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THE MANAGEMENT OF SOCIAL AND ENVIRONMENTAL ASPECTS AND THEIR IMPACT ON FIRM PERFORMANCE: EVIDENCE FROM THE ENERGY SECTOR

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The author of this thesis has actively participated in all stages of the development of this article, making original, substantial, and meaningful contributions to its conception, design, analysis, writing, and revision. According to the CRediT (Contributor Roles Taxonomy), the author's contributions include: Conceptualization (Ideas; formulation or evolution of overarching research goals and aims), Methodology (Development or design of methodology; creation of models), Formal analysis (statistical techniques to analyze or synthesize study data), Investigation (data collection), Writing and Original Draft, Reviewed & Edited.

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*This is a publication indexed in the Journal Citation Reports (JCR), with a 2023 impact factor of 5.5, placing it in the **first decile** of its field—ranked **17th out of 233 journals**, at the **92.6th percentile** in the "Business, Finance" category. According to the Journal Citation Indicator, it ranks **34th out of 233**, again within the **first decile** of its field.*

The author of this thesis has actively participated in all stages of the development of this article, making original, substantial, and meaningful contributions to its conception, design, analysis, writing, and revision. According to the CRediT (Contributor Roles Taxonomy), the author's contributions include: Conceptualization

(Ideas; formulation or evolution of overarching research goals and aims), Methodology (Development or design of methodology; creation of models) , Formal analysis (statistical techniques to analyze or synthesize study data), Investigation (data collection), Writing and Original Draft, Reviewed & Edited.

INDEX

List of publications included in the thesis **5**

Index of tables **11**

Index of figures **13**

List of acronymos & abbreviations **15**

Summary **19**

INTRODUCTION **37**

A. Background and Justification 37

B. Motivation of the study 39

C. Objectives and Hypothesis 41

D. Methodology 45

E. Structure 52

1. IMPACT ON FINANCIAL PERFORMANCE OF HUMAN CAPITAL, ENVIRONMENTAL CAPITAL, CONTROVERSIES AND INFORMATION QUALITY: EVIDENCE FROM THE ENERGY SECTOR **57**

Abstract 57

1.1. Introduction 58

1.2. Theoretical framework, literature reviews and hypothesis 61

1.2.1. Theoretical Framework 61

1.2.2. Human Capital and Firm Performance 63

1.2.3. Environmental Capital, Controversies and Firm Performance 66

1.2.4. Quality of Accounting Information and Firm Performance 67

1.3. Research design 68

1.3.1. Data 68

1.3.2. Variables 69

1.3.2.1. Dependent Variable 69

1.3.2.2. Independent Variable 69

1.3.3. Control variables 71

1.4. Empirical results and discussion 72

1.4.1. Reference Model 72
1.5. RESULTS AND DISCUSSION 72
1.5.1. Descriptive Analysis 72
1.5.2. Multivariate Analysis 76
1.5.2.1. Human Capital and Financial Performance 77
1.5.2.2. Environmental Capital, Controversies and Financial Performance 77
1.5.2.3. Accounting Information Quality and Financial Performance 78
1.5.2.4. Control Variables 78
1.5.2.5. Robustness and Complementary Analysis 79
1.5.2.5.1. Alternative measures of core variables 79
1.5.2.5.2. Sub-sample comparison and alternative model 81
1.6. CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH DIRECTIONS 83

2. DOES CORPORATE SOCIAL PERFORMANCE IMPROVE ENVIRONMENTALLY ADJUSTED EFFICIENCY? EVIDENCE FROM THE ENERGY SECTOR 87

ABSTRACT 87
2.1. INTRODUCTION 88
2.2. THEORETICAL FRAMEWORK AND DEVELOPMENT HYPOTHESES 89
2.2.1. Global CSR performance and FP 90
2.2.2. CSR activity performance and FP 91
2.3. EMPIRICAL RESEARCH 93
2.3.1. Data 93
2.3.2. Methodology 93
2.3.3. The Environmental Efficiency Measure 95
2.3.4. Corporate Social Performance and Control Variables 96
2.4. EMPIRICAL RESULTS AND DISCUSSION 97
2.4.1. Descriptive Statistics 97
2.4.2. Truncated regression analysis for environmental efficiency 99
2.4.3. Robustness Analysis 102
2.5. CONCLUSIONS 103
2.5.1. Managerial implications 104
2.5.2. Limitations and future research avenues 105

3. DO DIVERSITY & INCLUSION OF HUMAN CAPITAL AFFECT ECOEFFICIENCY? EVIDENCE FOR THE ENERGY SECTOR 109

ABSTRACT 109
3.1. INTRODUCTION 110

3.2. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT 112
3.2.1. Theoretical Framework 112
3.2.2. Diversity, Inclusion, People Development, Labor Controversies, and ECO 113
3.3. MATERIALS AND METHODS 116
3.3.1. Sample and Data Collection 116
3.3.2. Methodology 116
3.3.2.1. Variables 117
3.3.2.1.1. Dependent variable: Ecoefficiency (ECO). 117
3.3.2.1.2. Independent variables: Diversity and inclusion scores 118
3.3.3. Control Variables 119
3.3.4. Model Settings 120
3.4. RESULTS 121
3.4.1. Descriptive Statistics 121
3.4.2. Baseline Model: Results and Discussion 123
3.4.3. Complementary Analysis 126
3.4.4. Robustness 128
3.5. CONCLUSIONS 129

4. COMMITMENT TO SOCIAL SDGS AND ITS INFLUENCE ON ENERGY SECTOR PERFORMANCE: SYMBOLISM OR REALITY? 135

ABSTRACT 135
4.1. INTRODUCTION 136
4.2. THEORETICAL BACKGROUND AND HYPOTHESES 137
4.2.1. Walking the Talk on Social SDGs Vs. Social SDG Washing 138
4.2.2. The Moderating Role of a Country's Development Level and Environmental Performance 141
4.3. METHODOLOGY 142
4.3.1. Sample and Data 142
4.3.2. Measurement of Variables 142
4.3.2.1. Dependent Variables 142
4.3.2.2. Independent Variables 142
4.3.2.3. Moderator |Variables 143
4.3.2.4. Control Variables 144
4.4. EMPIRICAL METHODOLOGY 144
4.5. EMPIRICAL RESULTS 145
4.5.1. Descriptive Statistics 145

4.5.2. Multivariate Analysis 148
4.5.3. Robustness Analysis 151
4.6. DISCUSSION 153
4.7. CONCLUSIONS 154

5. CONCLUSION, LIMITATIONS AND FUTURE RESEARCH STUDIES 159

REFERENCES 175

APPENDICES 209
APPENDIX A 209
APPENDIX B 211
APPENDIX C 215

INDEX OF TABLES

Table 1. Relationship between objectives, methodology and research structure 46
Table 2. Descriptive Statistics of Variables 74
Table 3. Correlation Matrix 75
Table 4. OLS Regression Analysis 76
Table 5. Robustness Check Results.OLS 79
Table 6. Robustness Check Results: OLS and RE GLS 82
Table 7. DEA Models: Operational and Environmental Efficiency 95
Table 8. Descriptive statistics of inputs and outputs for the EAE model 96
Table 9. Spearman rank correlation coefficients 96
Table 10. Descriptive statistics of control variables 97
Table 11. Descriptive statistics of operational and environmental efficiency 97
Table 12. Descriptive statistics of independent variables: the ESG index and its pillars and dimensions 98
Table 13. Results of truncated regressions for Corporate Social Performance-Environmental Efficiency relationship 101
Table 14. Robustness test for Corporate Social Performance-Environmental Efficiency relationship 103
Table 15. Inputs and outputs for operational efficiency and ECO. 117
Table 16. Composition of D&I scores. 119
Table 17. Descriptive statistics of operational efficiency and ECO. 121
Table 18. Descriptive statistics of independent variables. 122
Table 19. Descriptive statistics of control variables. 123
Table 20. Truncated regressions result for the D&I-ECO relationship. 126
Table 21. Truncated regressions result for the D&I-environmental score relationship. 127
Table 22. Truncated regressions result for the D&I-financial performance relationship. 128
Table 23. Tobit regressions result for the D&I-ECO relationship, non-US firms. 128
Table 24. Descriptive statistics of dependent, independent and moderating variables 146

