).

(c) United Kingdom (UK) and Norway

Both the UK and Norway are European countries. Davey (2025) claims that the UK exports a large portion of its oil because refinery capacity has decreased by about 30% since 2010, making it impossible to refine sufficient products for local consumption. Its premium crudes are then shipped to European refinery hubs. It depends on North Sea resources, Norwegian supply, and LNG imports due to storage constraints. The UK's oil reserves are also rapidly depleting, leading to increased supply constraints and price volatility following the pandemic and the Russian-Ukraine war (Oke et al., 2024).

For Norway, its O&G sector emerged after the discovery of oil in 1969. Recently, Norway changed its economy with digitalization and green restructuring. This shift has pushed firms to modify their business models, with over 60% expecting growth in offshore wind by 2023. Although Norway is known for its advanced technology in delivering green O&G, some argue that the industry is exaggerating its green credentials (Sletten et al., 2023).

The North Sea is the main O&G production region for both the UK and Norway. However, the North Sea O&G infrastructures are outdated and must be decommissioned safely. This will cost the highest at €100 billion, and the UK and Norway will have the most responsibility as they own the most facilities there (Martins et al., 2023).

3.2.2 Why O&G Sector

It is a well-known industry that boosts the global economy. According to IBIS World, O&G industry ranks #5 in the top 10 world's largest industries based on revenue in 2025 at $42,338 billion (Table 3.1). Despite its contribution to the global economy, it is also the sector that harms the world the most, ranking at #1 (Aurassure, AI-Powered Climate Intelligence, 2025). Due to the nature of O&G operations, it cannot escape polluting the environment to fulfill the world's demand. Thus, instead of blaming the O&G sector, everyone is responsible for sustaining a better Earth, including individual consumers, corporations, and public institutions.

Table 3.1 *Top 10 World's Largest Industries by Revenue in 2025*

NO	Industry	Revenue for 2025
1	Life & Health Insurance Carriers	$5,531,9B
2	Car & Automobile Sales	$4,357,5B
3	Commercial Real Estate	$4,329,8B
4	Pension Funds	$4,253,6B
5	Oil & Gas Exploration & Production	$4,233,8B
6	Direct General Insurance Carriers	$2,858,5B
7	Auto Parts & Accessories Manufacturing	$2,721,2B
8	Car & Automobile Manufacturing	$2,668,9B
9	Coal Mining	$2,542,6B
10	Tourism	$2,029,7B

Source: *Global Sources* (2025)

3.2.3 Why Top 30 Companies

To be concise, the sample consists of the top 29 companies from the selected countries in the US, Canada, the UK, and Norway, with Malaysia included as the 30th. They were chosen based on their market share from the *CompaniesMarketCap* website on 3 November 2025. This allows a more detailed and meaningful analysis compared to using a much larger sample, like most research papers in the O&G field.

Also, based on what I have access to, there are limited previous studies have included a company or a country outside the usual range in this way. This enables an observation of how Malaysia could learn from them, or whether Malaysia outperforms some of them in certain areas.

3.2.4 Why This Time Frame

The majority of the past studies, such as Okeke (2021) and Ali et al. (2023), were conducted more than or equal to 10 years. In contrast, Jin et al. (2025) conducted China-based research using selected 4 key years from 2000 to 2021 timeframe to clearly capture representative phases of carbon emission intensity of the O&G industry evolution. Nonetheless, Wang et al. (2022) observed in a single year to get the most recent industry conditions. Yet, Ahamed et al. (2024) selected 2014-2018 (5 years) to avoid irregularities caused by the pandemic, and the period showed significant turbulence in the O&G industry.

The year 2024 is chosen as the most recent point of analysis, so its findings are current and relevant. The period from 2020 to 2024 will enable this study to monitor how businesses and nations adjusted and recovered in the aftermath of the economic slump, since 2020 marks the beginning of the post-pandemic recovery. All the chosen companies' most recent annual reports are included, and this enables an evaluation of their overall SP in the post-pandemic period.

3.3 Research Sampling

3.3.1 Sampling Techniques

Purposive sampling lets the researchers focus directly on what is most relevant to the study objectives. It ensures the selected sample shows high-quality data for analysis. The O&G industry is highly diversified in operational scope, size, and regional presence (Bolodeoku et al., 2022). The countries were selected as each represents varied resource richness and the ability to influence the world. Focusing on the top 30 companies for 5 years reflects the current industry conditions.

3.3.2 Sampling Size

The sample is purposely selected with the following criteria:

1. HQ located in the US, Canada, the UK, Norway, or Malaysia
2. Ranked within the top 30 of 419 O&G companies by market shares according to the *CompaniesMarketCap* website
3. Petronas is included as the 30th to represent Malaysia, despite falling outside the top 30
4. Accessibility of ESG and Financial Data from LSEG Workspace
5. Publicly disclosed data is updated until 2024

Figure 3.4 *Map Regions Included in this Study*

Source: Created from Excel with Data Input

A total of 30 companies meet these criteria: 21 from the US, 5 from Canada, 2 from the UK, and 1 from each Norway and Malaysia. With 5 years for each company, Figure 3.4 shows that 150 companies' raw data were collected from LSEG Workspace before further analysis.

However, some data is not fully disclosed by the company due to different operating methods. That is why unbalanced data panel analysis is also introduced in this study. Following Mohn and Misund (2008), who used this method to screen 2197 potential firm-years to 443 after removing those with missing values, this research will analyze 30 global O&G companies with 5 years each (30 companies*5 years). From an initial 150 observations, the final sample was reduced to 123 after removing years with missing data (Table 3.2). Excluded data included years when certain data were not reported and not available on the LSEG Workspace.

Table 3.2 *Final Dataset*

Country	US	Canada	UK	Norway	Malaysia	Total
Total Dataset (Company from Each Country)	21	5	2	1	1	30
Total Company (Population)	105	25	10	5	5	150
Excluded N/A data for certain years	18	8	0	1	0	27
Data used for analysis	87	17	10	4	5	123
Percentage of dataset used for analysis	71%	14%	8%	3%	4%	100%

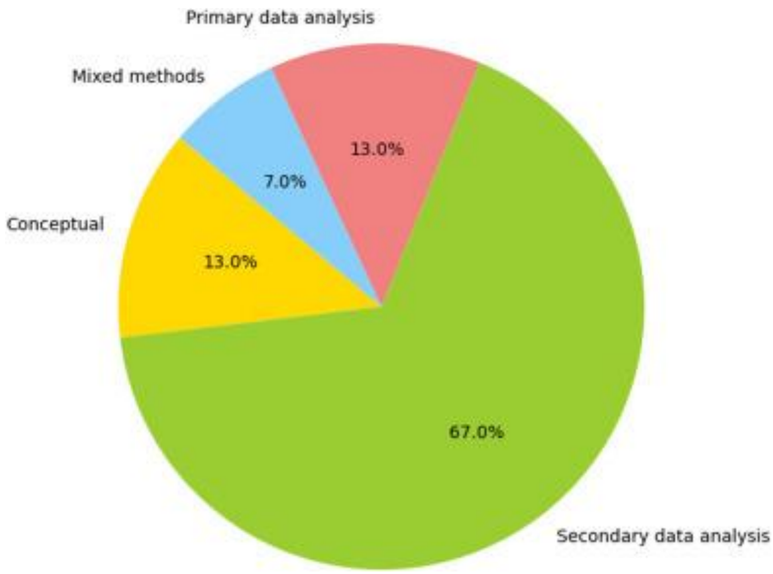
Source: Collected by the author

3.4 Data Collection Method

3.4.1 Data Collection Method

The research utilizes a desk study approach and relies exclusively on secondary data. According to Bais et al. (2024), approximately 67% of research uses secondary data analysis by analysing business reports' content. The study sample was purposely selected to ensure traceability and transparency, making it possible to achieve a good understanding of business sustainability-related plans, activities, and disclosures of companies across countries. The approach is highly suitable as it eliminates the requirement of primary fieldwork and allows for comparisons to be made between many countries and companies.

Figure 3.5 *Percentage of Reports Employing Secondary Data Method*



Source: Bais et al. (2024)

However, the use of only secondary data has its own drawbacks. These are (i) a lack of insider or behind-the-scenes data, (ii) possible self-reporting prejudice, and (iii) varying reporting standards among companies. During data collection, there were certain difficulties that were faced. To begin with, scope 3 carbon footprint data are often missing or unavailable; hence, only scopes 1 and 2 are considered in this study. This is a limitation because scope 3 emissions are outside the company's control and remain voluntary rather than mandatory, with guidance for standardised reporting still to be established (Carroll, 2023). Secondly, extracting comparable data was challenging because terms found in reports differ, with some companies not disclosing some data at all. Third, differences between official yearly reports and third-party website information were found, further complicating data consistency. Fourth, the units of measurement made it harder to include several useful information.

Despite these constraints, secondary data remain sufficient for public SP research, especially when triangulated from various credible sources to add validity and dependability.

3.4.2 Data Sources

(a) LSEG Workspace

Raw data are retrieved solely from LSEG (London Stock Exchange Group) Workspace on 6 November 2025. LSEG Workspace, previously named Thomson Reuters, later Refinitiv Eikon. It is a leading global data provider with comprehensive financial and ESG databases. It covers standardized and comparable data for more than 9000 companies across 175 countries (Ramírez-Orellana et al., 2023b). The ESG scores are constructed from over 180 material indicators by global analysts (Arseni, 2020). LSEG is a reliable secondary data source for empirical research and is used extensively in academic studies (Doni et al., 2021). Therefore, it is ideal for evaluating SP, emissions indicators, GQ, and financial variables due to its unified structure, cross-industry accessibility, and long-standing trustworthiness in academic research. Thus, utilizing LSEG data ensures the data used in this analysis are reliable, current, and compliant with international ESG reporting standards.

(b) *CompaniesMarketCap* Website

CompaniesMarketCap.com data was used to identify and rank the top 30 companies in selected countries, as it is a reputable, free-access platform that gives transparent and recent market capitalization rankings. It covers 10,638 companies worldwide, and the user-friendly design makes it easier to compare cross-country and cross-industry. It is positioned in the Global Rank of #14,613 and within the finance-investing category at #130 (*Website Performance*, 2025). There is a total of 419 O&G public companies on the website. Users can rank them by market capitalization, earnings, revenue, P/E ratio, and more.

3.5 Factors Measurement

As explained in Chapter 2, SP in the O&G industry is the outcome of the research. It would be measured using the ESG Combined Score collected from LSEG for each company based on the independent factors (IFs) used. The cause-and-effect is the result to observe here. LSEG shows raw data in alphabetical letters; to make it easier to analyze, it has been changed to numerical numbers (Table 3.3). Each company's GHG Emission Method is coded as 1 = Not Reported and 2 = Reported.

Table 3.3 *LSEG Score Rate*

Letter	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	N/A
Score	12	11	10	9	8	7	6	5	4	3	2	1	Blank
Group	1	1	1	2	2	2	3	3	3	4	4	4	Excluded

Source: LSEG; Converted by the Author

There are 5 IFs with different indicators and scales used to measure. Both DS and FP will be calculated using the average of 3 respective indicators. Their internal consistency will be tested using Cronbach's Alpha to ensure that combining the indicators is agreeable. For CS and Country, they are nominal measurements, which are not suitable for Cronbach's testing. For SR and GQ, each has only one indicator; there is no need for Cronbach's testing. This allows the cause-and-effect relationship between all factors to be observed and analyzed quantitatively.

Table 3.4 *Rule of Thumb of Cronbach's Alpha*

Cronbach's Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Source: Guzman et al. (2022)

3.6 Data Preparation Before Analysis

Table 3.5 *Data Preparation*

Factor Type	Factor	Indicator(s)	Coding	Measurement	Source
Dependent	Sustainability Performance (SP)	ESG Combined	12–1 (A+ to D–)	Ordinal	LSEG
Independent	Decarbonization Strategy (DS)	Average of ESG Score, E Pillar, and GHG Emission Method	12–1 (A+ to D–)	Ordinal	LSEG
	Financial Performance (FP)	Average of ROA (%), Net Profit Margin (%), and Operating Profit Margin (%)		Scale	LSEG
	Company Structure (CS)	Company Type	1 = Integrated 2 = Upstream 3 = Midstream 4 = Downstream	Nominal	LSEG
	Social Responsibility (SR)	S Pillar	12–1 (A+ to D–)	Ordinal	LSEG
	Governance Quality (GQ)	G Pillar	12–1 (A+ to D–)	Ordinal	LSEG
Control	Company HQ Origin Country	Country	1 = United States 2 = Canada 3 = United Kingdom 4 = Norway 5 = Malaysia	Nominal	Company Official Website

Source: Stated in Table 3.5

Before analysis, data are screened for missing values, outliers, and coding errors. Nominal variables are dummy-coded, composite variables (DS and FP) are standardized before aggregation. Observations with incomplete data are excluded to ensure consistency in statistical testing.

3.7 Data Analysis Tools and Techniques

Data Analysis transforms raw information into meaningful insights using various techniques (Mahdieh Zakizadeh, 2024).

3.7.1 Descriptive Analysis

Descriptive analysis summarized the companies' profiles, like CS and countries of origin. For the IFs and the dependent factor (DF), descriptive statistics include the mean, standard deviation, minimum, maximum, and frequency distribution. Before analysis, data screening was performed to address missing values, verify coding accuracy, and confirm suitable measurement types (nominal, ordinal, or scale).

Composite factors such as DS and FP were tested using Cronbach's Alpha to assess the internal consistency reliability. Cronbach's Alpha will be used to evaluate internal consistency, with values above 0.70 indicating reliability according to the rule of thumb. This allows their indicators to be averaged into a single composite score. Correlations among IFs and DF will also be run. All analyses will be conducted using SPSS version 29 and Microsoft Excel.