Table 25. Descriptive statistics of control variables 147
Table 26. Spearman correlations among dependent, independent and moderating variables (p star(.05)) 147
Table 27. Truncated regression for SDG-Social and D&I performance 148
Table 28. The moderating effect of development level and EPI 150
Table 29. Truncated regression lag 151
Table 30. Instrumental variables (2SLS) regression 152
Table 31. Tobit regression 152
Table 32. Hypotheses of Chapter 1 and the findings 159
Table 33. Hypotheses of Chapter 2 and the findings 161
Table 34. Hypotheses of Chapter 3 and the findings 164
Table 35. Hypotheses of Chapter 4 and the findings 168
Table A. Definitions, source, expected sign and main references of the variables for chapter 1 209
Table B.1. Distribution of sample observations by country for chapter 2 211
Table B.2. Sample Selection for chapter 2 211
Table B.3. Variables Description 212
Table C.1. Distribution of sample observations by country for chapter 3 215
Table C.2. Sample selection for chapter 3 216
Table C.3. Descriptive statistics for the inputs and outputs used in the DEA model. 216
Table C.4. Spearman rank correlation coefficients for the inputs and outputs used in the DEA model 216
Table C.5. Variable explanations 216
Table C.6. Lag OLS 218
Table C.7. Two-stage least squares regression 218

INDEX OF FIGURES

Figure 1. Research Structure 52
Figure 2. Efficiency over time 98
Figure 3. Study framework. 120
Figure 4. Evolution of efficiency over time. 121
Figure 5. Evolution of D&I scores over time. 122
Figure 6. Research Model 145

LIST OF ACRONYMS & ABBREVIATIONS

2SLS	Two-Stage Least Squares
CO_2	Carbon Dioxide
CSP	Corporate Social Performance
CSRD	Directive on Corporate Sustainability Reporting
CSR	Corporate Social Responsibility
D&I	Diversity and Inclusion
DEA	Data Envelopment Analysis
EAE	Environmentally Adjusted Efficiency
ECO	Ecoefficiency
EQ	Earnings Quality
EPI	Environmental Performance Index
ESG	Environmental, Social, and Governance
FP	Financial Performance
GDP	Gross Domestic Product
HCE	Human Capital Efficiency
HR	Human Resource
HDI	Human Development Index
IEA	International Energy Agency
LSEG	London Stock Exchange Group
OLS	Ordinary Least Squares
ROA	Return on Assets
SDG	Sustainable Development Goals
SFA	Stochastic Frontier Analysis
TBL	Triple Bottom Line
VAIC	Value Added Intellectual Coefficient
VIF	Variance Inflation Factor
VRS	Variable returns-to-scale
UN	United Nations

Summary

SUMMARY

This dissertation explores the complex interplay between corporate performance and sustainability in global publicly listed energy companies. It investigates how firms can simultaneously pursue profitability, meet environmental targets, and uphold social responsibilities in an increasingly demanding global context.

In Chapter I, empirical examinations are conducted to examine the impact of human capital, environmental capital, and financial reporting quality on financial performance. Findings reveal that efficient management of human assets has a significant impact on enhancing financial performance through efficient use of assets, increased productivity, and boosting investor confidence. In contrast, high carbon dioxide emissions (CO_2) and ongoing ESG-related scandals have a detrimental impact on financial performance, suggesting that high-polluting enterprises have costly financial consequences. Finally, we find that the quality of accounting information has a positive effect on the financial performance of companies. Overall, these results confirm that internal factors such as human resource management, compliance with best practices in sustainability, and high-quality financial reporting are critical value and financial success drivers in the energy sector. Furthermore, we find that the development level of the country where an energy company is based plays a moderate role in these relationships.

Chapter II analyzes the impact of Corporate Social Performance (CSP) – proxied by the Environmental, Social and Governance (ESG) index and its different pillars and dimensions – on the environmentally adjusted efficiency (EAE) in the energy sector. The research explores a non-linear U-shape pattern, with the implication that firms with medium-level CSP investments can face initial inefficiencies before they achieve long-term environmental benefits. Our results support the hypothesis that only above a certain level of CSP practices positively influence EAE, so there is a non-linear U-shaped association between overall ESG score, as well the individual social and governance pillar and the human rights and management subspecific dimensions, and EAE. Other ESG dimensions show a positive linear relationship with EAE: environmental pillar, innovation in the environmental area and shareholder score.

In Chapter III, the study examines the relationship between workplace diversity and inclusion (D&I) initiatives and their effects on both financial performance and environmental outcomes. The findings reveal a significant positive association between the aggregate indicator—encompassing diversity, inclusion, people development, and the absence of labor-related controversies—and eco-efficiency (ECO). Practices promoting workforce diversity, the effective implementation of cultural and gender diversity policies, and investments in employee training and development were found to enhance ECO. However, no significant relationship was observed between inclusion-specific policies or labor-related controversies and ECO. The results confirm a connection between human capital practices and environmental performance. Regarding financial

performance, only employee training and development opportunities exhibited a positive and significant impact. While inclusion policies were found to positively influence environmental performance, they did not have a significant effect on financial outcomes.

Finally, chapter IV examines the relationship between corporate commitments to social Sustainable Development Goals (SDGs) and actual social performance. The findings indicate that, in general, companies tend to align their public commitments with corresponding social and diversity and inclusion (D&I) practices, although some discrepancies are observed. Notably, commitments to SDG 5: Gender Equality and SDG 8: Decent Work and Economic Growth are positively associated with improved performance in these areas. However, the evidence also reveals signs of symbolic compliance with SDG 10: Reduced Inequalities, especially regarding the promotion of workplace inclusion, raising concerns about potential instances of "social washing." Additionally, the analysis shows that companies headquartered in developed countries, or those with a stronger environmental orientation, exhibit a more robust alignment between SDG commitments and actual social performance. These results highlight the importance of institutional context in shaping the effectiveness of corporate sustainability initiatives.

In conclusion, this dissertation highlights the central role of human capital investment, sustainability practices, sound corporate governance, and the authentic implementation of Sustainable Development Goal (SDG) commitments in driving sustainable performance within the energy sector. The findings offer robust empirical support for Resource-Based Theory, Stakeholder Theory, and Institutional Theory, emphasizing that achieving long-term competitiveness and corporate sustainability depends on the strategic alignment of workforce development, environmental responsibility, and financial transparency.

This doctoral thesis offers valuable implications for academics, policymakers, corporate leaders, and investors. Using an empirical and multidimensional approach, it demonstrates how sustainability strategies impact corporate performance in the energy sector. The study emphasizes the importance of aligning financial objectives with environmental, social, and governance (ESG) principles to build resilient and socially responsible organizations. For corporate leaders, it highlights the strategic relevance of investing in human capital development, fostering diversity and inclusion, and ensuring transparent sustainability reporting. It recommends prioritizing professional training, fair compensation, and inclusive workplace practices. For policymakers, the thesis calls for regulatory frameworks that support the integration of ESG and the Sustainable Development Goals (SDGs) without constraining business growth. Finally, it encourages investors to consider both financial and non-financial indicators especially in high-impact sectors like energy—where ESG performance is a key driver of long-term value creation.

Keywords: ESG, Financial Performance, Environmental Performance, Social Performance, Corporate Governance, Non-Financial Reporting, Corporate Social Responsibility, Eco-Efficiency, Diversity and Inclusion, Sustainable Development Goals, Energy Sector.

SUMMARY
(SPANISH)

Esta tesis explora la compleja interacción entre el desempeño corporativo y la sostenibilidad en empresas energéticas globales que cotizan en bolsa. Investiga cómo las empresas pueden perseguir simultáneamente la rentabilidad, cumplir con objetivos ambientales y mantener responsabilidades sociales en un contexto global cada vez más exigente.

En el Capítulo I, se llevan a cabo análisis empíricos destinados a examinar el impacto del capital humano, el capital ambiental y la calidad de la información financiera sobre el desempeño económico de las empresas. Los resultados obtenidos evidencian que una gestión eficiente de los recursos humanos incide de forma significativa en la mejora del rendimiento financiero, a través del uso eficiente de los recursos, el incremento de la productividad y el fortalecimiento de la confianza de los inversores. Por el contrario, las elevadas emisiones de dióxido de carbono (CO_2) y la recurrencia de escándalos vinculados a criterios ESG ejercen un efecto negativo sobre la rentabilidad financiera, lo que sugiere que las empresas altamente contaminantes enfrentan consecuencias económicas adversas. Asimismo, se constata que la calidad de la información contable influye positivamente en el desempeño financiero corporativo. En conjunto, estos hallazgos confirman que factores internos tales como la gestión del capital humano, la adopción de buenas prácticas en sostenibilidad y la elaboración de informes financieros de alta calidad constituyen determinantes fundamentales del valor empresarial y del éxito financiero en el sector energético. Además, observamos que el nivel de desarrollo del país donde se ubica la empresa energética desempeña un papel moderador en estas relaciones.

El Capítulo II analiza el impacto de la Responsabilidad Social Corporativa (CSP, por sus siglas en inglés), medido a través del índice Ambiental, Social y de Gobernanza (ESG, por sus siglas en inglés) y sus distintos pilares y dimensiones, sobre la eficiencia ajustada ambientalmente (EAE) en el sector energético. La investigación identifica un patrón no lineal en forma de U, lo que implica que las empresas con niveles intermedios de inversión en CSP podrían experimentar ineficiencias iniciales antes de alcanzar beneficios ambientales sostenidos. Los resultados respaldan la hipótesis de que únicamente a partir de un determinado umbral de prácticas CSP se genera un impacto positivo sobre la EAE, lo cual evidencia una relación en forma de U entre la puntuación ESG global —así como entre los pilares social y de gobernanza y las dimensiones subspecíficas de derechos humanos y gestión— y la eficiencia ambiental. Otras dimensiones ESG muestran una relación lineal positiva con la EAE: el pilar ambiental, la innovación en el área ambiental y la puntuación relacionada con los accionistas.

En el Capítulo III, el estudio examina la relación entre las iniciativas de diversidad e inclusión (D&I) en el lugar de trabajo y sus efectos tanto sobre el desempeño financiero como sobre los resultados ambientales. Los hallazgos revelan una asociación positiva significativa entre el indicador agregado —que abarca diversidad, inclusión, desarrollo de personas y ausencia de controversias laborales— y la ecoeficiencia (ECO). Las prácticas que promueven la diversidad en la fuerza laboral, la implementación efectiva de políticas de diversidad cultural y de género, y las inversiones en formación y desarrollo de los empleados contribuyen a mejorar la ECO. Sin embargo, no se observó una relación significativa entre las políticas específicas de inclusión o las controversias laborales y la ECO. Los resultados confirman una conexión entre las prácticas de capital humano y el desempeño ambiental. Con respecto al desempeño financiero, solo las oportunidades de formación y desarrollo de los empleados mostraron un impacto positivo y significativo. Si bien las políticas de inclusión influyeron positivamente en el desempeño ambiental, no tuvieron un efecto significativo en los resultados financieros.

Finalmente, el Capítulo IV examina la relación entre los compromisos corporativos con los Objetivos de Desarrollo Sostenible (ODS) sociales y el desempeño social real. Los hallazgos indican que, en general, las empresas tienden a alinear sus compromisos públicos con prácticas concretas en materia social y de diversidad e inclusión (D&I), aunque se observan algunas discrepancias. En particular, los compromisos con el ODS 5: Igualdad de Género y el ODS 8: Trabajo Decente y Crecimiento Económico están positivamente asociados con una mejora en el desempeño en estas áreas. Sin embargo, la evidencia también revela signos de cumplimiento simbólico respecto al ODS 10: Reducción de las Desigualdades, especialmente en lo que respecta a la promoción de la inclusión en el lugar de trabajo, lo que genera preocupación sobre posibles casos de “lavado social”. Además, el análisis muestra que las empresas con sede en países desarrollados o con una mayor orientación ambiental exhiben una alineación más sólida entre los compromisos con los ODS y el desempeño social real. Estos resultados destacan la importancia del contexto institucional en la efectividad de las iniciativas corporativas de sostenibilidad.

En conclusión, esta tesis resalta el papel central de la inversión en capital humano, las prácticas sostenibles, una buena gobernanza corporativa y la implementación real de los compromisos con los Objetivos de Desarrollo Sostenible (ODS) para impulsar un desempeño sostenible en el sector energético. Los hallazgos ofrecen un sólido respaldo empírico a la Teoría de los Recursos y Capacidades, la Teoría de los Stakeholders y la Teoría Institucional, subrayando que lograr competitividad a largo plazo y sostenibilidad corporativa depende de la alineación estratégica del desarrollo del personal, la responsabilidad ambiental y la transparencia financiera.

Esta tesis doctoral ofrece valiosas implicaciones para académicos, responsables políticos, dirigentes empresariales e inversores. Mediante un enfoque empírico y multidimensional, demuestra cómo las estrategias de sostenibilidad impactan el desempeño corporativo en el sector energético. El estudio enfatiza la importancia de alinear los objetivos financieros con los principios ambientales, sociales y de gobernanza (ESG) para construir organizaciones resilientes y socialmente responsables. Para los dirigentes corporativos, resalta la relevancia estratégica de invertir en el desarrollo del capital humano, fomentar la diversidad e inclusión y garantizar una información transparente en sostenibilidad. Se recomienda priorizar la formación

profesional, salarios justos y un entorno laboral inclusivo. Para los responsables políticos, la tesis aboga por marcos regulatorios que respalden la integración de los criterios ESG y los Objetivos de Desarrollo Sostenible (ODS) sin restringir el crecimiento empresarial. Finalmente, se alienta a los inversores a considerar tanto los indicadores financieros como los no financieros, especialmente en sectores de alto impacto como el energético, donde el desempeño ESG es un motor clave para la creación de valor a largo plazo.

Palabras clave: ESG, Desempeño Financiero, Desempeño Ambiental, Desempeño Social, Gobernanza Corporativa, Información No Financiera, Responsabilidad Social Corporativa, Ecoeficiencia, Diversidad e Inclusión, Objetivos de Desarrollo Sostenible, Sector Energético.

EXTENDED SUMMARY
(GALICIAN)

O sector enerxético, como un dos maiores contribuíntes ás emisións globais de carbono, está a experimentar unha profunda transición cara a modelos de negocio máis sostibles, impulsada pola crecente presión dos investidores, a evolución dos marcos regulatorios e os compromisos internacionais sobre o clima. A pandemia da COVID-19 revelou aínda máis as vulnerabilidades estruturais do sector, subliñando a urxencia de adoptar estratexias corporativas resilientes e socialmente responsables. A pesar do crecente interese académico pola sustentabilidade, gran parte da investigación existente está concentrada nas economías desenvolvidas, o que xera unha importante lagoa na nosa comprensión sobre como as prácticas de sustentabilidade afectan ás empresas enerxéticas nos mercados emerxentes. Este estudo busca cubrir esa lagoa examinando como as empresas enerxéticas dunha mostra global poden equilibrar eficazmente a rendibilidade coas responsabilidades ambientais e sociais.

O Capítulo 1 ten como obxectivo examinar o impacto do capital humano, así como dos factores ambientais e informativos, sobre o desempeño financeiro no sector enerxético. Unha parte significativa da investigación no ámbito da Reponsabilidade Social Corporativa (CSP, polo seu acrónimo en inglés) e os criterios Ambientais, Sociais e de Gobernanza (ESG, polo seu acrónimo en inglés) atopou unha relación positiva entre o desempeño ambiental e o desempeño financeiro. Porén, estas conclusións non son uniformes en todos os sectores nin mercados (MSCI, 2024a).

Este capítulo adopta un marco teórico múltiple baseado na Teoría Baseada en Recursos (RBT), na Teoría dos Stakeholders e na Teoría Institucional para examinar como as empresas enerxéticas poden optimizar a asignación de recursos ao tempo que manteñen relacións sólidas cos seus stakeholders. Ao sintetizar estas teorías, o estudo ofrece unha explicación máis universal de como as empresas poden utilizar mellor os recursos sen sacrificar a súa responsabilidade ante os stakeholders.

Esta análise utiliza información de 169 empresas enerxéticas cotizadas que operan en 50 países no período 2016-2022. Os indicadores de desempeño ESG e os datos financeiros foron proporcionados pola base de datos Data & Analytics do London Stock Exchange Group (LSEG), anteriormente coñecida como Refinitiv de Thomson Reuters.

Este estudo contribúe á literatura abordando lagoas clave na medición do impacto do capital humano, do capital ambiental e da calidade da información sobre o desempeño financeiro do sector enerxético, que posúe unha pegada ambiental e social significativa. En primeiro lugar, este estudo integra capital humano, capital ambiental e calidade da información nun modelo único para analizar o seu impacto combinado sobre o desempeño financeiro no sector enerxético. Mentres que estudos anteriores exploraron estes conceptos de forma separada, este traballo presenta un enfoque holístico que

inclúe os seus efectos sinérxicos e tamén conflitivos. En segundo lugar, partindo dunha ampla mostra multinacional, este estudo ofrece resultados sólidos e xeneralizables en diferentes contextos institucionais e culturais. A diferenza doutros estudos centrados en análises de país único ou mercados desenvolvidos, este estudo achega unha perspectiva máis ampla sobre os factores impulsores do desempeño financeiro no sector enerxético global. Para profundar na análise, os países clasifícanse en desenvolvidos e emerxentes.