3.7.2 Inferential Analysis

Several statistical techniques will be used based on the measurement type and ROs. The initial step will involve correlation analysis (Pearson correlation) to examine the relationship among key continuous factors such as DS, FP, SR, GQ, and SP. Then, one-way ANOVA will be used to assess performance differences across the nominal categories, like CS and Country. When p-value < 0.05, the significance of differences is statistically significant. Tukey tests will be conducted if ANOVA shows significant differences to identify which specific groups differ (Kwak, 2023). Finally, multiple linear regression (MLR) will be employed to run the overall predictive effect of DS, FP, CS, SR, and GQ on SP. Nominal factors like CS and Country will be dummy-coded for inclusion in the model. The significance of each predictor is assessed using its p-value ($p < 0.05$ indicates significance), and the model fit is assessed via R^2 (Roustaei, 2024). This model allows the study to determine the unique contribution of each IF while controlling for others. Overall, these techniques deliver a structured and precise approach to examining the cause-and-effect relationship between the selected factors and SP in the O&G industry.

$$SP = \beta_0 + \beta_1 (DS) + \beta_2 (FP) + \beta_3 (CS) + \beta_4 (SR) + \beta_5 (GQ) + \beta_6 (Country) + \varepsilon$$

SP = Sustainability Performance in the O&G Industry

DS = Decarbonization Strategy

FP = Financial Performance

CS = Company Structure

SR = Social Responsibility

GQ = Governance Quality

3.8 Ethical Considerations

Only publicly available documents are used in this study; there are no human subjects involved. Therefore, formal ethical clearance is not required. The study conforms to the ethics of data quality, correct referencing, and transparency. Sensitive or personal information is not utilized. Data handling is undertaken according to ethical standards of interpretation, citation, and storage that are academic in nature.

3.9 Chapter Summary

This chapter outlines the quantitative research methodology used to examine how factors influence sustainability performance in the O&G industry across Malaysia, the US, Canada, the UK, and Norway, with data collected from LSEG Workspace for 30 selected companies. It details the sampling approach, data sources, and the measurements of all factors, including DS, FP, SR, GQ, CS, Country, and SP. The data will be analyzed through Pearson correlation, one-way ANOVA, and Multiple Linear Regression to address the research questions.

CHAPTER 4: DATA ANALYSIS

4.0 Chapter Introduction

This chapter presents the results of the data analysis conducted using SPSS version 29 and Microsoft Excel. It includes descriptive analysis and inferential analysis to present the results of the relationships between IFs and SP using Pearson Correlations, one-way ANOVA, and Multiple Linear Regression (MLR) to examine the relationships between IFs on sustainability performance in the O&G industry.

4.1 Data Screening

As stated in Chapter 3, data screening was performed to ensure the dataset was consistent and accurate for analysis. This study adopts an unbalanced panel data analysis covering the years 2020-2024. Data of the top 30 companies selected from the 5 mentioned countries were extracted from LSEG Workspace. However, not all indicators were available every year. Thus, to ensure consistency, years with missing data were excluded to maintain analytical reliability.

LSEG ranks the data using alphabetical grades (A+ to D-). These were converted into numerical values (12 to 1) for SPSS statistical analysis. After screening, the usable data for factors (DS, FP, SR, GQ, SP) were then reduced from 150 possible observations (30 companies*5 years) to 123 valid samples. For factors like Country and CS, the data remain because these attributes do not change over time. Thus, Country and CS remain 30 observations. The final dataset is attached in Appendix.

Cronbach's Alpha analyses were conducted for Decarbonization Strategy (DS) and Financial Performance (FP); both constructs show acceptable internal consistency: DS (0.737) and FP (0.740). This indicates reliability and allows their indicators to be averaged in the analysis.

4.2 Descriptive Analysis

An analysis was conducted using the data collected from the sample. This is important to understand the distribution and characteristics of the factors before conducting inferential analysis (Owolabi et al., 2022). Descriptive analysis was employed to summarize the companies' profiles and countries of origin. The sample includes the top 30 Companies' data headquartered in 5 countries: the US, Canada, the UK, Norway, and Malaysia. Each country has at least one company, and that company represents one of these company types (Integrated, Upstream, Midstream, Downstream).

The collected data ranged from 2020-2024, having 150 potential observations. After removing years with missing data, it was reduced to 123 samples for factors like DS, FP, SR, GQ, and SP, as Appendix 4.1. Factors like Country and CS are companies' characteristics data; hence, they were analyzed at n=30. The majority of this sample is from the US (21); both Norway and Malaysia have the lowest representation at only 1 company, which is Equinor and Petronas, respectively.

Table 4.1 *Country and Company Structure Distribution (N = 30)*

Country		US	Canada	UK	Norway	Malaysia
Structure	Integrated	7	3	2	1	1
	Upstream	2	0	0	0	0
	Midstream	6	2	0	0	0
	Downstream	6	0	0	0	0
Total (n)		21	5	2	1	1
Percentage (%)		70%	17%	7%	3%	3%

Source: Developed for this Study

For factors such as DS, FP, SR, GQ, and SP, descriptive statistics were generated and included the mean, standard deviation, minimum, and maximum value. The results are presented in Table 4.2. These statistics show an overview of the central tendency and variability of each factor before conducting inferential tests.

Table 4.2 *Descriptive Statistics of Continuous Factors (N=123)*

	Sample Size	Mean	Standard Deviation	r	p-value
Decarbonization Strategy (DS)	123	6.35	1.318	0.448**	<0.001
Financial Performance (FP)	123	11.24	14.159	-0.069	0.446
Social Responsibility (SR)	123	8.92	1.867	0.411**	<0.001
Governance Quality (GQ)	123	8.45	2.881	0.341**	<0.001
Sustainability Performance (SP)	123	7.22	1.818	1	

r = Pearson Correlation
p-value = 2-Tailed Significance
** = Correlation is significant at the 0.01 level (2-tailed)
* = Correlation is significant at the 0.05 level (2-tailed)
Dependent Factor = Sustainability Performance (SP)

Source: Author's own data analysis

Since the factors are measured on a 1-12 scale, values above the midpoint (6) indicate moderate levels, while values approaching 8-12 are high levels. Table 4.2 presents the results of companies displaying moderate to high levels of DS (Mean=6.35), SR (Mean=8.92), and GQ (Mean=8.45). SP is also moderately high (Mean=7.22) with relatively low variation (SD=1.818). In contrast, FP shows the highest variation (SD=14.159), ranging from large losses to strong profits. This means that some companies had significant losses while others had strong profits, showing a diversity of financial status across companies. Overall, the descriptive statistics indicate that the dataset is appropriate for further analysis.

4.3 Inferential Analysis

This section presents the results of statistical tests used to examine the relationships between IFs (DS, FP, SR, GQ, CS, Country) and the DF (SP). Pearson Correlation, One-Way ANOVA, and Multiple Linear Regression (MLR) will be used to do the analysis using SPSS version 29.

4.3.1 Pearson Correlation Analysis

Pearson Correlation Coefficient (PCC) is widely used in similar research. Morais et al. (2023) used it to quantify the relationship between petroleum potential and maturity. Kiiza et al. (2024) used it to study the relationship between the O&G activities and the quality of livelihoods.

Pearson Correlation Analysis is a statistical method to measure the degree of linear correlation between two variables. It is based on the Pearson correlation coefficient between -1 and +1, and represented by the symbol ‘r’. It reveals the strength of relationships, which helps to understand which factors have the greatest influence on SP. A correlation of +1 indicates a perfect direct relationship between two variables; a correlation of -1 indicates that one variable changes inversely in relation to the other.

Zero indicates the lack of any linear relationship at all (Jin et al., 2024). Table 4.3 illustrates the PCC interpretation scale. Table 4.2 shows the PCCs among DS, FP, SR, GQ, and SP. When $p<0.05$, it means the correlation between two variables is statistically significant; it indicates extremely strong statistical significance when $p<0.001$ (Zhu, 2016).

Table 4.3 Pearson Correlation Coefficient Rules of Thumb

Correlation Coefficient	Interpretation
0.00 – 0.10	Negligible Correlation
0.10 – 0.39	Weak Correlation
0.40 – 0.69	Moderate Correlation
0.70 – 0.89	Strong Correlation
0.90 – 1.00	Very Strong Correlation

Source: Schober et al. (2018)

The results presented that DS and SR both have moderate positive correlations with SP, with $r = 0.488$ and 0.411, respectively ($p<0.001$). This means companies with stronger DS and more active SR initiatives tend to achieve higher SP. On the other hand, Governance Quality (GQ) presents a weak but significant positive correlation with SP ($r=0.341$, $p< 0.001$), indicating that better governance practices are still meaningfully improving SP even though to a lesser degree.

However, FP displays a negligible and non-significant correlation with SP ($r=-0.069$, $p=0.446$). This indicates that short-term financial outcomes may not directly reflect a company's SP. It is also notable that DS and SR are highly correlated ($r=0.768$, $p<0.001$). This implies that companies that prioritize decarbonization are often also investing heavily in SR events.

Overall, these results confirm that the selected continuous factors are meaningfully related to SP. These support their inclusion in the following inferential analyses. The dataset shows sufficient variability and statistically significant correlations to proceed with examining the cause-and-effect relationships.

4.3.2 One-Way ANOVA

A one-way ANOVA was conducted to examine whether SP differs across CS and Country. In ANOVA, the F-value represents the ratio of between-group variance relative to the within-group variance. A larger F-value means greater differences across groups. Statistical significance is assessed using the p-value. A smaller p-value ($p<0.05$) means a significant difference among the group means (Kim, 2014). Since CS and Country will not change over the years, the average of SP for each company (N=30) was used. In this research, SP is measured using the ESG Combined Score scale; thus, higher values indicate better performance.

Table 4.4 *ANOVA Test for Company Structure (CS)*

Company Structure (CS)	**n**	**Mean SP**
Integrated (CS =1)	14	7.0393
Upstream (CS = 2)	2	6.7500
Midstream (CS = 3)	8	7.5063
Downstream (CS = 4)	6	7.7500
ANOVA F = 0.484 p-value = 0.696 (Not significant) Sum of Squares: Between Groups vs Within Groups = (3.107 vs 55.583) Effect Size (Eta-squared, η^2) = 0.053		

Source: Author's own data analysis

For CS, the ANOVA test (Table 4.4) shows no statistically significant differences in SP among the 4 types of CS (F=0.484, p=0.696). The sum of squares shows variability explained between groups and within groups. Most variation is within groups (55.583), leading to small F-value. However, it is notable that the mean values show Downstream companies (CS=4) have the highest average SP (7.75), followed by Midstream (7.5063), Integrated (7.0393), and Upstream (6.75). The effect size is small (η^2=0.053), roughly 5%, indicates CS stands only a minor portion of variation in SP. Overall, this suggests that SP is similar across all CS, and the differences are not considered significant and may be due to random variation.

Table 4.5 *ANOVA test for Country*

Country	**n**	**Standard Deviation**	**Mean SP**
United States (Country = 1)	21	1.65760	7.3786
Canada (Country = 2)	5	0.41473	7.3800
United Kingdom (Country = 3)	2	0.28284	6.2000
Norway (Country = 4)	1		6.7500
Malaysia (Country = 5)	1		7.6000
ANOVA F = 0.333 p-value = 0.853 Sum of Squares: Between Groups vs Within Groups = (2.99 vs 55.721)			

Source: Author's own data analysis

Yet again, the ANOVA shows Country does not have a significant effect on SP (F=0.333, p=0.853). This means that there are no meaningful differences in SP among the five countries (the US, Canada, the UK, Norway, Malaysia). While Malaysia, the US, and Canada have slightly higher average SP (7.6000, 7.3786, 7.8000) than the United Kingdom and Norway (6.2000, 6.7500), these differences are not statistically significant due to small sample sizes in some countries and the overall low F-value.

Overall, SP appears similar across countries, and any observed variation is likely due to random variation rather than true country-level effects.

In conclusion, although the ANOVA results are not significant, the descriptive differences still deliver useful insights. According to Serdar et al. (2020), it is important to know that the non-significant results might be generated due to several factors. First, the group sizes are uneven. Especially in this research, Norway and Malaysia each have only one company, and CS groups ranged from n=2 to n=14. Small and unbalanced group sizes reduce statistical power and make it harder to detect true differences. Besides, since this research focuses on the top 30 O&G companies, same concern goes to Country, ranged from n=1 to n=21, where the most are headquartered in the US (n=21), this further contributes to unevenness. These may have limited ANOVA's ability to identify meaningful differences.

4.3.3 Multicollinearity Check

Table 4.6 *Tolerance and VIF Result*

Independent Factor	**Tolerance**	**VIF**
Decarbonization Strategy (DS)	0.291	3.441
Financial Performance (FP)	0.823	1.214
Social Responsibility (SR)	0.348	2.873
Governance Quality (GQ)	0.601	1.664
Company Structure (CS=2)	0.828	1.207
Company Structure (CS=3)	0.643	1.555
Company Structure (CS=4)	0.734	1.362
Country=2	0.880	1.137
Country=3	0.718	1.392
Country=4	0.896	1.116
Country=5	0.805	1.242

Source: Author's own data analysis

The multicollinearity diagnostic results for the independent factors: DS, FP, SR, GQ, CS, and Country are presented below. CS and Country are dummy-coded to compare groups effectively without implying order or distance between categories. CS=1 and Country=1 serve as the baseline for comparison in the MLR model. All independent factors have tolerance values above 0.10, and VIF values well below the threshold of 5, indicating that multicollinearity is not a concern in this model. Hence, the regression coefficients can be interpreted reliably (Jou et al., 2014).

4.3.4 Multiple Linear Regression (MLR)

Table 4.7 *Multiple Linear Regression Analysis Result*

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig. (p-value)	Tolerance	VIF
	B	Std Error	β				
(Constant)	0.868	0.767	–	1.131	0.26	–	–
Decarbonization Strategy (DS)	0.663	0.177	0.481	3.745	<0.001	0.291	3.441
Financial Performance (FP)	-0.012	0.01	-0.092	-1.21	0.229	0.823	1.214
Social Responsibility (SR)	0.109	0.114	0.112	0.954	0.342	0.348	2.873
Governance Quality (GQ)	0.15	0.056	0.238	2.661	0.009	0.601	1.664
CS = 2 (Upstream)	0.375	0.558	0.051	0.671	0.503	0.828	1.207
CS = 3 (Midstream)	0.513	0.364	0.122	1.41	0.161	0.643	1.555
CS = 4 (Downstream)	0.503	0.369	0.11	1.364	0.175	0.734	1.362
Country = 2 (Canada)	0.035	0.387	0.007	0.091	0.928	0.88	1.137
Country = 3 (UK)	-2.952	0.541	-0.446	-5.455	<0.001	0.718	1.392
Country = 4 (Norway)	-0.976	0.747	-0.096	-1.308	0.194	0.896	1.116
Country = 5 (Malaysia)	1.285	0.707	0.14	1.816	0.072	0.805	1.242

Model Summary:

$R^2 = 0.468$, Adjusted $R^2 = 0.415$

$F = 8.872$, $p < 0.001$

Durbin-Watson = 1.439

Source: Author's own data analysis

The econometrics equation model is shown below:

SP = $0.868 + 0.663DS - 0.012FP + 0.375\ (CS_{Up}) + 0.513\ (CS_{Mid}) + 0.503\ (CS_{Down}) + 0.109SR + 0.150GQ + 0.035(Canada) - 2.952\ (United\ Kingdom) - 0.976\ (Norway) + 1.285\ (Malaysia) + \varepsilon$

This MLR model explains a moderate proportion of the variance in SP (R^2=0.468, Adjusted R^2=0.415) and is statistically significant (F=8.872, p<0.001). The Durbin-Watson statistic of 1.439 is close to the acceptable range around 2, indicating no serious autocorrelation of residuals and supporting the independence of errors assumption (Kabaila et al., 2020). The ANOVA results indicate the MLR is statistically significant (F=8.872, p<0.001). This confirms the set of predictors significantly explains variation in SP when together.