Co obxectivo de illar a relación entre as variables independentes e dependentes, inclúense na análise varias variables de control. Seguindo investigacións previas, incorporamos controis a nivel de empresa como o apalancamento, o gasto de capital, o tamaño da empresa e a propiedade familiar. Ademais, considéranse factores macroeconómicos—como a taxa de crecemento do PIB, a inflación, o Índice de Desenvolvemento Humano e o sistema legal.

Desde un punto de vista metodolóxico, este estudo emprega estimacións por Mínimos Cadrados Ordinarios (OLS) con efectos fixos de ano e industria para analizar os determinantes da marxe bruta de beneficio. Este enfoque ten en conta a heteroxeneidade non observada, así como as influencias do tempo e da industria, mentres que os erros estándar robustos mitigan posibles problemas de heterocedasticidade. Realizáronse análises adicionais empregando medidas alternativas para as principais variables para reforzar a robustez dos achados. Ademais, utilizouse un modelo de mínimos cadrados xeneralizados con efectos aleatorios (RE GLS) para analizar o impacto das características específicas das empresas sobre a variable dependente dentro dun panel de datos.

Os nosos resultados indican que o capital humano é un factor clave no desempeño financeiro dunha empresa: a xestión eficiente do capital humano e o investimento estratéxico no desenvolvemento profesional dos empregados están asociados positivamente cun mellor desempeño financeiro. Con todo, as diferenzas salariais extremas, particularmente entre os empregados medios e os directores executivos (CEOs), desmotivan ao persoal e debilitan a cohesión organizativa, perxudicando o desempeño financeiro. Unhas maiores emisións de CO_2 están asociadas con menores resutados financeiros, poñendo de manifesto os custos ocultos e os riscos económicos de descoidar as responsabilidades ambientais. As empresas que non xestionan eficazmente a súa pegada de carbono enfróntanse a un aumento dos riscos operativos, posibles multas, regulacións máis estritas e unha redución do apoio por parte de investidores e consumidores. Ademais, as controversias negativas relacionadas cos criterios ESG contribúen aínda máis ás perdas financeiras e reputacionais, subliñando a necesidade crítica de mecanismos de gobernanza robustos. A calidade da información contable emerxe como un factor clave no desempeño corporativo. Unhas divulgacións financeiras de alta calidade melloran a transparencia e a fiabilidade, fortalecendo a confianza de investidores e stakeholders, proporcionando unha vantaxe competitiva.

En conxunto, estes resultados validan firmemente o modelo teórico combinado e suxiren que unha estratexia xeral—combinando xestión estratéxica do capital humano, liderado ambiental proactivo e transparencia financeira rigorosa—é necesaria para lograr un crecemento sostible e competitividade a longo prazo no sector enerxético. As empresas que logran un equilibrio entre rendibilidade e obxectivos de sustentabilidade

están mellor posicionadas para xestionar as presións regulatorias, satisfacer as expectativas dos stakeholders e obter vantaxes competitivas.

Aínda que o sector enerxético é cada vez máis global, persisten as diferenzas institucionais entre países desenvolvidos e en desenvolvemento. A pesar da globalización financeira, os factores do país de orixe seguen condicionando o impacto da Reponsabilidade Social Corporativa sobre o desempeño financeiro.

Os achados desta investigación teñen varias implicacións relevantes para responsables políticos, investidores, directivos e outros stakeholders do sector enerxético. Os directivos deberían priorizar os investimentos no desenvolvemento do persoal, adoptar prácticas sostibles e garantir unha información financeira e non financeira de alta calidade para acadar rendibilidade a longo prazo. Os responsables políticos, investidores e outros interesados tamén deberían recoñecer o valor destas prácticas para promover un crecemento sostible e a resiliencia nunha industria cada vez máis complexa e sometida a escrutinio.

O Capítulo 2 analiza o impacto da Responsabilidade Social Corporativa (CSP, en inglés) – representado polo índice Ambiental, Social e de Gobernanza (ESG, en inglés) e os seus distintos piares e dimensións – sobre a eficiencia axustada ambientalmente (EAE) desde unha perspectiva non lineal, no sector enerxético global.

Aínda que a relación entre o CSP e o desempeño das empresas foi o foco de numerosos estudos desde o artigo seminal de Bragdon & Marlin (1972), esta conexión non foi examinada especificamente no sector enerxético ata a última década (por exemplo, Sepúlveda & Mendizabal, 2011; Ekatah et al., 2011; Pätäri et al., 2014; Bracco, 2015; Shahbaz et al., 2020). Os resultados destes estudos varían e asumen unha relación lineal entre o CSP e o desempeño das empresas, aínda que a relación entre ambas variables pode ser positiva ou negativa dependendo do nivel de actividade en CSP levado a cabo. Ademais, os estudos existentes adoitan basearse en indicadores unidimensionais, pasando por alto aspectos clave como as emisións ou o uso de recursos. Artigos recentes como os de Lu et al. (2023) e Ren et al. (2023) empregan unha medida global de desempeño financeiro e ambiental; porén, ningún destes estudos explorou especificamente esta relación dentro do sector enerxético. Ademais, non todas as prácticas de CSP teñen o mesmo impacto sobre o desempeño empresarial, e os efectos individuais de cada un dos tres piares das actividades de CSP e as súas distintas dimensións non foron estudados en profundidade.

Baseándonos nas teorías dos stakeholders e na teoría baseada en recursos, analizamos o efecto do CSP sobre a eficiencia axustada ambientalmente (EAE). Aínda que levar a cabo actividades de CSP para reducir o impacto ambiental das operacións dunha empresa pode supoñer inicialmente custos significativos —como importantes investimentos iniciais en activos fixos tanxibles e na formación de recursos humanos para reducir as emisións de CO_2—, estes esforzos poden aumentar a satisfacción dos stakeholders. Aínda que os inconvenientes a curto prazo poden superar os beneficios iniciais, co paso do tempo estas iniciativas poden mellorar a reputación da empresa entre os stakeholders, xerando así activos intanxibles valiosos. A continuación, e baseándonos na investigación previa e no exame dun sector caracterizado por actividades perigosas e múltiples iniciativas de CSP, onde os custos iniciais son

superados polos beneficios que supón a xeración de vantaxes competitivas —o que é coherente tanto coa teoría dos stakeholders como coa teoría baseada en recursos—, estudamos se a relación entre o CSP e a EAE é non lineal con forma de U.

A nosa base de datos de panel non balanceada está composta por 239 empresas enerxéticas cotizadas publicamente de 46 países, cubrindo o período 2016–2021. Os datos financeiros, as puntuacións ESG, os tres piares e as oito dimensións subxacentes, foron extraídos da base de datos Thomson Reuters Refinitiv Eikon e utilízanse como variables representativas do Desempeño Social Corporativo (CSP). As variables macroeconómicas obtivéronse da base de datos World Development Indicators (WDI) xestionada polo Banco Mundial.

Este capítulo realiza varias contribucións á literatura existente. En primeiro lugar, propoñemos a adopción do concepto de eficiencia empresarial axustada ambientalmente (EAE) mediante a aplicación da análise envolvente de datos (DEA). A EAE funciona como un indicador global xa que, ao tempo que considera diversos aspectos económicos, recoñece a importancia de mellorar a eficiencia ambiental, en termos de redución das emisións de CO_2 e do consumo de enerxía, contribuíndo así á sustentabilidade no sector enerxético. Este enfoque contrasta cos estudos previos sobre o sector enerxético que empregan indicadores financeiros unidimensionais, contables e/ou medidas de mercado como substitutos do desempeño empresarial. En segundo lugar, a falta de consenso na literatura existente suxire que a relación entre CSP e desempeño empresarial pode depender do tipo e da intensidade das actividades, así como da sensibilidade da industria ás preocupacións ambientais (Kludacz-Alessandri & Cyganska, 2021). Dado que o estudo recente de Kumar et al. (2022) é o único que analiza o efecto curvilíneo do CSP sobre o desempeño das empresas no sector enerxético, o noso estudo realiza unha contribución significativa a este campo de investigación. En terceiro lugar, esta investigación é pioneira na súa análise do impacto de varias actividades de CSP (a puntuación ESG global, así como os tres piares individuais – ambiental, social e de gobernanza – e as súas dimensións, por exemplo, a innovación ambiental ou os dereitos humanos) sobre a EAE no contexto desta industria. ESG é un termo agregado que abrangue unha ampla gama de cuestións temáticas; as empresas poden esforzarse por reducir as emisións de CO_2 e o consumo de enerxía, pero fracasar noutros aspectos ambientais, sociais e de gobernanza.