Among all the IFs, DS has the strongest positive effect on SP (β=0.481, p<0.001), indicating that stronger DS is associated with higher SP. GQ also shows a significant positive effect (β=0.238, p=0.009), suggesting that stronger GQ are associated with better SP. In contrast, FP and SR are not significant predictors in this model.

CS and Country are dummy-coded, with Integrated (CS=1) and Country=1 (US) as reference categories. None of the CS dummy variables are statistically significant, indicating no meaningful differences in SP across CS. However, Country=3 (UK) shows a significant negative effect on SP relative to the reference country (β=-0.446, p<0.001), while Country=5 (Malaysia) shows a marginally positive effect (β=0.140, p=0.072). Overall, the results suggest that DS and GQ are the key factors in influencing SP in this sample.

4.4 Chapter Summary

This chapter discussed and presented the findings of descriptive and inferential analyses from all 123 valid samples regarding the factors influencing SP in the O&G industry. Descriptive statistics showed moderate to high levels of DS, SR, GQ, and SP across the sample. Pearson correlations indicated that DS, SR, and GQ were significantly related to SP, while FP showed no meaningful association. ANOVA showed no significant differences in SP across company types and countries, yet it might be due to uneven and small group sizes. The MLR model identified DS and GQ as significant predictors of SP.

CHAPTER 5: DISCUSSION, CONCLUSION, AND IMPLICATIONS

5.0 Chapter Introduction

This chapter presents the discussion of major findings of this research. Next, it also provides suggestions and inspiration for the relevant industry, highlighting the significant potential of this research and outlining future research directions.

5.1 Discussion of Major Findings

This study examined the key factors influencing SP among the top 30 O&G companies across five selected countries using multiple linear regression (MLR). The results indicate that the proposed model explains a substantial proportion of variation in SP (R^2=0.468). It reveals that decarbonization strategy (DS) and governance quality (GQ) play a vital role in shaping SP in O&G industry. On the other hand, financial performance (FP), social responsibility (SR), company structure (CS), and country differences show limited explanatory powers.

DS emerges as the strongest predictor of SP with a significant and positive effect (β=0.481, p<0.001). This finding supports research papers (Hoa et al. (2024; Iswara et al., 2024); Chrysikopoulos et al. (2024)) that emphasize the central role of emissions reduction initiatives, carbon management, and long-term climate strategies in improving SP. Companies that actively integrate decarbonization into their core operational activities tend to achieve better SP (Anagnostopoulou, 2025). This reinforces that environmental commitment is a critical driver of SP in O&G sector.

GQ is also found to have a significant effect on SP ($\beta=0.238$, $p=0.009$). This aligns with stakeholder and institutional theory, which argue that companies respond to external pressures from regulatory, civil society, and the public (Al Mataani, 2020). In countries with stronger environmental regulations, higher transparency requirements, and greater societal awareness, O&G companies deliver stronger SP. According to Herzog-Hawelka and Gupta (2023), publicly listed O&G companies operating in jurisdictions with stringent reporting and transparency regulations (the US and the EU) are subject to stronger governance oversight, which enhances accountability and SP. In contrast, government-owned O&G companies (Petronas and Equinor) are more common in emerging and resource-dependent economies. They often operate under politically driven objectives and less stringent disclosure regimes, resulting in more non-transparent governance structures. These differences explain why GQ varies across countries and exerts a meaningful influence on SP, although Country factor is largely non-significant. Notably, Malaysia shows a marginally positive effect, likely due to Petronas' proactive sustainability initiatives, while the UK shows a negative effect, potentially reflecting challenges from declining North Sea reserves and aging infrastructure. This finding suggests that external institutional pressure plays a vital role in shaping sustainability behavior, especially in industries that face intense public scrutiny due to their environmental impact.

Conversely, although Rojo-Suárez et al. (2023) mention that FP can influence SP, and recent discussions (Ahmad et al., 2025) highlight green financing (investing in cleaner technologies that have environmental benefits); this study found that FP was not significant for SP in the sampled countries. Sustainability investments in O&G sector are typically capital-intensive and long-term (Garbie, 2016), which may weaken the immediate link between FP and SP. This study found that short-term financial success does not lead to superior SP.

Although SR correlates positively with SP in bivariate analysis, it is not significant in the MLR model. This may be due to high correlation between SR and DS, indicating DS captures most of the variance in SP. SR in O&G sector is often constrained by corruption, and different companies respond differently according to their understanding of SR (Kwarto et al., 2022). It is vital but remains comparatively weak in measured SP due to strong dependence on companies' financial situation (Markovskaya et al., 2021). Thus, SR initiatives are not sufficient to drive measurable improvements in SP.

Lastly, Yatimi et al. (2024) argue that upstream companies exhibit lower SP due to their operational activities. However, the results indicate that CS (integrated, upstream, midstream, downstream) does not have a significant impact on SP. The small effect size (η^2=0.053) of CS explains only 5% of variation in SP, further explaining that CS has very little influence on SP.

5.2 Implications of the Study

This study provides key implications for O&G companies, policymakers, and researchers to improve SP globally. The findings show that DS and GQ significantly influence SP, while FP, SR, and CS have no impact.

5.2.1 O&G Companies

The findings highlight that DS and GQ are the key drivers of SP, emphasizing the importance of integrating environmental and governance initiatives into core business operations. As supported by Stakeholder and Institutional Theory, companies that respond proactively to external pressures and societal expectations tend to achieve higher SP. This demonstrates that operational decisions around emissions reductions, climate strategies, and transparent reporting are not just regulatory compliance exercise but strategic imperatives that strengthen corporate reputation and long-term resilience.

O&G companies should prioritize investments in decarbonization technologies and adopt robust governance practices while aligning with environmental objectives to maximize SP outcomes (Sitompul et al., 2023). Benchmarking against international peers, especially those operating under stricter environmental and governance regimes, can provide actionable insights for continuous improvement. For future research, longitudinal studies could explore how sustained DS and GQ initiatives impact SP over time or under different market conditions. Additionally, qualitative research could investigate managerial decision-making processes that successfully integrate sustainability into operations, providing deeper context for best practices.

5.2.2 Policymakers

Policymakers can leverage these findings to enhance regulatory frameworks and reporting standards that improve SP in O&G sector. Governments can introduce stricter disclosure requirements for emissions and governance practices or provide tax incentives for investments in cleaner technologies (Aljanadi & Alazzani, 2023; Etim et al., 2025). This is significant because the results indicate that external institutional pressures, such as regulations and societal expectations, play a meaningful role in shaping corporate sustainability behavior, particularly in industries with high environmental impact.

The study contributes to understanding the mechanisms through which policy and governance influence corporate SP. Policymakers should design context-specific policies that encourage long-term investment in decarbonization and transparent governance while facilitating cross-country learning (Naruetharadhol et al., 2024). For example, the EU’s Emissions Trading Scheme or the US SEC’s proposed climate disclosure rules, illustrate how regulatory tools can drive measurable sustainability improvements. Future research could assess the effectiveness of different policy instruments across countries and industries.

5.2.3 Research

This study contributes to the theoretical framework of corporate sustainability by validating the roles of DS and GQ in driving SP and extending it with other factors, including SR, FP and CS, highlighting their relative significance in high -impact industries like O&G. By demonstrating that DS and GQ are stronger predictors than FP, CS, SR, or Country-level differences, the research reinforces Stakeholder and Institutional Theories, emphasizing the importance of external pressures and internal governance mechanisms in shaping sustainability outcomes (Seroka-Stolka, 2023). Future research should explore additional information, including scope 3 emissions and climate-related financial disclosures, to provide a more holistic understanding of what drives SP across various contexts. For instance, examining managerial decision-making processes around sustainability or long-term climate strategies could reveal nuanced pathways such as prioritizing resource efficiency and minimizing waste, linking strategy to SP (Eelager et al., 2025).

Researchers should also examine cross-industry comparisons to understand how sector-specific factors influence SP. These insights can enhance theoretical models by integrating context-specific factors and bridging gaps in current empirical studies. By incorporating these additional elements, future studies can refine predictive frameworks, offer actionable guidance for both companies and policymakers, and support the development of evidence-based sustainability strategies.

5.3 Limitations of the Study

Despite providing valuable insights into the factors influencing SP in O&G industry, this study has several limitations.

First, the sample size is relatively small and unevenly distributed across countries. With 21 companies from the US but only one company each from Malaysia and Norway, the findings may be disproportionately influenced by countries with more representation. This uneven distribution reduces the statistical power of analyses like ANOVA and limits the ability to detect meaningful differences across countries or CS (Parra-Frutos, 2012). Consequently, the generalizability of the results to all O&G companies, especially smaller or emerging-market companies, is restricted.

Second, the study relies exclusively on publicly disclosed secondary data from LSEG Workspace, which has inherent limitations. Certain information, like scope 3 emissions, was missing or underreported, restricting the comprehensiveness of the analysis. While LSEG provides reliable and standardized data, relying on secondary sources may introduce reporting bias, as companies tend to highlight positive sustainability actions while omitting less favourable practices like greenwashing (Cardoni et al., 2019). Yet, it is also important to understand that scope 3 emissions are hard to measure as they are outside company's direct control (Puschmann & Quattrocchi, 2023). This limitation could affect the accuracy of assessing true SP across companies.

Finally, this research focuses solely on the top 30 O&G companies, which may not represent the broader industry. Smaller or medium-sized companies may provide different data and insights, which are not captured in this study. As such, the findings are most applicable to large, leading companies and may not fully reflect the experiences of all companies in the sector. Future studies should consider more diverse samples, such as private O&G companies and small/medium-sized O&G companies, to improve generalizability (Hughes & Zabala, 2023).

5.4 Recommendations for Future Research

Future research should expand the sample size by including a larger and more balanced number of O&G companies across countries. Incorporating firms from additional regions, such as Saudi Arabia and China, which are top global O&G players, would allow for stronger cross-country comparisons and improve the generalizability of findings. A more even distribution of companies across countries and CS would also enhance statistical power in conducting analyses like ANOVA and deliver clearer identification of country and CS specific sustainability differences.

Besides, future studies should include a broader set of sustainability indicators to provide a more holistic assessment of SP. Specifically, incorporating scope 3 emissions would capture downstream and supply-chain impacts that are particularly relevant in the O&G industry. Researchers could also examine other ESG-related factors, such as climate risk exposure, executive compensation linked to sustainability targets, or green investment intensity. Including these indicators may help explain SP beyond DS and GQ.

Finally, future research could adopt mixed-method approaches by combining quantitative and qualitative methods, such as interviews, survey forms, or content analysis of sustainability reports. This would provide deeper insights into how sustainability strategies are designed, implemented, and monitored within companies. Qualitative evidence could also help explain why certain factors, like SR or FP, show weaker effects in regression models. By integrating multiple methods, future studies can develop a more comprehensive and multifaceted understanding of SP in O&G industry.

5.5 Chapter Summary

This study examined the key factors influencing SP among the top 30 O&G companies across the US, Canada, the UK, Norway, and Malaysia using quantitative analysis of secondary ESG data from 2020 to 2024 from LSEG Workspace. Descriptive analysis, correlation tests, one-way ANOVA, and MLR were employed to assess the relationship between proposed factors and SP.

The findings reveal that DS and GQ are the most significant drivers of SP, while FP, SR, CS, and Country differences show limited influence. These results highlight the importance of embedding emissions reduction initiatives and strong governance mechanisms into core business strategies to improve sustainability outcomes in the O&G industry.

The study contributes to the sustainability and O&G literature by providing cross-country empirical evidence in a high-emission industry and offers practical insights for both companies and policymakers seeking to strengthen sustainability practices. Despite limitations related to sample size and data availability, the study provides a foundation for future research to further explore sustainability dynamics and performance drivers in global O&G sector.