Para evitar problemas de especificación no modelo, incorporamos certas variables de control xa identificadas na literatura, que poden dividirse en dous grupos: o primeiro inclúe aquelas relacionadas con características específicas das empresas; o segundo, variables macroeconómicas. Entre as variables específicas das empresas incluímos o tamaño, o ROA, o gasto en I+D, a participación estratéxica, o índice de solvencia e o índice de cobertura de xuros. Ademais, a nivel macroeconómico, na análise de robustez incluímos dúas variables que estudos anteriores demostraron que inflúen na eficiencia: o prezo do petróleo e o crecemento do PIB.

Desde un punto de vista metodolóxico, emprégase un enfoque en dúas etapas. En primeiro lugar, utilízase a Análise Envolvente de Datos (DEA) para estimar as puntuacións de EAE corrixidas por sesgo a nivel de empresa. Na segunda etapa, aplícanse modelos de regresión truncada para examinar a relación entre as puntuacións ESG e a EAE. As comprobacións de robustez realízanse mediante modelos Tobit con

efectos aleatorios (xa que a EAE está limitada entre 0 e 1) e engadimos variables macroeconómicas ao noso modelo principal que son comúns na literatura previa: prezo do petróleo e crecemento do PIB.

En conclusión, un alto desempeño das actividades de RSC conduce a unha mellor eficiencia económica e ambiental, pero o estudo en profundidade das distintas actividades permítenos extraer importantes implicacións teóricas. En primeiro lugar, o estudo identifica actividades nas que as empresas deben acadar un nivel mínimo de CSP para ser recompensadas (relación en forma de U coa EAE): as actividades sociais e de gobernanza corporativa. Aínda que as primeiras xeran importantes vantaxes competitivas en termos de reputación e imaxe e conducen a beneficios en termos de EAE, nas segundas os incrementos son lixeiros. En segundo lugar, contribúe á literatura sobre CSP ao aclarar cales son as actividades nas que as empresas deben centrar os seus esforzos, xa que son recompensadas por unha ampla gama de stakeholders, independentemente do seu nivel de desempeño (relación lineal e positiva coa EAE): prácticas relacionadas co medio ambiente, e atopamos evidencia de investimento en innovación ambiental. Ademais, a efectividade da empresa no tratamento equitativo dos accionistas (piar de gobernanza corporativa) ten un efecto positivo sobre a nosa medida de eficiencia. En consecuencia, os resultados obtidos respaldan en gran medida tanto a teoría baseada en recursos como a teoría dos stakeholders, así como o enfoque do "too little of a good thing" (TLGT), o que implica que certas actividades de RSC deben ser deseñadas para priorizar o longo prazo sobre o curto prazo.

En xeral, os resultados da análise de robustez son similares aos do modelo de referencia, e as estimacións da maioría dos coeficientes son estables en ambos modelos. Confírmase a relación en forma de U entre a puntuación ESG global, o piar social e o de gobernanza corporativa, as dimensións de dereitos humanos e xestión, e a EAE. Ademais, confírmase unha relación lineal positiva coa EAE para o piar ambiental, a innovación ambiental e a puntuación dos accionistas. Polo tanto, no seu conxunto, os resultados coinciden cos obtidos na regresión truncada.

Con respecto ás variables macroeconómicas, tanto o prezo do petróleo como o crecemento do PIB están relacionados positiva e significativamente coa eficiencia ambiental, en consonancia cos achados doutros autores como Sueyoshi & Wang (2018) e Sánchez-Robles et al. (2022), que apuntan a un comportamento procíclico no que respecta á eficiencia.

O noso artigo ten importantes implicacións para as empresas, responsables políticos e investigadores, na medida en que estima a EAE e indica en que prácticas de CSP se debe investir a longo prazo para ter un efecto positivo sobre ela.

O Capítulo 3 explora o impacto das políticas de diversidade, inclusión e desenvolvemento de persoas, así como das controversias laborais, tanto sobre o desempeño financeiro como sobre os resultados ambientais dentro do sector enerxético global.

A literatura existente adoita vincular a adopción de políticas de Diversidade e Inclusión (D&I) cos principios de xustiza social e motivacións éticas ou morais (Dahanayake et al., 2018). Porén, a maior parte das investigacións centráronse nas súas

implicacións financeiras, obtendo resultados mixtos. Aínda así, varios estudos subliñan os posibles beneficios das prácticas de recursos humanos centradas na diversidade e inclusión (Rohwerder, 2017; Özbilgin e Tatli, 2011).

O marco teórico baséase na Teoría dos Stakeholders e na Teoría Baseada en Recursos (RBT). A Teoría dos Stakeholders sostén que as empresas implementan programas de D&I para mellorar a lexitimidade corporativa e satisfacer as expectativas dos stakeholders, mellorando así a súa reputación e o seu desempeño financeiro (Kim et al., 2018; Li et al., 2019). Pola súa banda, a RBT argumenta que as prácticas de RRHH socialmente responsables crean vantaxes competitivas ao desenvolver capacidades únicas e difíciles de imitar (Sgrò, 2021).

A análise empírica baséase nun conxunto de datos de empresas enerxéticas cotizadas publicamente de 53 países, que operan nos subsectores de carbón, petróleo e gas, renovables e uranio, durante o período 2016–2022. Os datos financeiros, ambientais, de gobernanza e de D&I foron obtidos da base de datos Data & Analytics do London Stock Exchange Group (LSEG).

Este estudo realiza varias contribucións clave á literatura. En primeiro lugar, introduce un indicador de ecoeficiencia (ECO) como variable dependente—unha medida agregada que combina o desempeño económico, financeiro, operativo e ambiental. Este enfoque multidimensional aborda as limitacións dos estudos previos que se basean en indicadores unidimensionais. En segundo lugar, utilízanse cinco variables explicativas: catro piares principais—diversidade, inclusión, desenvolvemento de persoas e controversias laborais—e unha quinta variable (D&I Global) que capta a estratexia global de diversidade e inclusión da empresa.

Para evitar problemas de especificación do modelo, a análise inclúe un conxunto de variables de control agrupadas en dúas categorías: variables relacionadas coa gobernanza corporativa (por exemplo, tamaño do consello, independencia do consello, dualidade CEO, compensación executiva vinculada a ESG, estratexia e comités de RSC, sistemas de xestión da calidade) e variables específicas da empresa (por exemplo, rendibilidade, gasto de capital, risco de mercado, apalancamento, tamaño e antigüidade da empresa). Ademais, constrúese un índice ambiental de ODS para medir o compromiso da empresa cos Obxectivos de Desenvolvemento Sostible ambientais.

Desde o punto de vista metodolóxico, emprégase un enfoque en dúas etapas. En primeiro lugar, aplícase a Análise Envolvente de Datos (DEA) para estimar as puntuacións de ECO corrixidas por sesgo a nivel de empresa. Na segunda etapa, aplícanse modelos de regresión truncada para examinar a relación entre as prácticas de D&I e a ecoeficiencia. As comprobacións de robustez realízanse mediante modelos Tobit con efectos aleatorios (dado que a ECO está acoutada entre 0 e 1), regresións de Mínimos Cadrados Ordinarios (OLS) con retardos dun ano e estimacións en dúas etapas de mínimos cadrados (2SLS), empregando variables retardadas como instrumentos, en consonancia con investigacións anteriores (por exemplo, Amorelli e García-Sánchez, 2023; Khatri, 2023).

Os resultados revelan unha relación positiva e significativa entre o índice global de D&I —que recolle diversidade, inclusión, desenvolvemento de persoas e ausencia de

controversias laborais— e a ecoeficiencia. Isto suxire que as prácticas de D&I poden mellorar a satisfacción laboral, reducir o absentismo, fomentar a retención de talento e diminuír os riscos de litixios, mellorando así tanto os resultados financeiros como ambientais (Suciu et al., 2020). As políticas que promoven a diversidade cultural e de xénero e a súa implementación efectiva están fortemente asociadas con puntuacións máis altas de ECO. Os investimentos na formación e desenvolvemento dos empregados tamén amosan unha relación positiva e significativa coa ECO. Porén, as políticas específicas de inclusión e as controversias laborais non amosan efectos estatisticamente significativos sobre a ECO, en consonancia con investigacións previas (Suciu et al., 2020; Rodríguez-Fernández et al., 2018; Nirino et al., 2021).

Unha análise complementaria desagrega o desempeño en dúas dimensións: ambiental (usando como proxy a Puntuación Ambiental) e financeira (medida mediante o retorno sobre activos, ROA). Os resultados confirman unha conexión entre as prácticas de capital humano e o desempeño ambiental. Non obstante, só a formación e o desenvolvemento dos empregados amosan unha asociación positiva e significativa co desempeño financeiro (Syed et al., 2020). As políticas de inclusión teñen un efecto positivo sobre o desempeño ambiental, pero non impactan nos resultados financeiros (Habib e Khalid, 2019; Suciu et al., 2020). De forma sorprendente, as controversias laborais non están significativamente asociadas con ningunha das dúas dimensións do desempeño.

As comprobacións de robustez, incluíndo un enfoque de estimación alternativo que exclúe as empresas estadounidenses, confirman a estabilidade e coherencia dos principais achados.

Desde unha perspectiva teórica, esta investigación integra a Teoría dos Stakeholders e a Teoría Baseada en Recursos para explicar o valor estratéxico da xestión do capital humano no sector enerxético. As empresas que priorizan a diversidade, a equidade e a inclusión melloran a súa reputación e xeran valor a longo prazo para os stakeholders, ao tempo que constrúen vantaxes competitivas inimitables baseadas en recursos humanos intanxibles.

Este estudo ofrece implicacións prácticas para diversos grupos de interese. Proporciona unha ferramenta integral para avaliar o desempeño corporativo ao incorporar métricas tanto financeiras como ambientais. Para os investidores, os resultados subliñan a importancia estratéxica das dimensións sociais como a diversidade e o desenvolvemento do persoal. Para os directivos empresariais, os achados defenden situar as políticas de D&I no núcleo das estratexias de recursos humanos para optimizar os resultados en termos de ecoeficiencia. Finalmente, para os responsables políticos, o estudo destaca a necesidade de deseñar e promover marcos regulatorios que fomenten prácticas de xestión de recursos humanos inclusivas e orientadas ao desenvolvemento no sector enerxético, promovendo unha industria máis sostible tanto económica como ambientalmente.

O Capítulo 4 investiga a relación entre o compromiso corporativo cos Obxectivos de Desenvolvemento Sostible (ODS) sociais e o desempeño social real dentro do sector enerxético. A Axenda 2030 para o Desenvolvemento Sostible, establecida no ano 2015, identifica 17 ODS, dos cales varios teñen un impacto directo sobre a sustentabilidade

empresarial —especialmente aqueles centrados nos dereitos humanos, a diversidade de xénero e cultural, os ambientes de traballo inclusivos e o desenvolvemento dos empregados.

Aínda que as empresas enerxéticas desempeñan un papel crucial na economía global, o seu compromiso cos ODS sociais —especialmente no relativo á diversidade, inclusión e desenvolvemento profesional— segue sendo escasamente estudado. A literatura sobre SDG-washing ofrece achados mixtos, frecuentemente debido a diferenzas metodolóxicas e de mostraxe. Mentres algúns estudos suxiren que os compromisos sociais corporativos son maiormente simbólicos (por exemplo, Ferrón Vilchez et al., 2022; Del Río et al., 2023; Van der Waal & Thijssens, 2020; Lodhia et al., 2023), outros sinalan cambios prácticos tanxibles (Beretta et al., 2024; Bellostas et al., 2023; Perevoznic & Dragomir, 2024). Cómpre destacar que as empresas enerxéticas, dada a súa alta visibilidade pública, poden ter menos incentivos para realizar accións meramente simbólicas debido aos riscos reputacionais.

O marco teórico deste capítulo baséase na Teoría da Lexitimidade e na Teoría Institucional. A Teoría da Lexitimidade sostén que as empresas adoptan actividades relacionadas cos ODS para mellorar a súa reputación, o que pode implicar accións simbólicas ou substantivas. Con base nesta teoría, exploramos se os compromisos cos ODS das empresas enerxéticas son substanciais ou meramente simbólicos. A Teoría Institucional, pola súa banda, suxire que os comportamentos corporativos en materia de sustentabilidade están dirixidos por presións institucionais externas —normativas, miméticas e coercitivas— que levan ás empresas a adoptar compromisos cos ODS como resposta a forzas externas máis que por motivacións internas. Esta teoría motiva a investigación sobre se factores institucionais como o nivel de desenvolvemento económico e a conciencia ambiental do país de orixe dunha empresa inflúen na relación entre o compromiso cos ODS e o desempeño social.

A análise baséase en datos de empresas enerxéticas cotizadas publicamente que operan entre 2016 e 2022, representando 51 países e diversos subsectores (por exemplo, carbón, petróleo e gas, renovables e uranio). Os indicadores clave de desempeño —incluíndo puntuacións financeiras, ambientais, de gobernanza e de diversidade e inclusión (D&I) — foron obtidos da base de datos Data & Analytics do London Stock Exchange Group (LSEG).

As variables dependentes inclúen o Desempeño Social, medido mediante o uso cuantificado de métricas ESG para avaliar o benestar da forza laboral, o impacto na comunidade, as prácticas en dereitos humanos e a responsabilidade sobre os produtos. As Puntuacións de Diversidade e Inclusión mídense avaliando as iniciativas de diversidade, inclusión e desenvolvemento de empregados. As métricas específicas de desempeño social inclúen: o Desempeño en Diversidade (avaliando a diversidade de xénero e cultural nos cargos de liderado), o Desempeño en Inclusión (avaliando políticas laborais inclusivas como o traballo flexible e programas de igualdade de emprego) e o Desenvolvemento de Persoas (indicando o investimento en formación, planificación de carreira e reciclaxe profesional).

As variables independentes inclúen un índice composto de compromiso corporativo cos ODS sociais, e o indicador D&I SDG representa o foco dos

compromisos da empresa cos ODS 5 (Igualdade de Xénero), ODS 8 (Traballo Decente e Crecemento Económico) e ODS 10 (Redución das Desigualdades), os cales teñen implicacións directas sobre as prácticas de diversidade e inclusión. As variables moderadoras inclúen o nivel de desenvolvemento económico do país de orixe da empresa e o Índice de Desempeño Ambiental, unha medida da gobernanza ambiental nacional proporcionada polo Yale Center for Environmental Law & Policy.

Para garantir a robustez do modelo, contrólanse factores como a gobernanza corporativa (por exemplo, tratamento dos accionistas, estratexia de RSC e cobertura de analistas), os atributos da empresa (rendibilidade, antigüidade, apalancamento, gasto de capital e tamaño), así como variables macroeconómicas (nivel de débeda pública como proxy das restricións financeiras).

Desde o punto de vista metodolóxico, aplicamos un modelo de regresión truncada con efectos fixos de ano para examinar a relación entre os compromisos cos ODS e o desempeño social, con especial atención a como os factores institucionais moderan esta relación. Para abordar posibles problemas de endoxeneidade, introducimos variables a nivel de empresa retardadas un ano como regresores. Ademais, utilizamos unha regresión en dúas etapas de mínimos cadrados (2SLS), empregando valores retardados dos ODS e das variables de gobernanza corporativa como instrumentos. Dado o carácter en panel dos datos e a natureza acoutada das puntuacións ESG, utilízase un modelo Tobit con efectos aleatorios para ter en conta a censura dos datos (Sánchez-Robles et al., 2022; García-Sánchez et al., 2024b).

Os resultados empíricos demostran que un forte compromiso cos ODS sociais inflúe positivamente no desempeño social (Arena et al., 2023). As empresas que se implican activamente co ODS 5 e o ODS 8 amosan melloras significativas no desempeño en diversidade e inclusión (García-Meca & Martínez-Ferrero, 2021). En cambio, o ODS 10 (Redución das Desigualdades) non mostra unha conexión significativa coa inclusión no lugar de traballo, o que é coherente cos achados de Garlin (2022). Ademais, o estudo destaca o papel moderador dos factores institucionais. As empresas con sede en países desenvolvidos amosan unha ligazón máis forte entre os compromisos cos ODS e o desempeño social, mentres que aquelas situadas en países ambientalmente avanzados aliñan mellor as súas prácticas cos principios dos ODS (Tetteh et al., 2024).

Finalmente, as probas de robustez confirman que a relación entre o compromiso cos ODS e o desempeño social/D&I segue a ser significativa mesmo ao abordar as preocupacións sobre endoxeneidade.

Desde un punto de vista teórico, os nosos achados contribúen á integración da Teoría da Lexitimidade e da Teoría Institucional. Destácase que, aínda que algunhas empresas enerxéticas poden empregar os compromisos cos ODS como ferramenta de lexitimación, moitas demostran unha implicación real cos ODS sociais, especialmente nos ámbitos da diversidade e da inclusión. Os factores institucionais, como o desempeño ambiental e o nivel de desenvolvemento económico do país de orixe, inflúen significativamente na forma en que estes compromisos se traducen en prácticas reais.