References

Apridayani, A., & Teo, A. (2021). The interplay among SRL strategies, English self-efficacy, and English proficiency of Thai university students. *Studies in English Language and Education*, *8*(3), 1123–1143. https://doi.org/10.24815/siele.v8i3.20213

Accreditations | PETRONAS Global. (n.d.). https://www.petronas.com/about-us/accreditations

Ahamed, S., Galford, G. L., Bindu Panikkar, Rizzo, D., & Stephens, J. C. (2024). Carbon collusion: Cooperation, competition, and climate obstruction in the global oil and gas extraction network. *Energy Policy*, *190*, 114103–114103. https://doi.org/10.1016/j.enpol.2024.114103

Ahmad, F., Boumaiza, A., Sanfilippo, A., & Al-Fagih, L. (2025). A comprehensive review on green finance and its impact on net zero energy transition: From the perspective of renewable energy development. *Energy Strategy Reviews*, *62*, 101948. https://doi.org/10.1016/j.esr.2025.101948

Akepa. (2025, July 26). *A brief history of sustainability*. The Sustainable Agency. https://thesustainableagency.com/blog/the-history-of-sustainability/

Aki, A. (2023). A Comparative Study on ESG Performance of the top 100 Bombay Stock Exchange (BSE) Listed Companies in India. *Zenodo (CERN European Organization for Nuclear Research)*. https://doi.org/10.5281/zenodo.8268903

Aksom, H., & Tymchenko, I. (2020). How institutional theories explain and fail to explain organizations. *Journal of Organizational Change Management*, *33*(7), 1223–1252. https://doi.org/10.1108/jocm-05-2019-0130

Al Mataani, A. (2020). *The Role of Focal Companies in Driving Sustainability Performance in the Oil and Gas Sector: the case of Oman*. https://bura.brunel.ac.uk/bitstream/2438/22939/1/FulltextThesis.pdf

Al-Fattah, S. (2013). National Oil Companies: Business models, challenges, and emerging Trends. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2299879

Ali, M. K., Zahoor, M. K., Saeed, A., & Nosheen, S. (2023). Moderating effect of vertical integration on the relationship between sustainability and performance: evidence from oil and gas energy sector. *Future Business Journal*, *9*(1). https://doi.org/10.1186/s43093-023-00236-x

Ali, N. J., Lodhi, M. S., & Shafiq, M. (2021). Challenges of knowledge sharing within oil & gas sector. *Journal of Public Value and Administrative Insight*, *4*(2), 128–143. https://doi.org/10.31580/jpvai.v4i2.2084

Ali, U., & Ali, U. (2019, March 7). The history of the oil and gas industry from 347 AD to today. *Offshore Technology*. https://www.offshore-technology.com/comment/history-oil-gas/?cf-view

Aljanadi, Y., & Alazzani, A. (2023). Sustainability reporting indicators used by oil and gas companies in GCC countries: IPIECA guidance approach. *Frontiers in Environmental Science*, *11*. https://doi.org/10.3389/fenvs.2023.1069152

Amel-Zadeh, A., & Tang, Q. (2025). MANAGING THE SHIFT FROM VOLUNTARY TO MANDATORY CLIMATE DISCLOSURE: THE ROLE OF CARBON ACCOUNTING. *The British Accounting Review*, 101594. https://doi.org/10.1016/j.bar.2025.101594

Anagnostopoulou, E. (2025). Linking sustainable development goals and climate action in the oil and gas value chain. *Sustainable Development*. https://doi.org/10.1002/sd.70407

Arseni, O. (2020). *ESG and stock performance in the oil and gas industry A quantitative analysis of the public traded firms in the United States*. https://doi.org/10.13140/rg.2.2.29792.35847

Aurassure, AI-Powered Climate Intelligence. (2025, August 20). Top 10 polluting industries in the world 2025. *Aurassure | AI-Powered Climate Intelligence - Hyperlocal Climate Intelligence Platform*. https://aurassure.com/2025/08/18/top-10-polluting-industries/

Austvik, O. G. (2024). Norway in the geopolitics of energy. *Energy Policy*, *198*, 114410. https://doi.org/10.1016/j.enpol.2024.114410

Awa, H. O., Etim, W., & Ogbonda, E. (2024). Stakeholders, stakeholder theory and Corporate Social Responsibility (CSR). *International Journal of Corporate Social Responsibility*, *9*(1). https://doi.org/10.1186/s40991-024-00094-y

Bais, B., Nassimbeni, G., & Orzes, G. (2024). Global Reporting Initiative: literature review and research directions. *Journal of Cleaner Production*, *471*, 143428. https://doi.org/10.1016/j.jclepro.2024.143428

Balzano, M., Marzi, G., & Turzo, T. (2024). SMEs and institutional theory: major inroads and opportunities ahead. *Management Decision*, *63*(13), 1–27. https://doi.org/10.1108/md-05-2023-0734

Bamishe, O. O., & Adegbie, F. F. (2024). Environmental conservation costs and financial sustainability in oil and gas companies listed in Nigeria. *OALib*, *11*(01), 1–22. https://doi.org/10.4236/oalib.1111063

Barbar, J. (2025). Expanding the lens of institutions: a holistic approach. *Frontiers in Political Science*, *7*. https://doi.org/10.3389/fpos.2025.1563937

Bee, Jin, O., Ahmad, Bin, Z., Leinbach, R, T., Lockard, & A, C. (2025, September 21). *Malaysia | History, Flag, Map, Population, Language, religion, & Facts*. Encyclopedia Britannica. https://www.britannica.com/place/Malaysia

Benvenuto, M., Aufiero, C., & Viola, C. (2023). A systematic literature review on the determinants of sustainability reporting systems. *Heliyon*, *9*(4), e14893. https://doi.org/10.1016/j.heliyon.2023.e14893

Bessette, D. L., Hoen, B., Rand, J., Hoesch, K., White, J., Mills, S. B., & Nilson, R. (2023). Good fences make good neighbors: Stakeholder perspectives on the local benefits and burdens of large-scale solar energy development in the United States. *Energy Research & Social Science*, *108*, 103375. https://doi.org/10.1016/j.erss.2023.103375

Block, J. H., Sharma, P., & Benz, L. (2023). Stakeholder pressures and decarbonization strategies in Mittelstand firms. *Journal of Business Ethics*, *193*(3), 511–533. https://doi.org/10.1007/s10551-023-05576-w

Bolodeoku, P. B., Igbinoba, E., Salau, P. O., Chukwudi, C. K., & Idia, S. E. (2022). Perceived usefulness of technology and multiple salient outcomes: the improbable case of oil and gas workers. *Heliyon*, *8*(4), e09322. https://doi.org/10.1016/j.heliyon.2022.e09322

Canada Action. (2025, October 29). *10 BIG Reasons Why Oil & Gas Makes Canada Stronger*. https://www.canadaaction.ca/reasons-why-oil-gas-make-canada-stronger

Cardillo, M. a. D. R., & Basso, L. F. C. (2024). Revisiting knowledge on ESG/CSR and financial performance: A bibliometric and systematic review of moderating variables. *Journal of Innovation & Knowledge*, *10*(1), 100648. https://doi.org/10.1016/j.jik.2024.100648

Cardoni, A., Kiseleva, E., & Terzani, S. (2019). Evaluating the Intra-Industry Comparability of Sustainability Reports: the case of the oil and gas industry. *Sustainability*, *11*(4), 1093. https://doi.org/10.3390/su11041093

Carrington, D. (2022, February 17). Oil firms' climate claims are greenwashing, study concludes. *The Guardian*. https://www.theguardian.com/environment/2022/feb/16/oil-firms-climate-claims-are-greenwashing-study-concludes

Carroll, S. (2023, March 22). What are sustainability scope 1, 2 and 3 emissions? *Grant Thornton International Ltd. Home*. https://www.grantthornton.global/en/insights/articles/sustainability-scope-1-2-and-3-emissions/

Cherepovitsyn, A., Rutenko, E., & Solovyova, V. (2021). Sustainable Development of Oil and Gas Resources: A system of environmental, Socio-Economic, and innovation indicators. *Journal of Marine Science and Engineering*, *9*(11), 1307. https://doi.org/10.3390/jmse9111307

Christine, A. F., Hakam, D. F., Nainggolan, Y. A., Wiryono, S. K., & Hakam, L. I. (2025). Environmental, social, and governance (ESG) impact on corporate financial strategy of energy and utilities companies worldwide. *Energy Strategy Reviews*, *62*, 101916. https://doi.org/10.1016/j.esr.2025.101916

Christoph. (2024, November 7). A short timeline of the energy transition. *WTS Energy*. https://www.wtsenergy.com/a-short-timeline-of-the-energy-transition/

Chrysikopoulos, S. K., Chountalas, P. T., Georgakellos, D. A., & Lagodimos, A. G. (2024). Decarbonization in the oil and gas sector: the role of power purchase agreements and renewable energy certificates. *Sustainability*, *16*(15), 6339. https://doi.org/10.3390/su16156339

Chrysikopoulos, S. K., Chountalas, P. T., Georgakellos, D. A., & Lagodimos, A. G. (2024). Decarbonization in the oil and gas sector: the role of power purchase agreements and renewable energy certificates. *Sustainability*, *16*(15), 6339. https://doi.org/10.3390/su16156339

Client challenge. (n.d.). https://www.ft.com/content/baffdc7a-6656-11e9-9adc-98bf1d35a056

CONGRESS.GOV. (n.d.). *U.S.-Canada Trade Relations*. Retrieved December 4, 2025, from https://www.congress.gov/crs-product/IF12595

Contributor, P. (2024, December 16). *PETRONAS BrandVoice: Building on an innovation legacy toward a sustainable future*. Forbes. https://www.forbes.com/sites/petronas/2024/12/16/building-on-an-innovation-legacy-toward-a-sustainable-future/

Davey, J. (2025, August 28). *Why is the UK exporting gas when we are in short supply?* Offshore Energies UK (OEUK). https://oeuk.org.uk/why-is-the-uk-exporting-gas-when-we-are-in-short-supply/

David Robinson, PhD. (2025, October 24). *Multiple Linear Regression on SPSS (2025) With an Example Results Section* [Video]. YouTube. https://www.youtube.com/watch?v=kwN7QN71RSc

De Camargo Fiorini, P., Seles, B. M. R. P., Jabbour, C. J. C., Mariano, E. B., & De Sousa Jabbour, A. B. L. (2018). Management theory and big data literature: From a review to a research agenda. *International Journal of Information Management*, *43*, 112–129. https://doi.org/10.1016/j.ijinfomgt.2018.07.005

Ding, H., & Wang, Z. (2025). The Influence of Institutional Pressures on Environmental, Social, and Governance Responsibility Fulfillment: Insights from Chinese Listed Firms. *Sustainability*, *17*(9), 3982. https://doi.org/10.3390/su17093982

Doni, F., Corvino, A., & Martini, S. B. (2021). Corporate governance model, stakeholder engagement and social issues evidence from European oil and gas industry. *Social Responsibility Journal*, *18*(3), 636–662. https://doi.org/10.1108/srj-08-2020-0336

Edwards, C. (2024, July 2). *What is greenwashing?* Business News Daily. https://www.businessnewsdaily.com/10946-greenwashing.html

Eelager, M. P., Dalbanjan, N. P., Madihalli, S., Madar, M., Agadi, N. P., Korganokar, K., & Kiran, B. (2025). Pathways to a sustainable future: Exploring the synergy between sustainability and circular economy. *Sustainable Futures*, *10*, 101208. https://doi.org/10.1016/j.sftr.2025.101208

EIA. (2024, November 12). *U.S. Energy Information Administration (EIA)*. U.S. Energy Information Administration. https://www.eia.gov/international/analysis/country/MYS

EKT Interactive. (2024, September 30). *History of Oil - A timeline of the modern oil industry*. https://ektinteractive.com/history-of-oil/

Elkington, J. (2018, June 25). *25 Years Ago I Coined the Phrase "Triple Bottom Line." Here's Why It's Time to Rethink It.* Harvard Business Review. https://hbr.org/2018/06/25-years-ago-i-coined-the-phrase-triple-bottom-line-heres-why-im-giving-up-on-it

Etim, E. E., Samuel, H. S., Akinpelu, O. O., Undie, D. A., Onotu, O. P., & Ibekwe, F. A. (2025). Presentation of environmental management of corporate environmental responsibility in the oil and gas industry. *Discover Sustainability*. https://doi.org/10.1007/s43621-025-02367-3

Ewing, B. T., Malik, F., & Payne, J. E. (2024). Volatility transmission between upstream and midstream energy sectors. *International Review of Economics & Finance*, *92*, 1191–1199. https://doi.org/10.1016/j.iref.2024.02.074

Fam, A., & Fam, S. (2024). Review of the US 2050 long term strategy to reach net zero carbon emissions. *Energy Reports*, *12*, 845–860. https://doi.org/10.1016/j.egyr.2024.06.031

Finance, B. (2023, March 20). *PETRONAS: Ramping up efforts towards a lower carbon future | Brand finance*. Brand Finance. https://brandfinance.com/insights/petronas-ramping-up-efforts-towards-a-lower-carbon-future-2

Firera, N., Musadieq, M. A., Solimun, N., & Hutahayan, B. (2024). The impact of purchasing and inventory performance on sustainable financial performance with fiscal term as a moderating factor (A case study from oil and gas industry in Indonesia). *Journal of Open Innovation Technology Market and Complexity*, *10*(1), 100225. https://doi.org/10.1016/j.joitmc.2024.100225

Fisher, K. (2025, March 24). *Trump's energy policy's potential effect on production of oil and natural gas in the US*. OANDA. https://www.oanda.com/us-en/trade-tap-blog/analysis/fundamental/what-are-implications-of-trumps-energy-policy/

Frynas, J. G. (2009). Corporate social responsibility in the oil and gas sector. *The Journal of World Energy Law & Business*, *2*(3), 178–195. https://doi.org/10.1093/jwelb/jwp012

Garbie, I. (2016). Sustainability in service sector: oil and gas industry. In *Green energy and technology* (pp. 217–236). https://doi.org/10.1007/978-3-319-29306-6_17

Ge, M. (n.d.). *Where do emissions come from? 4 Charts explain greenhouse gas emissions by sector*. World Resources Institute. https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors

Global Sources. (2025, June 6). Global Sources. https://www.globalsources.com/knowledge/top-10-world-s-largest-industries-by-revenue-in-2024/?srsltid=AfmBOooF-3P0uTn_HMFS0pbIVMPt9YdUygxCjaaqAA2XY7PsHagW7uqG

Guerrero-Martin, C. A., Ortega-Ramírez, A. T., Rodríguez, P. a. P., López, S. J. R., Guerrero-Martin, L. E., Salinas-Silva, R., & Camacho-Galindo, S. (2023). Analysis of Environmental Sustainability through a Weighting Matrix in the Oil and Gas Industry. *Sustainability*, *15*(11), 9063. https://doi.org/10.3390/su15119063

Guzman, J., Recoco, G. A., Pandi, A. W., Padrones, J. M., & Ignacio, J. J. (2022). Evaluating workplace safety in the oil and gas industry during the COVID-19 pandemic using occupational health and safety Vulnerability Measure and partial least square Structural Equation Modelling. *Cleaner Engineering and Technology*, *6*, 100378. https://doi.org/10.1016/j.clet.2021.100378

Handoyo, S., & Anas, S. (2024). The effect of environmental, social, and governance (ESG) on firm performance: the moderating role of country regulatory quality and government effectiveness in ASEAN. *Cogent Business & Management*, *11*(1). https://doi.org/10.1080/23311975.2024.2371071

Herzog-Hawelka, J., & Gupta, J. (2023). The role of (multi)national oil and gas companies in leaving fossil fuels underground: A systematic literature review. *Energy Research & Social Science*, *103*, 103194. https://doi.org/10.1016/j.erss.2023.103194

Hettler, M., & Graf-Vlachy, L. (2023). Corporate scope 3 carbon emission reporting as an enabler of supply chain decarbonization: A systematic review and comprehensive research agenda. *Business Strategy and the Environment*, *33*(2), 263–282. https://doi.org/10.1002/bse.3486

Hoa, P. X., Xuan, V. N., & Thu, N. T. P. (2024). Factors affecting carbon dioxide emissions for sustainable development goals – New insights into six asian developed countries. *Heliyon*, *10*(21), e39943. https://doi.org/10.1016/j.heliyon.2024.e39943

Hughes, E., & Zabala, A. (2023). Net zero by choice? Oil and gas industry motivations for the energy transition and public policy in Scotland. *Climate Policy*, *23*(9), 1115–1131. https://doi.org/10.1080/14693062.2023.2262439