Estes achados ofrecen valiosas orientacións para directivos empresariais, investidores e responsables políticos. A transparencia na comunicación do progreso relativo aos ODS sociais mellora a credibilidade ante os stakeholders e promove a mellora continua. Os responsables políticos deben fomentar marcos regulatorios que promovan a integración auténtica dos ODS nas prácticas empresariais, incluíndo incentivos financeiros e recoñecemento público para aquelas empresas que destaquen en iniciativas socialmente responsables. Unha regulación máis estrita da información sobre sustentabilidade tamén promoverá unha maior rendición de contas e transparencia, asegurando que as accións relacionadas cos ODS deriven en resultados tanxibles no ámbito da sustentabilidade corporativa.

Palabras clave: ASG, Desempeño Financeiro, Desempeño Ambiental, Desempeño Social, Gobernanza Corporativa, Información Non Financeira, Responsabilidade Social Corporativa, Ecoeficiencia, Diversidade e Inclusión, Obxectivos de Desenvolvemento Sustentable, Sector Enerxético.

Introduction

INTRODUCTION

A. BACKGROUND AND JUSTIFICATION

The increasing awareness of the environmental and social impacts of human activities, particularly since the late 20th century, has profoundly influenced the role of businesses in society. One of the conceptual frameworks that emerged from this shift is the Triple Bottom Line (TBL), which promotes a holistic view of business performance by integrating environmental stewardship, social responsibility, and economic viability (Tomislav, 2018). This approach laid the foundation for a broader transformation in global governance, marked by milestones such as the Millennium Declaration in 2000—endorsed by 189 United Nations member states—and the adoption of the 2030 Agenda for Sustainable Development in 2015.

In recent years, the European regulatory framework for corporate sustainability has been substantially reinforced. The Corporate Sustainability Reporting Directive (CSRD) , adopted in December 2022 and effective for large firms from the 2024 financial year, replaces the Non-Financial Reporting Directive (NFRD). It broadens the scope of mandatory ESG disclosure to a wider set of companies, introduces standardized reporting through the European Sustainability Reporting Standards (ESRS), and requires third-party assurance of sustainability information (European Commission, 2022; Bini & Tsalavoutas, 2023). In the United States, the regulatory framework for sustainability disclosure remains significant but less comprehensive than in Europe, characterized by comparatively lighter requirements for companies (Christensen, Hail, & Leuz, 2021). The Securities and Exchange Commission (SEC) has introduced rules mandating climate-related disclosures for publicly listed firms, reflecting growing investor demand for transparency on environmental risks (SEC, 2022).

However, recent policy shifts, particularly under the Trump administration, have reversed or weakened several of these regulatory measures (Cummings & McLennan, 2023 Krueger et.al., 2024). These regulatory rollbacks have also reverberated in Europe, where concerns over global asymmetries and administrative burdens prompted delays in the implementation of CSRD-related obligations. Specifically, the European Commission introduced the 2025 “Omnibus” legislative packages, aimed at revising key EU ESG rules to ease bureaucratic and administrative pressures on companies while maintaining the Union’s sustainability commitments (Bini & Tsalavoutas, 2023; European Commission, 2025).

Despite these challenges, ESG considerations remain deeply embedded in corporate strategy and continue to shape investor expectations, market valuations, and firms’ competitive positioning (Kotsantonis & Pinney, 2020). The global response to climate change and sustainable development has given rise to ambitious international

frameworks, notably the Sustainable Development Goals (SDGs), which call for the integration of Environmental, Social, and Governance (ESG) principles into corporate operations. Companies are now expected to reduce their environmental footprint, improve governance practices, and promote inclusive and equitable work environments. In this context, sustainability has evolved from a peripheral topic to a central pillar of corporate strategy. It is no longer a trend or branding exercise—environmental and social values have become embedded in the core identity of leading organizations.

Over the past decade, companies have been increasingly pressured by stakeholders, including investors, regulators, consumers, and employees to incorporate sustainability into their business models. This shift is particularly significant in the energy sector, which plays a dual role: it is both a driver of global economic growth and a major contributor to greenhouse gas emissions. As such, the energy industry is central to climate change mitigation and to the broader sustainable development agenda.

Within this landscape, the energy sector occupies a strategic position due to its role in the production and consumption of resources that directly affect climate, infrastructure, and economic performance. The activities of energy companies intersect with multiple SDGs, including Affordable and Clean Energy (SDG 7), Climate Action (SDG 13), Industry, Innovation and Infrastructure (SDG 9), and Decent Work and Economic Growth (SDG 8) (Wynn & Jones, 2022). However, given its high environmental impact, the sector faces growing public scrutiny, and firms are increasingly expected to go beyond environmental and financial metrics.

In this context, business sustainability in the energy sector depends more than ever on its contribution to social goals, including respect for human rights, gender and cultural diversity, inclusive workplaces, and employee development (Saha et al., 2024). These dimensions have become especially relevant as ESG criteria continue to shape market expectations and regulatory frameworks. Yet, despite a growing body of research on environmental performance and reporting, the social dimension of sustainability—particularly in relation to equity, inclusion, and human capital—remains underexplored.

At the same time, recent years have seen a backlash against ESG and sustainability, fueled by political polarization and ideological resistance. In some cases, companies have started to downplay or underreport their sustainability efforts—not because they have ceased, but to avoid reputational or political risks. This phenomenon, known as “greenhushing”, has emerged as a new paradox in sustainability communication: while ESG strategies are crucial for risk management and long-term value creation, their public narrative has become contested.

Complicating matters further, some firms that previously engaged in symbolic sustainability gestures have become vocal critics of ESG, undermining the progress made by more committed companies (Zervoudi, Moschos, & Christopoulos, 2025). This shift contributes to a misleading narrative that positions sustainability as a temporary phase, rather than as the irreversible path toward a low-carbon and socially responsible economy. Nonetheless, empirical evidence shows that companies embracing innovation in environmental and social practices—such as gender diversity, inclusive leadership, employee development, and transparent reporting—are better positioned to meet

stakeholder expectations and perform strongly across both financial and environmental indicators (Al Hosani, Nobanee, & Ellili, 2025). This is particularly true in the energy industry, where reputational risks and institutional pressures are especially pronounced.

This doctoral thesis aims to address this increasingly complex and contested landscape, with a particular focus on an industry experiencing profound regulatory and structural transformation. It provides an evidence-based examination of how ESG strategies, diversity and inclusion (D&I) initiatives, and human capital development influence corporate performance in the energy industry. Using a comprehensive international dataset of listed energy firms, including those in coal, oil & gas, renewables, and uranium—from 2016 to 2022, the study investigates whether these firms can balance profitability with environmental and social obligations. The research integrates financial, environmental, and social indicators to construct a multidimensional perspective on sustainability.

This work aims to fill critical gaps in the literature, especially regarding the role of ESG in emerging markets and the effectiveness of social SDG commitments. The thesis also advances theoretical understanding by combining insights from Resource-Based Theory, Stakeholder Theory, and Institutional Theory to explore synergies—and potential trade-offs—between sustainable and financial outcomes.

Beyond its academic contribution, the study offers practical implications for corporate executives, investors, and policymakers, advocating for sustainability practices grounded in analytical rigor rather than political expediency. It warns against narratives that undermine environmental progress and reaffirms that sustainability is not a reputational strategy—but a moral and strategic imperative to navigate the complex challenges of the 21st century.

B. MOTIVATION OF THE STUDY

The motivation for this study stems from the increasing integration of corporate sustainability into the core of business strategy and performance measurement, particularly in the energy sector. Over the past decade, energy companies have come under growing pressure to align their operations with environmental, social, and governance (ESG) principles in response to evolving regulatory requirements, rising investor expectations, and intensified public scrutiny. This pressure underscores the widespread recognition that financial success can no longer be pursued in isolation from sustainability objectives.

Given that fossil energy sources are responsible for 80% of CO_2 emissions (International Energy Agency [IEA], 2018), the energy sector plays a leading role in the transition toward a low-carbon economy. Firms face the dual challenge of reducing their environmental footprint while preserving profitability and competitiveness. The failure to incorporate sustainability into strategic planning exposes businesses to regulatory sanctions, reputational risks, and diminished investor trust. ESG performance has therefore become a crucial determinant of access to capital and long-term value creation, reinforcing the need for credible, measurable sustainability practices.

The COVID-19 pandemic further accelerated this paradigm shift. It exposed structural vulnerabilities across global supply chains and energy markets, highlighting the urgent need for more resilient and adaptive business models. In this context, sustainable innovation, digitalization, and ESG integration emerged as key mechanisms for mitigating external shocks and ensuring business continuity (Javed, 2024; Gao, 2024). As a result, sustainability is now central to risk management and strategic positioning, rather than a peripheral or voluntary effort.