Hwang, Y. K., & Venter, A. (2024). The impact of the digital economy and institutional quality in promoting low-carbon energy transition. *Renewable Energy*, 121884. https://doi.org/10.1016/j.renene.2024.121884

IEA. (2025, May 7). *Methane Tracker*. https://www.iea.org/data-and-statistics/data-tools/methane-tracker

Iswara, A. P., Hsieh, L. C., Abbas, S., Dermawan, D., & Kristianto, S. (2024). The inquiries for efficient decarbonization in the Indonesian upstream oil and gas field. *Case Studies in Chemical and Environmental Engineering*, *9*, 100730. https://doi.org/10.1016/j.cscee.2024.100730

Jin, H., Sun, X., Cui, M., & Liu, L. (2025). Study on the spatial and temporal evolution and influencing factors of carbon emission intensity in China’s oil and gas industry. *Energy Reports*, *13*, 4388–4402. https://doi.org/10.1016/j.egyr.2025.04.002

Jin, Y., Guo, K., Gao, X., & Li, Q. (2024). Tight oil well Productivity prediction model based on neural network. *Processes*, *12*(10), 2088. https://doi.org/10.3390/pr12102088

Jou, Y., Huang, C. L., & Cho, H. (2014). A VIF-based optimization model to alleviate collinearity problems in multiple linear regression. *Computational Statistics*, *29*(6), 1515–1541. https://doi.org/10.1007/s00180-014-0504-3

Kabaila, P., Farchione, D., Alhelli, S., & Bragg, N. (2020). The effect of a Durbin–Watson pretest on confidence intervals in regression. *Statistica Neerlandica*, *75*(1), 4–23. https://doi.org/10.1111/stan.12222

Kaupke, K., & Knyphausen-Aufseß, D. Z. (2022). Sustainability and firm value in the oil and gas industry—A vicious circle? *Corporate Social Responsibility and Environmental Management*, *30*(3), 1129–1144. https://doi.org/10.1002/csr.2409

Kauppi, K., & Luzzini, D. (2021). Measuring institutional pressures in a supply chain context: scale development and testing. *Supply Chain Management an International Journal*, *27*(7), 79–107. https://doi.org/10.1108/scm-04-2021-0169

Kgi-Admin, & Kgi-Admin. (2023, May 8). Q2 2024 update: mentions of social responsibility in oil & gas industry filings. *Offshore Technology*. https://www.offshore-technology.com/data-insights/social-responsibility-mentions-oil-gas-industry/

Khanna, I., Mehra, P., & Verma, S. (2025). Balancing economic growth and environmental sustainability in G-20 countries using green innovation. *Discover Sustainability*, *6*(1). https://doi.org/10.1007/s43621-025-01513-1

Kiiza, M., Jude, G., & Busobozi, D. (2024). Disinterring Oil and Gas seismic activities and quality of livelihood in the Great Lakes Region:... *ResearchGate*, *8*(9), 40–49. https://www.researchgate.net/publication/384565907_Disinterring_Oil_and_Gas_seismic_activities_and_quality_of_livelihood_in_the_Great_Lakes_Region_Experiential_lessons_from_Albertine_Region_Uganda

Kim, H. (2014). Analysis of variance (ANOVA) comparing means of more than two groups. *Restorative Dentistry & Endodontics*, *39*(1), 74. https://doi.org/10.5395/rde.2014.39.1.74

Kraska, K. (2024, November 11). *Greenwashed gas: a fossil fuel industry coverup*. Earth Day. https://www.earthday.org/greenwashed-gas-a-fossil-fuel-industry-coverup/

Kwak, S. (2023). Are only P-Values less than 0.05 significant? A P-Value greater than 0.05 is also significant! *Journal of Lipid and Atherosclerosis*, *12*(2), 89. https://doi.org/10.12997/jla.2023.12.2.89

Kwarto, F., Nurafiah, N., Suharman, H., & Dahlan, M. (2022). The potential bias for sustainability reporting of global upstream oil and gas companies: a systematic literature review of the evidence. *Management Review Quarterly*, *74*(1), 35–64. https://doi.org/10.1007/s11301-022-00292-7

Largest oil and gas companies by market cap. (2025). Companiesmarketcap.com. https://companiesmarketcap.com/oil-gas/largest-oil-and-gas-companies-by-market-cap/?page=1

Leppink, J. (2017). Revisiting the quantitative–qualitative-mixed methods labels: Research questions, developments, and the need for replication. *Journal of Taibah University Medical Sciences*, *12*(2), 97–101. https://doi.org/10.1016/j.jtumed.2016.11.008

Li, M., Trencher, G., & Asuka, J. (2022). The clean energy claims of BP, Chevron, ExxonMobil and Shell: A mismatch between discourse, actions and investments. *PLoS ONE*, *17*(2), e0263596. https://doi.org/10.1371/journal.pone.0263596

Li, Z., & Alharthi, S. (2023). Oil revenue and production cost disconnect and its impact on the environment: Economic globalization in Asia-Pacific economic cooperation countries. *Geoscience Frontiers*, *15*(3), 101772.

Liu, S., & Zhang, H. (2024). Governance quality and green growth: New empirical evidence from BRICS. *Finance Research Letters*, *65*, 105566. https://doi.org/10.1016/j.frl.2024.105566

Mahajan, R., Lim, W. M., Sareen, M., Kumar, S., & Panwar, R. (2023). Stakeholder theory. *Journal of Business Research*, *166*, 114104. https://doi.org/10.1016/j.jbusres.2023.114104

Mahdieh Zakizadeh. (2024). *Data Analysis and Management in the Oil & Gas Industry*. https://doi.org/10.13140/rg.2.2.28184.92165

Markland, R. (2023, September 27). *7 of the Worst Oil Rig Disasters of All Time*. Roberts Markland LLP. https://robertsmarkland.com/blog/7-of-the-worst-oil-rig-disasters-of-all-time/

Markovskaya, E., Nikolaishvili, N., & Kashperyuk, P. (2021). The impact of oil companies' sustainability on environmental safety. *IOP Conference Series: Earth and Environmental Science*, *937*(2), 022079. https://doi.org/10.1088/1755-1315/937/2/022079

Martins, M. C. I., Carter, M. I., Rouse, S., & Russell, D. J. (2023). Offshore energy structures in the North Sea: Past, present and future. *Marine Policy*, *152*, 105629. https://doi.org/10.1016/j.marpol.2023.105629

McClay, R. (2024, September 25). *How the Oil and Gas Industry Works*. Investopedia. https://www.investopedia.com/investing/oil-gas-industry-overview

Mehta, B. (2020, November 6). Roofers, linemen, oil and gas workers among top 10 most dangerous jobs. *ISHN*. https://www.ishn.com/articles/112751-roofers-linemen-oil-and-gas-workers-among-top-10-most-dangerous-jobs

Moghani, A. M., & Loni, R. (2024). Review on energy governance and demand security in oil-rich countries. *Energy Strategy Reviews*, *57*, 101625. https://doi.org/10.1016/j.esr.2024.101625

Mohn, K., & Misund, B. (2008). Investment and uncertainty in the international oil and gas industry. *Energy Economics*, *31*(2), 240–248. https://doi.org/10.1016/j.eneco.2008.10.001

Morais, É. T., Barberes, G. A., Souza, I. V. a. F., Leal, F. G., Guzzo, J. V. P., & Spigolon, A. L. D. (2023). Pearson Correlation Coefficient applied to petroleum system characterization: The case study of Potiguar and Reconcavo Basins, Brazil. *Geosciences*, *13*(9), 282. https://doi.org/10.3390/geosciences13090282

Naji, G. M. A., Isha, A. S. N., Alazzani, A., Saleem, M. S., & Alzoraiki, M. (2022). Assessing the mediating role of safety communication between safety culture and employees safety performance. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.840281

Naruetharadhol, P., ConwayLenihan, A., & McGuirk, H. (2024). Assessing the role of public policy in fostering global eco-innovation. *Journal of Open Innovation Technology Market and Complexity*, *10*(2), 100294. https://doi.org/10.1016/j.joitmc.2024.100294

Nica, I., Chiriță, N., & Georgescu, I. (2025). Triple bottom line in sustainable Development: A comprehensive bibliometric analysis. *Sustainability*, *17*(5), 1932. https://doi.org/10.3390/su17051932

Nikše, D. (2025, May 23). *Vietnamese oil platform undergoing decommissioning catches fire (Video)*. Offshore Energy. https://www.offshore-energy.biz/vietnamese-oil-platform-undergoing-decommissioning-catches-fire-video/

Ojadi, J. O., Onukwulu, E. C., Odionu, C. S., & Owulade, O. A. (2023). AI-Driven Predictive Analytics for Carbon Emission Reduction in Industrial Manufacturing: A Machine Learning Approach to Sustainable Production. *International Journal of Multidisciplinary Research and Growth Evaluation*, *4*(1), 948–960. https://doi.org/10.54660/.ijmrge.2023.4.1.948-960

Oke, A., Osobajo, O. A., & Taylor, S. (2024). Addressing the trilemma of challenges: the need for more SC strategic collaborations in the UK oil and gas sector. *Sustainability*, *16*(2), 570. https://doi.org/10.3390/su16020570

Okeke, A. (2021). Towards sustainability in the global oil and gas industry: Identifying where the emphasis lies. *Environmental and Sustainability Indicators*, *12*, 100145. https://doi.org/10.1016/j.indic.2021.100145

Olugu, E. U., Wong, K. Y., Ee, J. Y. C., & Mammedov, Y. D. (2022). Incorporating Sustainability and Maintenance for performance assessment of offshore oil and gas platforms: A Perspective. *Sustainability*, *14*(2), 807. https://doi.org/10.3390/su14020807

Olujobi, O. J., Irumekhai, O. S., & Odjugo, O. (2025). Petroleum Laws, Regulations, and Sustainable Development: oil and gas perspectives from Nigeria, Norway, and Saudi Arabia. *Journal of Sustainable Development Law and Policy (The)*, *16*(3), 22–47. https://doi.org/10.4314/jsdlp.v16i3.2

Onn, L. P. (2022, March 2). *2022/21 "Malaysia's Oil and Gas Sector: Constant Expectations despite Diminishing Returns" by Pritish Bhattacharya and Francis E. Hutchinson*. ISEAS - Yusof Ishak Institute. https://www.iseas.edu.sg/articles-commentaries/iseas-perspective/2022-21-malaysias-oil-and-gas-sector-constant-expectations-despite-diminishing-returns-by-pritish-bhattacharya-and-francis-e-hutchinson/

Oruwari, H. O., & Itsekor, L. (2023). Strategies for decarbonizing the oil and gas industries. *SPE Nigeria Annual International Conference and Exhibition*. https://doi.org/10.2118/217179-ms

Our brand story | PETRONAS Global. (n.d.). https://www.petronas.com/our-passion/our-brand-story

Owolabi, S. A., Odunlade, O. A., & Amosun, O. O. (2022). Corporate social responsibility and earnings per share of oil and gas companies in Nigeria. *International Journal of Accounting Finance and Risk Management*, *7*(2), 56. https://doi.org/10.11648/j.ijafrm.20220702.14

Parra-Frutos, I. (2012). Testing homogeneity of variances with unequal sample sizes. *Computational Statistics*, *28*(3), 1269–1297. https://doi.org/10.1007/s00180-012-0353-x

Performance, S. (n.d.). What is a Field Service Supervisor? *Superior Performance*. https://www.superiorperformance.com/company-news/history-of-drilling

Peters, J., & Simaens, A. (2020). Integrating Sustainability into Corporate Strategy: A Case Study of the Textile and Clothing Industry. *Sustainability*, *12*(15), 6125. https://doi.org/10.3390/su12156125

Petronas. (2025, February 20). *PETRONAS, Universiti Teknologi PETRONAS and TM One Establish Malaysia's First Private 5G Lab* [Press release]. https://www.petronas.com/media/media-releases/petronas-universiti-teknologi-petronas-and-tm-one-establish-malaysias-first

Petronas' 2022 Fortune Global 500 rises to 216 from 277 in 2021. (n.d.). The Edge Malaysia. https://theedgemalaysia.com/article/petronas-2022-fortune-global-500-rises-216-277-

2021Christoph. (2024, November 7). A short timeline of the energy transition. *WTS Energy*. https://www.wtsenergy.com/a-short-timeline-of-the-energy-transition/

Pham, C., Liu, S., & Chen, S. (2024). Corporate ESG performance and intellectual capital: International evidence. *Asia Pacific Management Review*, *29*(3), 306–346. https://doi.org/10.1016/j.apmrv.2023.12.003

Pies, I., & Valentinov, V. (2023). Trade-offs in stakeholder theory: an ordonomic perspective. *Social Responsibility Journal*, *20*(5), 975–997. https://doi.org/10.1108/srj-06-2023-0321

Plourde, A. (2010). Oil and Gas in the Canadian Federation. *ideas.repec.org*. https://ideas.repec.org/p/ris/albaec/2010_001.html

Pt, G. |. G. I. N. (2023, July 28). *"Building a Sustainable Future: The correlation between ESG, CSR, and the triple bottom line."* https://www.linkedin.com/pulse/building-sustainable-future-correlation-between/

Puschmann, T., & Quattrocchi, D. (2023). Decreasing the impact of climate change in value chains by leveraging sustainable finance. *Journal of Cleaner Production*, *429*, 139575. https://doi.org/10.1016/j.jclepro.2023.139575

Ramírez-Orellana, A., Martínez-Victoria, M., García-Amate, A., & Rojo-Ramírez, A. A. (2023). Is the corporate financial strategy in the oil and gas sector affected by ESG dimensions? *Resources Policy*, *81*, 103303. https://doi.org/10.1016/j.resourpol.2023.103303

Ramírez-Orellana, A., Martínez-Victoria, M., García-Amate, A., & Rojo-Ramírez, A. A. (2023b). Is the corporate financial strategy in the oil and gas sector affected by ESG dimensions? *Resources Policy*, *81*, 103303. https://doi.org/10.1016/j.resourpol.2023.103303

Richter, F. (2025, June 23). The world's largest oil producers. *Statista Daily Data*. https://www.statista.com/chart/16274/oil-producing-countries/

Roberts, R., Flin, R., Millar, D., & Corradi, L. (2021). Psychological factors influencing technology adoption: A case study from the oil and gas industry. *Technovation*, *102*, 102219. https://doi.org/10.1016/j.technovation.2020.102219

Rojo-Suárez, J., Alonso-Conde, A. B., & Gonzalez-Ruiz, J. D. (2023). Does sustainability improve financial performance? An analysis of Latin American oil and gas firms. *Resources Policy*, *88*, 104484. https://doi.org/10.1016/j.resourpol.2023.104484

Roustaei, N. (2024). Application and interpretation of linear-regression analysis. *Medical Hypothesis Discovery & Innovation in Ophthalmology*, *13*(3), 151–159. https://doi.org/10.51329/mehdiophthal1506

Saadawi, H. (2016, November 1). *Bridging the divide between facilities and subsurface engineers*. JPT. https://jpt.spe.org/bridging-divide-between-facilities-and-subsurface-engineers

Sahin, K., & Mert, K. (2022). Institutional theory in international business studies: the period of period of 1990–2018. *International Journal of Organizational Analysis*, *31*(5), 1957–1986. https://doi.org/10.1108/ijoa-09-2021-2945

Sangaramoorthy, T., Jamison, A. M., Boyle, M. D., Payne-Sturges, D. C., Sapkota, A., Milton, D. K., & Wilson, S. M. (2016). Place-based perceptions of the impacts of fracking along the Marcellus Shale. *Social Science & Medicine*, *151*, 27–37. https://doi.org/10.1016/j.socscimed.2016.01.002

Scherr, R. (2025, February 25). *4 Contributors to climate change*. Earth Day. https://www.earthday.org/4-contributors-to-climate-change/

Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation Coefficients: appropriate use and interpretation. *Anesthesia & Analgesia*, *126*(5), 1763–1768. https://doi.org/10.1213/ane.0000000000002864

Serdar, C. C., Cihan, M., Yücel, D., & Serdar, M. A. (2020). Sample size, power and effect size revisited: simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochemia Medica*, *31*(1), 27–53. https://doi.org/10.11613/bm.2021.010502

Seroka-Stolka, O. (2023). Enhancing Environmental Sustainability: Stakeholder Pressure and Corporate CO2-Related Performance—An examination of the mediating and moderating effects of corporate decarbonization strategies. *Sustainability*, *15*(19), 14257. https://doi.org/10.3390/su151914257

Shahbaz, M., Karaman, A. S., Kilic, M., & Uyar, A. (2020). Board attributes, CSR engagement, and corporate performance: What is the nexus in the energy sector? *Energy Policy*, *143*, 111582. https://doi.org/10.1016/j.enpol.2020.111582

Shakil, M. H., Pollestad, A. J., & Kyaw, K. (2025). Environmental, social and governance controversies and systematic risk: A machine learning approach. *Finance Research Letters*, *75*, 106894. https://doi.org/10.1016/j.frl.2025.106894

Shammah, N., Favour, C., Precious, N., & Emeka, N. (2025). Towards a Low-Carbon Energy Industry: Financial and reputational resilience Strategies of integrated energy companies. *SPE Nigeria Annual International Conference and Exhibition*. https://doi.org/10.2118/228677-ms

Shitsi, F., Junior. (2024, May 12). *Oil and Gas Sustainability: Understanding Regional Differences and Determinants of Sustainability Performance*. https://hdl.handle.net/11379/596687

Sitompul, M., Suroso, A. I., Sumarwan, U., & Zulbainarni, N. (2023). Revisiting the Impact of Corporate carbon Management Strategies on Corporate Financial Performance: A Systematic Literature review. *Economies*, *11*(6), 171. https://doi.org/10.3390/economies11060171

Sletten, S., Jonasmo, K. W., & Solheim, M. C. (2023). Changing industrial trajectories through business model innovation: a case study of the oil and gas industry in Norway. *European Planning Studies*, *31*(7), 1555–1574. https://doi.org/10.1080/09654313.2023.2185503

Sovacool, B. K., Axsen, J., & Sorrell, S. (2018). Promoting novelty, rigor, and style in energy social science: Towards codes of practice for appropriate methods and research design. *Energy Research & Social Science*, *45*, 12–42. https://doi.org/10.1016/j.erss.2018.07.007

Struckell, E., Ojha, D., Patel, P. C., & Dhir, A. (2022). Strategic choice in times of stagnant growth and uncertainty: An institutional theory and organizational change perspective. *Technological Forecasting and Social Change*, *182*, 121839. https://doi.org/10.1016/j.techfore.2022.121839

Sukoco, R. (2025, September 22). Top 10 strongest oil and gas brands, 2024. *Seasia.co*. https://seasia.co/infographic/top-10-strongest-oil-and-gas-brands-2024

Tulaeva, S., & Tysiachniouk, M. (2017). Benefit-Sharing Arrangements between Oil Companies and Indigenous People in Russian Northern Regions. *Sustainability*, *9*(8), 1326. https://doi.org/10.3390/su9081326

Valentinov, V. (2024). Advancing a system-level perspective in stakeholder theory: Insights from the institutional economics of John R. Commons. *Social Science Information*, *63*(4), 443–467. https://doi.org/10.1177/05390184241302724

Wang, Z., Fan, Z., Zhang, X., Liu, B., & Chen, X. (2022). Status, trends and enlightenment of global oil and gas development in 2021. *Petroleum Exploration and Development*, *49*(5), 1210–1228. https://doi.org/10.1016/S1876-3804(22)60344-6

Website Performance. (2025, October). SimilarWeb Identity. https://pro.similarweb.com/#/digitalsuite/websiteanalysis/overview/website-performance/*/999/1m?webSource=Total&key=companiesmarketcap.com

Yahoo, M., Salleh, N. H. M., Chatri, F., & Huixin, L. (2024). Economic and environmental analysis of Malaysia's 2025 renewable and sustainable energy targets in the generation mix. *Heliyon*, *10*(9), e30157. https://doi.org/10.1016/j.heliyon.2024.e30157

Yatimi, Y., Mendil, J., Marafi, M., Alalou, A., & Al-Dahhan, M. H. (2024). Advancement in heavy oil upgrading and sustainable exploration emerging technologies. *Arabian Journal of Chemistry*, *17*(3), 105610. https://doi.org/10.1016/j.arabjc.2024.105610

Ye, W., & Chaiyapa, W. (2023). What does energy resilience mean for transitioning oil majors: A study of the impact of energy governance on energy resilience. *Social Sciences & Humanities Open*, *8*(1), 100686. https://doi.org/10.1016/j.ssaho.2023.100686

Yilgör, M., Korkmaz, S., & Kömüryakan, F. (2021). THE RELATIONSHIP BETWEEN NON-RENEWABLE ENERGY CONSUMPTION AND ECONOMIC GROWTH: a REGIONAL ANALYSIS OF EUROPEAN CONTINENT. *Ekonomi Politika Ve Finans Arastirmalari Dergisi*. https://doi.org/10.30784/epfad.916025

Yucel, M., & Yucel, S. (2024). Environmental, Social, and Governance (ESG) Dynamics in the energy sector: Strategic Approaches for Sustainable Development. *Energies*, *17*(24), 6291. https://doi.org/10.3390/en17246291

Zhou, D., Saeed, U. F., & Agyemang, A. O. (2024). Assessing the Role of Sustainability Disclosure on Firms' Financial Performance: Evidence from the Energy Sector of Belt and Road Initiative Countries. *Sustainability*, *16*(2), 930. https://doi.org/10.3390/su16020930

Zhu, W. (2016). p < 0.05, < 0.01, < 0.001, < 0.0001, < 0.00001, < 0.000001, or < 0.0000001 . . .. *Journal of Sport and Health Science/Journal of Sport and Health Science*, *5*(1), 77–79. https://doi.org/10.1016/j.jshs.2016.01.019

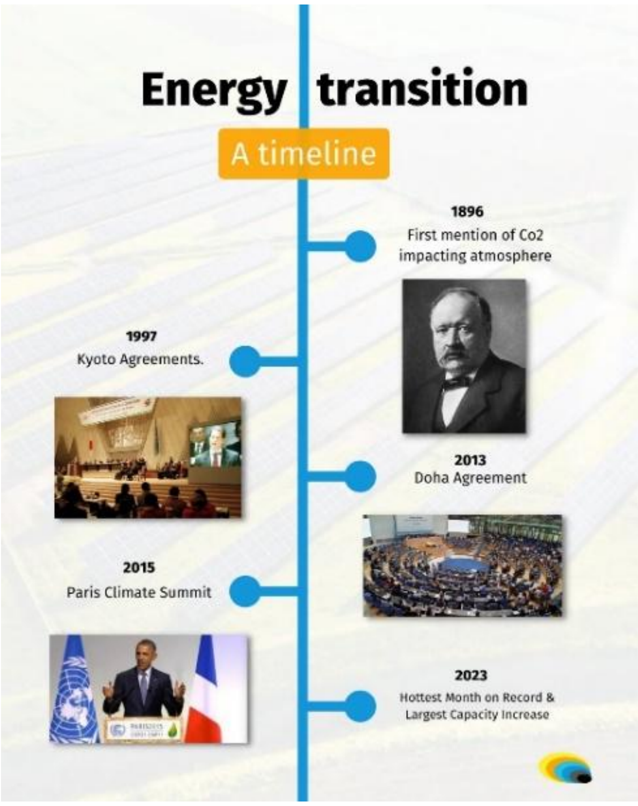
Appendix

Table 1.1 History of O&G Industry

Period	Milestone/Event	Details/Significance
Ancient Times	Early drilling in China (200–600 BCE)	Bamboo rigs and percussion drilling to access O&G, used for heating and salt extraction
1847	James Young's discovery in Scotland	Distilled petroleum from coal; the first commercial oil refinery was established
1846–1850	Abraham Gesner's kerosene invention	Created cleaner-burning fuel; founded Kerosene Gaslight Company
1854	First 'rock oil' mine in Poland	Ignacy Łukasiewicz improved kerosene distillation
1857	First oil well in La Brea, Trinidad	Drilled to 280 ft depth; early modern oil well
1859	Edwin Drake's well in Pennsylvania	First modern American oil well; triggered the Pennsylvania oil rush
1865	John D. Rockefeller founded Standard Oil	Became the dominant U.S. oil company, controlling 90% of refining capacity
1870s–1890s	Early offshore drilling developments	First offshore rigs on piers and piles in California and Ohio
1907	Anglo-Persian Oil Company formed	Foundation of BP; British Navy's main oil supplier during WWI
1929–1930	Directional drilling patented	Allowed drilling at angles, accessing hard-to-reach oil reserves
1949–1954	Offshore drilling innovations	Introduction of jackup rigs and semisubmersibles, enabling deeper water drilling
1955	First drillship (CUSS I)	Enabled drilling in deeper waters (400 feet)
1960	Formation of OPEC	Coalition of oil-producing countries controlling significant global oil reserves
1970s	Oil crises and price shocks	Peak production followed by rising prices and decreased demand
1980s	Oil glut and price collapse	Oversupply led to falling prices; OPEC struggled to maintain influence
2014 onwards	Shale oil boom and new surplus	U.S. shale production causes a new glut, impacting global prices
Modern Era	Technological advances	Hydraulic fracturing, automated rigs, and enhanced oil recovery improve extraction efficiency

Sources: U. Ali and Ali (2019); (EKT Interactive, 2024); Performance (n.d.)

Figure 1.5 *Energy Transition History*



Source: Christoph. (2024, November 7)

Table 1.2 History of Sustainability Concepts

Concept	**Year**	**Why It Matters**
UN Brundtland Commission - 'Our Common Future' report	1987	Popularized the term sustainable development with a clear, widely accepted definition
Kyoto Protocol	1997	First legally binding GHG reduction commitment for developed countries
Doha Amendment	2013	Extended Kyoto targets and obligations
Paris Agreement	2015	Global pledge to limit warming to 1.5°C
UN Sustainable Development Goals (SDGs)	2015	Broader framework linking energy, climate, and sustainability

Source: Akepa (2025)

Table 2.1 Comparison between TBL, CSR, and ESG

Aspect	Triple Bottom Line (TBL)	Corporate Social Responsibility (CSR)	Environmental, Social, and Governance (ESG)
Definition	A framework that considers People (Social), Planet (Environmental), and Profit (Economic) as measures of business performance.	A company's commitment to ethical and responsible business that contributes to societal well-being.	A framework to assess a company's performance in Environmental, Social, and Governance areas.
Goal	To encourage businesses to consider social and environmental responsibilities alongside profit.	To create a positive social impact beyond profit-making.	To evaluate a company's sustainability and ethical practices.
Focus Areas	Social, Environmental, and Economic dimensions.	Philanthropy, community engagement, environmental stewardship, employee welfare.	Environmental impact, social relationships, leadership, transparency, and ethics.
Approach	Holistic evaluation of business impact across three dimensions.	Actions taken by companies to contribute to sustainable development.	Used by investors, stakeholders, analysts for company evaluation.
Relation to Sustainability	Aligns with sustainability by emphasizing that businesses should not focus on profits alone.	Aligns with sustainability through ethical behavior and positive societal contributions.	Provides tools to assess sustainability performance in environmental, social, and governance areas.

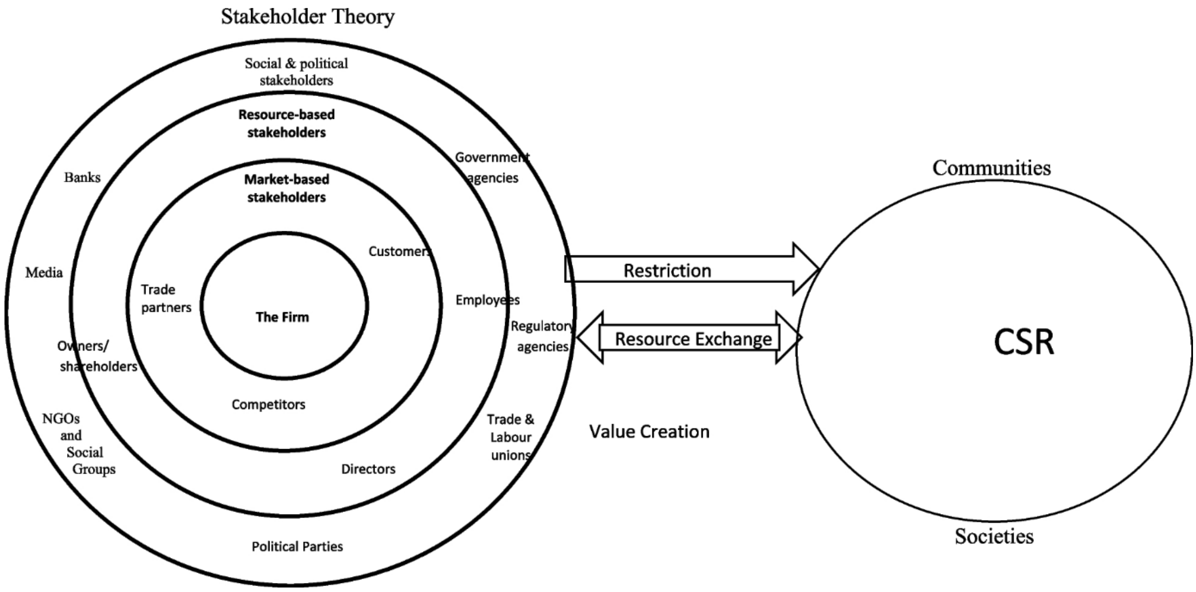
Source: Pt (2023)

Table 2.3 Evolution of Stakeholder Theory (ST)

Year	Author	Title	Key contributions
1984	Freeman	Strategic management: A stakeholder approach	Introduced ST and advocated for taking into account the interests of all stakeholders
1995	Donaldson and Preston	The stakeholder theory of the corporation: Concepts, evidence, and implications	Asserted the moral obligation to consider stakeholders and suggested three theoretical approaches which are descriptive (explaining how firms behave), instrumental (linking stakeholder engagement to firm performance), and normative (arguing firms have ethical duties to stakeholders) for stakeholder engagement
1997	Mitchell, Agle, and Wood	Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts	Introduced the attributes of power, legitimacy, and urgency as valuable indicators for guiding stakeholder management
1999	Jones and Wicks	Convergent stakeholder theory	Proposed a unified ST that integrates diverse perspectives and methodologies
2003	Phillips, Freeman, and Wicks	What stakeholder theory is not	Clarified the misconceptions about ST and emphasized its role as a framework for understanding and addressing the interests of various stakeholders
2010	Parmar, Freeman, Harrison, Wicks, Purnell, and de Colle	Stakeholder theory: The state of the art	Presented an overview of the current state of ST, its applications across different fields, and discussed the potential contributions of stakeholder management to corporate social responsibility, sustainability, and ethical conduct.

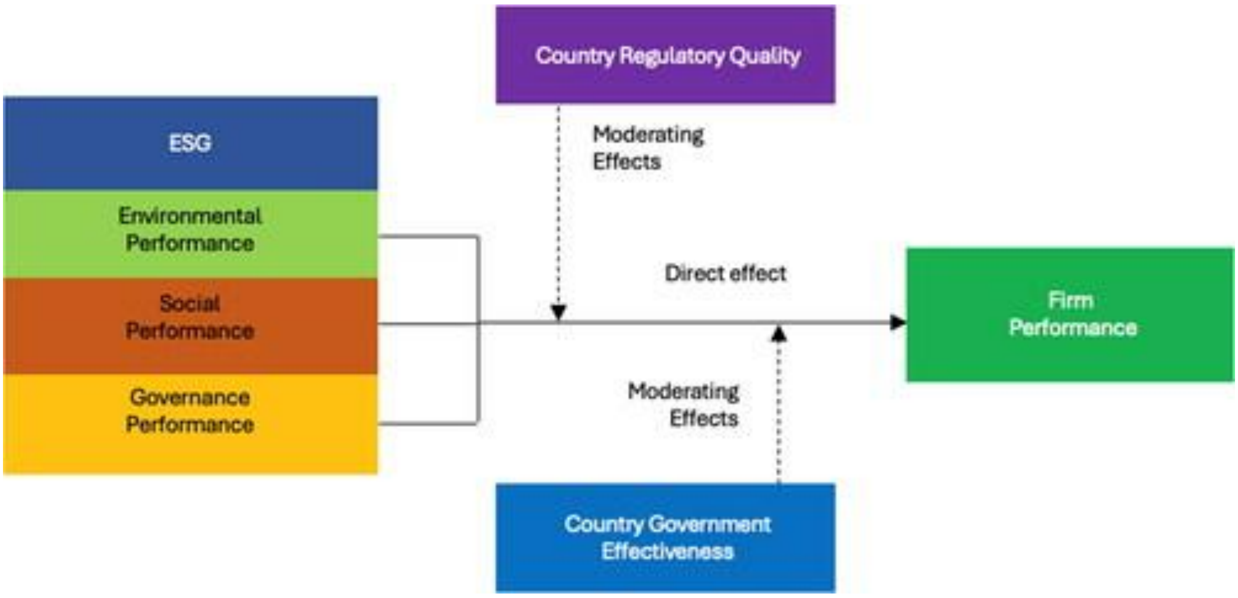
Source: Mahajan et al. (2023)

Figure 2.3 *Relationship between Stakeholder Theory (ST) and CSR*



Source: Awa et al. (2024)

Figure 2.4 *Relationship between Company's Performance and ESG*



Source: Handoyo and Anas (2024)

Table 2.5 Global Emission Data in the Energy Sector

regi	country	emission	type	segment	reason	baseYear	emission	energyRa
North A	US	1637.88	Energy	Abandoned	All	2024	2	2
North A	US	556.36	Energy	Bioenergy	All	2022-2023	2	2
North A	US	578.45	Energy	Coking coal	All	2024	2	2
North A	US	858.07	Energy	Gas pipeline	Fugitive	2024	2	2
North A	US	1221.88	Energy	Gas pipeline	Vented	2024	2	2
North A	US	21.9	Energy	Offshore gas	Fugitive	2024	2	2
North A	US	49.38	Energy	Offshore gas	Vented	2024	2	2
North A	US	26.88	Energy	Offshore oil	Flared	2024	2	2
North A	US	70.78	Energy	Offshore oil	Fugitive	2024	2	2
North A	US	283.14	Energy	Offshore oil	Vented	2024	2	2
North A	US	2043.59	Energy	Onshore gas	Fugitive	2024	2	2
North A	US	4608.47	Energy	Onshore gas	Vented	2024	2	2
North A	US	562.21	Energy	Onshore oil	Flared	2024	2	2
North A	US	1068.15	Energy	Onshore oil	Fugitive	2024	2	2
North A	US	4272.57	Energy	Onshore oil	Vented	2024	2	2
North A	US	18.07	Energy	Other from c	All	2022-2024	2	2
North A	US	682.85	Energy	Other from c	All	2022-2024	2	2
North A	US	830.7	Energy	Satellite-det	All	2024	2	2
North A	US	1109.24	Energy	Steam coal	All	2024	2	2
North A	US	**20500.58**	Energy	**Total**	All	2022-2024	**2**	**2**
North A	Canada	91.18	Energy	Abandoned	All	2024	16	10
North A	Canada	45.71	Energy	Bioenergy	All	2022-2023	16	10
North A	Canada	84.82	Energy	Coking coal	All	2024	16	10
North A	Canada	103.31	Energy	Gas pipeline	Fugitive	2024	16	10
North A	Canada	147.11	Energy	Gas pipeline	Vented	2024	16	10
North A	Canada	301.71	Energy	Onshore gas	Fugitive	2024	16	10
North A	Canada	680.38	Energy	Onshore gas	Vented	2024	16	10
North A	Canada	33.04	Energy	Onshore oil	Flared	2024	16	10
North A	Canada	243.52	Energy	Onshore oil	Fugitive	2024	16	10
North A	Canada	974.08	Energy	Onshore oil	Vented	2024	16	10
North A	Canada	0.91	Energy	Other from c	All	2022-2024	16	10
North A	Canada	70.72	Energy	Other from c	All	2022-2024	16	10
North A	Canada	1.5	Energy	Satellite-det	All	2024	16	10
North A	Canada	9.35	Energy	Steam coal	All	2024	16	10
North A	Canada	**2787.34**	Energy	**Total**	All	2022-2024	**16**	**10**
Asia Pa	Malaysia	0.45	Energy	Abandoned	All	2024	42	30
Asia Pa	Malaysia	7.38	Energy	Bioenergy	All	2022-2023	42	30
Asia Pa	Malaysia	56.99	Energy	Gas pipeline	Fugitive	2024	42	30
Asia Pa	Malaysia	81.16	Energy	Gas pipeline	Vented	2024	42	30
Asia Pa	Malaysia	100.96	Energy	Offshore gas	Fugitive	2024	42	30
Asia Pa	Malaysia	227.66	Energy	Offshore gas	Vented	2024	42	30
Asia Pa	Malaysia	72.19	Energy	Offshore oil	Flared	2024	42	30
Asia Pa	Malaysia	44.51	Energy	Offshore oil	Fugitive	2024	42	30
Asia Pa	Malaysia	178.02	Energy	Offshore oil	Vented	2024	42	30
Asia Pa	Malaysia	15.23	Energy	Onshore oil	Flared	2024	42	30
Asia Pa	Malaysia	1.72	Energy	Onshore oil	Fugitive	2024	42	30
Asia Pa	Malaysia	6.89	Energy	Onshore oil	Vented	2024	42	30
Asia Pa	Malaysia	1.1	Energy	Other from c	All	2022	42	30
Asia Pa	Malaysia	24.61	Energy	Other from c	All	2022-2024	42	30
Asia Pa	Malaysia	**818.87**	Energy	**Total**	All	2022-2024	**42**	**30**
Europe	UK	21.84	Energy	Abandoned	All	2024	36	43
Europe	UK	108.96	Energy	Bioenergy	All	2022-2023	36	43
Europe	UK	5	Energy	Coking coal	All	2024	36	43
Europe	UK	27.09	Energy	Gas pipeline	Fugitive	2024	36	43
Europe	UK	38.57	Energy	Gas pipeline	Vented	2024	36	43
Europe	UK	8.15	Energy	Offshore gas	Fugitive	2024	36	43
Europe	UK	18.39	Energy	Offshore gas	Vented	2024	36	43
Europe	UK	12.61	Energy	Offshore oil	Flared	2024	36	43
Europe	UK	12.92	Energy	Offshore oil	Fugitive	2024	36	43
Europe	UK	51.69	Energy	Offshore oil	Vented	2024	36	43
Europe	UK	0.19	Energy	Onshore gas	Fugitive	2024	36	43
Europe	UK	0.43	Energy	Onshore gas	Vented	2024	36	43
Europe	UK	0.93	Energy	Onshore oil	Flared	2024	36	43
Europe	UK	0.36	Energy	Onshore oil	Fugitive	2024	36	43
Europe	UK	1.43	Energy	Onshore oil	Vented	2024	36	43
Europe	UK	6.15	Energy	Other from c	All	2022-2024	36	43
Europe	UK	35.9	Energy	Other from c	All	2022-2024	36	43
Europe	UK	2.81	Energy	Steam coal	All	2024	36	43
Europe	UK	**353.42**	Energy	**Total**	All	2022-2024	**36**	**43**
Europe	Norway	11.41	Energy	Bioenergy	All	2022-2023	81	80
Europe	Norway	0.21	Energy	Gas pipeline	Fugitive	2024	81	80
Europe	Norway	0.3	Energy	Gas pipeline	Vented	2024	81	80
Europe	Norway	2.51	Energy	Offshore gas	Fugitive	2024	81	80
Europe	Norway	5.66	Energy	Offshore gas	Vented	2024	81	80
Europe	Norway	0.28	Energy	Offshore oil	Flared	2024	81	80
Europe	Norway	1.58	Energy	Offshore oil	Fugitive	2024	81	80
Europe	Norway	6.31	Energy	Offshore oil	Vented	2024	81	80
Europe	Norway	0.02	Energy	Onshore oil	Flared	2024	81	80
Europe	Norway	0.03	Energy	Onshore oil	Fugitive	2024	81	80
Europe	Norway	0.12	Energy	Onshore oil	Vented	2024	81	80
Europe	Norway	0.21	Energy	Other from c	All	2022	81	80
Europe	Norway	2.35	Energy	Other from c	All	2022-2024	81	80
Europe	Norway	**30.99**	Energy	**Total**	All	2022-2024	**81**	**80**

Source: (IEA, 2025)

Figure 2.10 *Financial Performance and ESG Index Positive Relationship*

	Path	*t*	*p*	Lo95	Hi95	f^2	VIF
Direct effects							
ESG → MV	0.588***	13.087	0.000	[0.514	0.662]	0.513	1.199
FP → MV	0.211***	3.688	0.000	[0.114	0.302]	0.063	1.257
MR → MV	0.063^{ns}	1.187	0.118	[-0.032	0.142]	0.005	1.282
R^2: 0,44; Q^2: 0.237							
ESG → FP	0.329***	7.376	0.000	[0.260	0.406]	0.121	1.000
R^2: 0.11; Q^2: 0.069							
ESG → MR	−0.354***	6.855	0.000	[-0.444	- 0.273]	0.143	1.000
R^2: 0.13; Q^2: 0.065							
Indirect effect						**VAF**	
ESG → FP → MV	0.070***	3.348	0.000	[0.036	0.105]	0.105	n/a
ESG → MR→ MV	-0.022^{ns}	1.127	0.130	[-0.054	0.011]	ns	n/a

*: p<0.05; **p<0.01; ***p<0.001.

Significance, t statistic, and 95% bias-corrected confidence interval performed by 5000 res. boot-strapping procedure. VIF: Inner model Variance Inflation Factor. VAF: Variance Accounted for. n/a: not applicable.

Source: Ramírez-Orellana et al. (2023)

Figure 2.11 *Negative ROA*

Variables	Obs.	Mean	Std. deviation	Minimum	Maximum
ESGScr	2,522	51.38	17.56	11.10	92.92
ENVScr	2,522	51.69	22.49	3.26	98.63
SOCScr	2,522	52.06	21.27	6.97	96.68
GOVScr	2,522	50.23	21.48	3.33	97.84
Tobinq	2,356	1.05	0.81	0.01	13.51
ROA	2,522	−0.78	16.62	−172.41	114.85
BoardIndep	2,519	78.12	14.64	5.88	100
BoardGenDiv	2,509	10.97	11.78	0	66.67
BoardAtt	2,101	90.15	10.85	0	100
CSRTeam	2,522	0.54	0.50	0	1
BoardSize	2,520	9.25	3.22	1	23
CEODual	2,522	0.38	0.49	0	1
TotAssets	2,522	21,800,000,000	53,500,000,000	1,403,261	411,000,000,000
Lvrg	2,522	53.03	24.49	0.70	290.03
FFPer	2,492	73.74	27.72	0.17	100

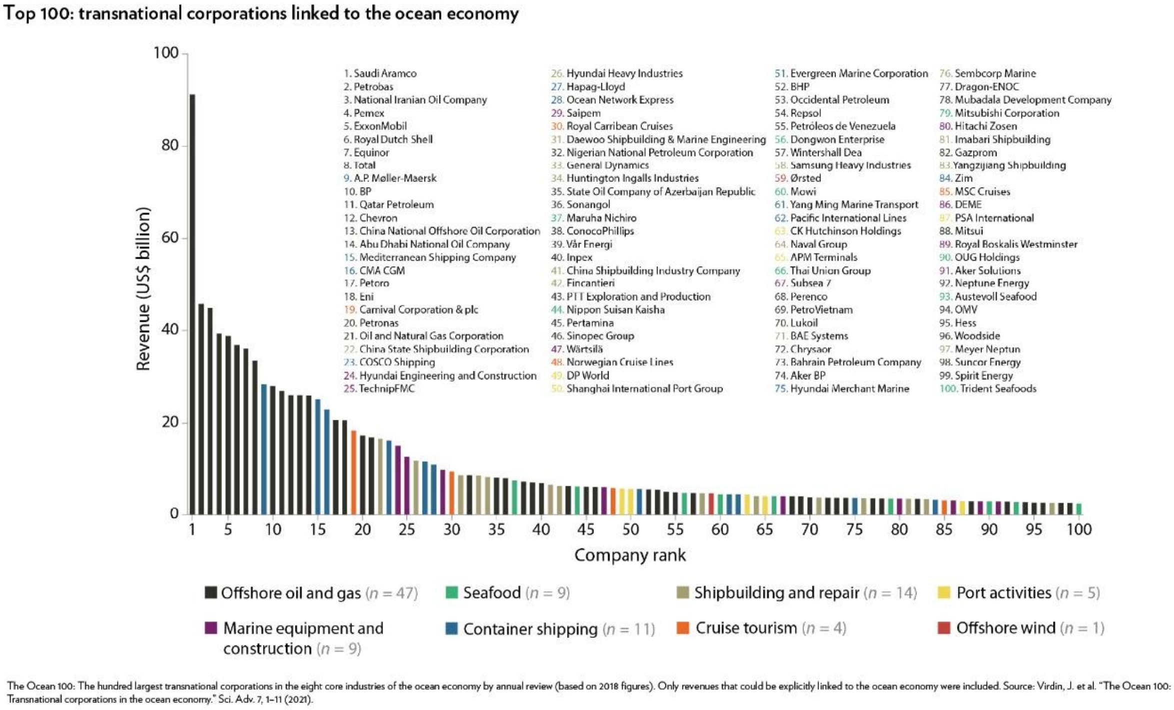
Source: Shahbaz et al. (2020)

Table 2.6 Function of ROA and ROE

Measure	Purpose	Description
Return on Assets (ROA)	Captures operating performance	• Calculated as income after taxes divided by average total assets. • Indicates how efficiently a company uses its assets to generate profits.
Return on Equity (ROE)	Captures financial performance	• Calculated as income available to common shareholders (excluding extraordinary items) divided by common equity. • Measures how effectively a company generates returns for its shareholders.

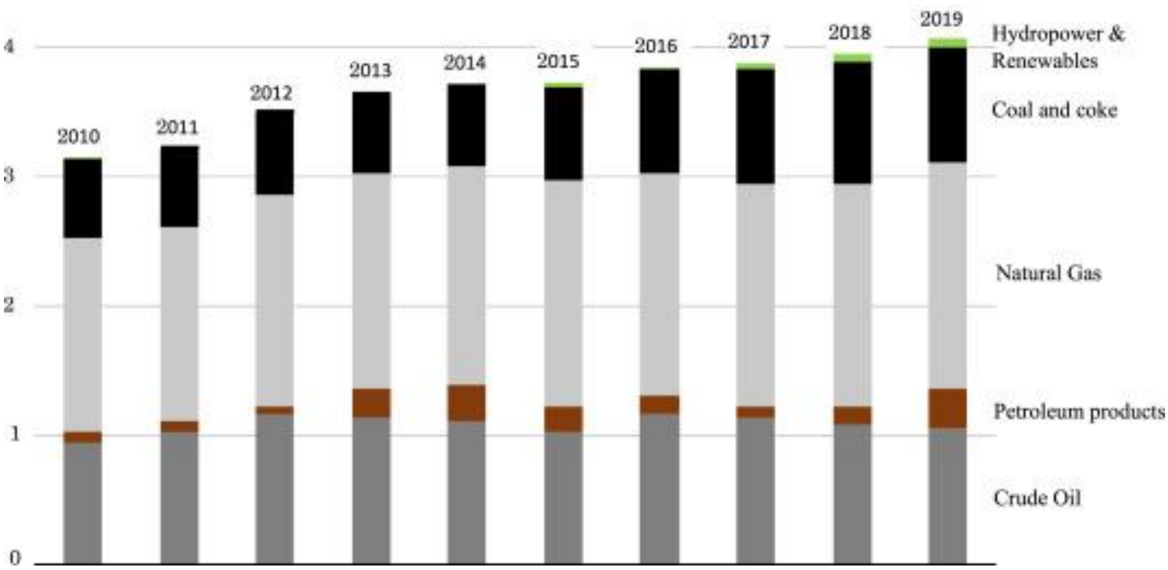
Source: Ramírez-Orellana et al. (2023)

Figure 2.13 *Top 100 Transnational Corporations Linked to the Ocean Economy*



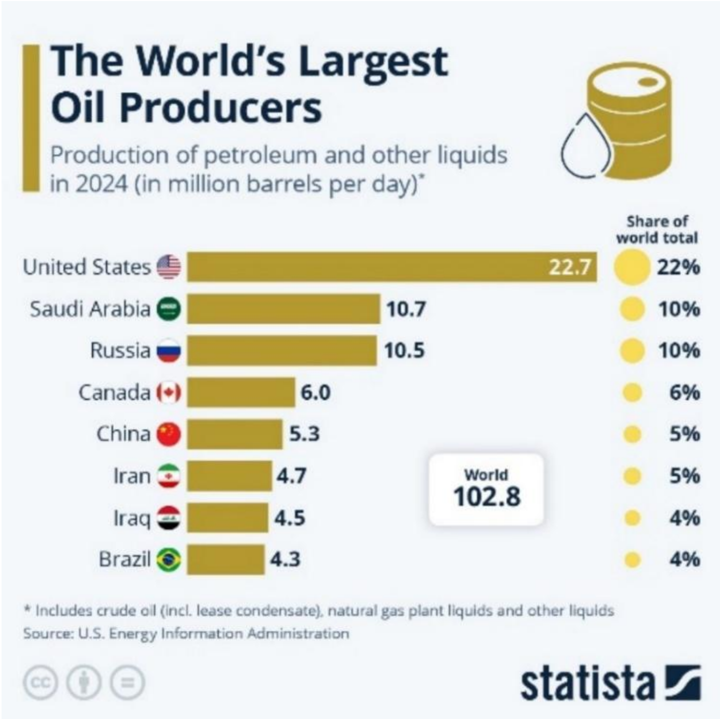
Source: Kgi-Admin and Kgi-Admin (2023)

Figure 3.1 *Different Types of Malaysia's Energy Supply*



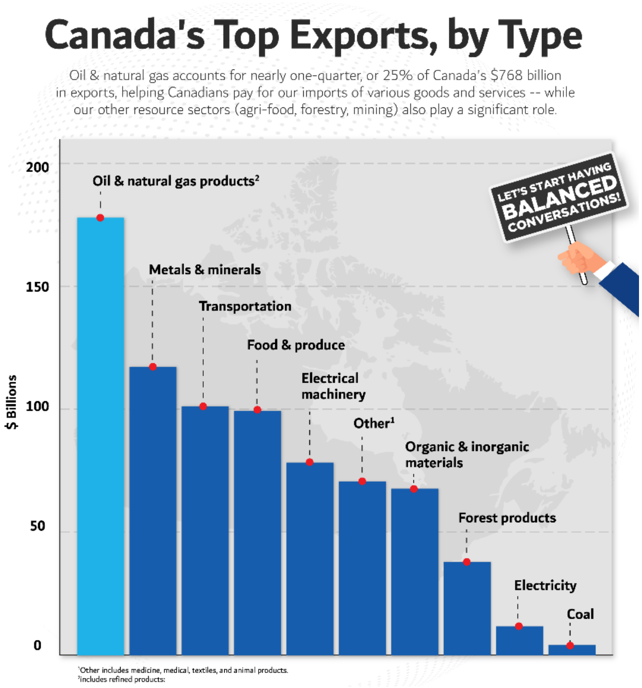
Source: Yahoo et al. (2024)

Figure 3.2 *The World's Largest Oil Producers*



Source: Richter (2025)

Figure 3.3 *Canada's Top Exports*



Source: Canada Action (2025)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
DS	123	3	9	6.35	1.318	-.628	.218	.071	.433
FP	123	-59	55	11.24	14.159	-1.175	.218	5.877	.433
SR	123	4	12	8.92	1.867	-.717	.218	-.048	.433
GQ	123	1	12	8.45	2.881	-.920	.218	.089	.433
SP	123	2	11	7.22	1.818	.017	.218	-.260	.433
Valid N (listwise)	123								

Correlations

		DS	FP	SR	GQ	SP
DS	Pearson Correlation	1	-.077	.768**	.537**	.488**
	Sig. (2-tailed)		.400	<.001	<.001	<.001
	N	123	123	123	123	123
FP	Pearson Correlation	-.077	1	-.181*	-.130	-.069
	Sig. (2-tailed)	.400		.045	.151	.446
	N	123	123	123	123	123
SR	Pearson Correlation	.768**	-.181*	1	.405**	.411**
	Sig. (2-tailed)	<.001	.045		<.001	<.001
	N	123	123	123	123	123
GQ	Pearson Correlation	.537**	-.130	.405**	1	.341**
	Sig. (2-tailed)	<.001	.151	<.001		<.001
	N	123	123	123	123	123
SP	Pearson Correlation	.488**	-.069	.411**	.341**	1
	Sig. (2-tailed)	<.001	.446	<.001	<.001	
	N	123	123	123	123	123

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Company Structure (CS)

ANOVA

SP_30

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.107	3	1.036	.484	.696
Within Groups	55.583	26	2.138		
Total	58.690	29			

ANOVA Effect Sizes[a,b]

		Point Estimate	95% Confidence Interval	
			Lower	Upper
SP_30	Eta-squared	.053	.000	.184
	Epsilon-squared	-.056	-.115	.090
	Omega-squared Fixed-effect	-.054	-.111	.087
	Omega-squared Random-effect	-.017	-.034	.031

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

SP_30

Tukey HSD[a,b]

CS	N	Subset for alpha = 0.05
		1
2	2	6.7500
1	14	7.0393
3	8	7.5063
4	6	7.7500
Sig.		.727

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 4.634.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Country

ANOVA

SP_30

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.969	4	.742	.333	.853
Within Groups	55.721	25	2.229		
Total	58.690	29			

Descriptive Statistics[a]

	N	Minimum	Maximum	Mean	Std. Deviation
SP_30	21	3.40	10.20	7.3786	1.65760
Valid N (listwise)	21				

a. Country = 1

Descriptive Statistics[a]

	N	Minimum	Maximum	Mean	Std. Deviation
SP_30	5	7.00	8.00	7.3800	.41473
Valid N (listwise)	5				

a. Country = 2

Descriptive Statistics[a]

	N	Minimum	Maximum	Mean	Std. Deviation
SP_30	2	6.00	6.40	6.2000	.28284
Valid N (listwise)	2				

a. Country = 3

Descriptive Statistics[a]

	N	Minimum	Maximum	Mean	Std. Deviation
SP_30	1	6.75	6.75	6.7500	.
Valid N (listwise)	1				

a. Country = 4

Descriptive Statistics[a]

	N	Minimum	Maximum	Mean	Std. Deviation
SP_30	1	7.60	7.60	7.6000	.
Valid N (listwise)	1				

a. Country = 5

Multicollinearity

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	188.578	11	17.143	8.872	<.001[b]
	Residual	214.495	111	1.932		
	Total	403.073	122			

a. Dependent Variable: SP

b. Predictors: (Constant), Country=5.0, SR, Country=4.0, CS=2.0, Country=2.0, CS=4.0, FP, GQ, Country=3.0, CS=3.0, DS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.868	.767		1.131	.260		
	DS	.663	.177	.481	3.745	<.001	.291	3.441
	FP	-.012	.010	-.092	-1.210	.229	.823	1.214
	SR	.109	.114	.112	.954	.342	.348	2.873
	GQ	.150	.056	.238	2.661	.009	.601	1.664
	CS=2.0	.375	.558	.051	.671	.503	.828	1.207
	CS=3.0	.513	.364	.122	1.410	.161	.643	1.555
	CS=4.0	.503	.369	.110	1.364	.175	.734	1.362
	Country=2.0	.035	.387	.007	.091	.928	.880	1.137
	Country=3.0	-2.952	.541	-.446	-5.455	<.001	.718	1.392
	Country=4.0	-.976	.747	-.096	-1.308	.194	.896	1.116
	Country=5.0	1.285	.707	.140	1.816	.072	.805	1.242

a. Dependent Variable: SP

MLR

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.684[a]	.468	.415	1.39010	1.439

a. Predictors: (Constant), Country=5.0, SR, Country=4.0, CS=2.0, Country=2.0, CS=4.0, FP, GQ, Country=3.0, CS=3.0, DS

b. Dependent Variable: SP

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	188.578	11	17.143	8.872	<.001[b]
	Residual	214.495	111	1.932		
	Total	403.073	122			

a. Dependent Variable: SP

b. Predictors: (Constant), Country=5.0, SR, Country=4.0, CS=2.0, Country=2.0, CS=4.0, FP, GQ, Country=3.0, CS=3.0, DS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.868	.767		1.131	.260		
	DS	.663	.177	.481	3.745	<.001	.291	3.441
	FP	-.012	.010	-.092	-1.210	.229	.823	1.214
	SR	.109	.114	.112	.954	.342	.348	2.873
	GQ	.150	.056	.238	2.661	.009	.601	1.664
	CS=2.0	.375	.558	.051	.671	.503	.828	1.207
	CS=3.0	.513	.364	.122	1.410	.161	.643	1.555
	CS=4.0	.503	.369	.110	1.364	.175	.734	1.362
	Country=2.0	.035	.387	.007	.091	.928	.880	1.137
	Country=3.0	-2.952	.541	-.446	-5.455	<.001	.718	1.392
	Country=4.0	-.976	.747	-.096	-1.308	.194	.896	1.116
	Country=5.0	1.285	.707	.140	1.816	.072	.805	1.242

a. Dependent Variable: SP

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.9787	9.4446	7.2195	1.24327	123
Residual	-3.04400	2.15602	.00000	1.32596	123
Std. Predicted Value	-2.607	1.790	.000	1.000	123
Std. Residual	-2.190	1.551	.000	.954	123

a. Dependent Variable: SP