In parallel, regulatory bodies and international organizations have imposed stricter transparency requirements on ESG reporting. Energy companies are increasingly expected to provide verifiable, comparable information regarding their social, environmental, and governance performance. This heightened accountability is reshaping the way firms manage sustainability and communicate their commitments to stakeholders.

This doctoral thesis responds to these challenges by offering a multidimensional, evidence-based analysis of how energy companies balance financial performance with environmental and social responsibility. It explores the interdependencies between ESG strategies, human capital efficiency, and diversity and inclusion (D&I) practices to understand how they contribute to both profitability and sustainability. A key objective is to provide a more integrated and holistic view of corporate performance, one that captures financial, environmental, and social dimensions in tandem.

The thesis unfolds as a logical progression that starts in Chapter 1, where the analytical lens is placed on human capital, environmental capital, and disclosure quality to explain financial performance in energy firms. By demonstrating that profitability is inseparable from sound ESG practices and transparent reporting, this chapter supplies the conceptual and empirical groundwork on which the rest of the study builds. It highlights the internal resources and stakeholder pressures that shape firm success—elements that later chapters deepen rather than repeat. Chapter 2 broadens the focus from pure profitability to environmentally adjusted efficiency (EAE), integrating financial returns with environmental outcomes through Data Envelopment Analysis. By testing for the non-linear “too little of a good thing” effect, it reveals the conditions under which corporate social performance boosts or hampers eco-efficiency. These findings directly motivate Chapter 3, which drills into workforce diversity and inclusion as a strategic lever for both environmental and financial gains. Here, human-centric policies are shown to reinforce the efficiency dynamics uncovered in Chapter 2, confirming that inclusive human-capital practices are a tangible extension of the resource and stakeholder considerations mapped in Chapter 1. Chapter 4 completes the narrative arc by evaluating whether public commitments to the social Sustainable Development Goals (SDGs) result in meaningful implementation or amount to mere SDG-washing. It leverages the credibility of disclosures established in Chapter 1, along with the social, diversity, and inclusive workforce metrics developed in Chapters 2 and 3, as benchmarks for assessing authenticity. By examining how institutional context influences these relationships, the chapter synthesizes the preceding evidence into a cohesive explanation: energy firms that genuinely embed social responsibility, diversity, and inclusion within their strategies consistently outperform those that approach sustainability as a symbolic gesture. This analysis reinforces the thesis’s core

argument—that profitability and responsibility are not competing objectives, but complementary forces that drive long-term corporate success.

The research introduces three significant innovations. First, it integrates human capital, environmental capital, and the quality of financial and non-financial disclosures into a unified empirical framework. This addresses a major gap in the literature, where these variables have traditionally been studied in isolation. By using a multinational sample of energy companies operating in diverse institutional environments, the study reveals how these factors interact under varying regulatory and market conditions. Second, the thesis examines how corporate social responsibility (CSR) initiatives—particularly those related to governance and environmental sustainability—affect not only financial outcomes but also environmental efficiency. By applying advanced methodologies such as Data Envelopment Analysis (DEA), the research captures the complex, non-linear effects of CSR practice and introduces the concept of "too little of a good thing" (TLGT) to assess the optimal intensity of these efforts. Third, the study addresses a growing area of interest in corporate governance: the role of inclusive workplace policies. By developing composite indicators of diversity, inclusion, and human development, and analyzing their influence on eco-efficiency, the research sheds light on how inclusive human resource practices can enhance organizational sustainability. It goes beyond board-level diversity to consider firm-wide strategies that affect daily operations and long-term performance. Finally, the thesis investigates whether companies' public commitments to social SDGs—such as gender equality, decent work, and reduced inequalities—are substantiated by concrete actions, or whether they reflect symbolic behavior often referred to as "SDG-washing." It evaluates how institutional factors like the economic development level and environmental awareness of a firm's home country moderate these relationships. This component of the research not only enriches theoretical understanding but also provides practical tools to identify gaps between sustainability rhetoric and real implementation.

In sum, the motivation behind this study lies in its potential to advance both academic inquiry and practical decision-making in a high-impact sector. By analyzing how energy firms can simultaneously pursue profitability and contribute to global sustainability goals, the thesis aims to support the development of resilient, accountable, and future-ready organizations.

C. OBJECTIVES AND HYPOTHESIS

Objectives

This thesis is structured into four chapters, each addressing a specific research objective related to the interplay between financial performance, sustainability, and corporate governance in the energy sector.

Chapter 1.

The main objective of this chapter is to analyze the combined impact of human capital efficiency, environmental capital, and the quality of financial and non-financial

reporting on the financial performance of energy companies, using a multinational sample and a multidimensional approach. The specific objectives are:

1. To contribute to theory-building by applying Resource-Based Theory, Stakeholder Theory, and Institutional Theory to explain the synergies and trade-offs between sustainability and profitability in the energy sector.

2. To evaluate the effect of human capital practices, such as professional training, equitable compensation, and employee development, on profitability in the energy sector.

3. To assess the impact of environmental capital, particularly CO_2 emissions, and ESG controversies, on firms' financial performance.

4. To determine the role of financial and non-financial information quality, especially ESG disclosures, in reducing information asymmetry, enhancing trust, and improving financial outcomes.

5. To develop an integrated framework that simultaneously examines the influence of human capital, environmental performance, and information quality on corporate financial performance.

6. To explore how these relationships differ across institutional contexts, by comparing firms from developed and emerging countries.

Chapter 2.

The main objective of this chapter is to examine the relationship between Corporate Social Performance (CSP) and environmentally adjusted efficiency (EAE) in the energy sector, incorporating both financial and environmental performance measures. To achieve this, the chapter establishes the following specific objectives:

1. To propose an alternative measure of corporate performance by adopting an environmentally adjusted efficiency (EAE) indicator—estimated through Data Envelopment Analysis (DEA)—that integrates financial, operational, and environmental dimensions.

2. To analyze the impact of Corporate Social Responsibility (CSR) practices on EAE, using a broad range of indicators including resource use, human rights, and corporate governance.

3. To assess whether the relationship between CSP and EAE is non-linear, testing the "too little of a good thing" (TLGT) hypothesis and identifying whether there is an optimal level of CSR investment that maximizes environmental efficiency.

4. To explore the disaggregated effects of CSP dimensions—environmental, social, and governance—on EAE, and evaluate which specific CSR activities contribute most to efficiency gains.

Chapter 3.

The third chapter explores the role of workforce diversity and inclusion (D&I) policies in shaping firm performance within the energy sector. To evaluate this effect, the following specific objectives are proposed:

1. To construct an aggregate indicator that integrates economic, financial, operational, and environmental performance, by applying the Data Envelopment Analysis (DEA) technique.

2. To evaluate the impact of workplace diversity and inclusion (D&I) initiatives on the eco-efficiency of companies operating in the global energy sector.

3. To analyze the influence of four specific dimensions of human resource management on eco-efficiency: diversity, inclusion, and people development (as potentially positive factors), and labor controversies (as a potentially negative factor).

4. To compare the effects of D&I policies on both environmental performance—using the Environmental Score as a proxy—and financial performance—using Return on Assets (ROA) as a proxy.

Chapter 4.

The final chapter examines the extent to which energy companies demonstrate a genuine commitment to social Sustainable Development Goals (SDGs) or instead engage in SDG-washing to enhance their corporate image. To address this issue, the following specific objectives are established:

1. To calculate a composite index reflecting corporate commitment to social and D&I-related Sustainable Development Goals (SDGs).

2. To examine the relationship between corporate support for social Sustainable Development Goals (SDGs) and social performance in energy companies.

3. To analyze how support for diversity and inclusion (D&I)-related SDGs influences the implementation of diversity, equality, and inclusion policies in energy companies.

4. To assess the impact of corporate commitment to SDG 5 (Gender Equality) on diversity performance in the energy sector.

5. To evaluate the influence of commitment to SDG 8 (Decent Work and Economic Growth) on professional development performance within energy companies.

6. To determine the relationship between support for SDG 10 (Reduced Inequalities) and inclusion performance in energy firms.

7. To explore how the level of environmental awareness in a company's home country affects the strength of the relationship between social SDG commitments and social performance.

8. To investigate whether the level of economic development of a company's home country moderates the relationship between social SDG commitments and social performance.

Hypothesis

The general hypotheses to be tested in this research are as follows:

Chapter 1.

H1: Human capital efficiency has a positive effect on the financial performance of energy companies.

H2: Human capital professional development has a positive effect on the financial performance of energy companies.

H3: A high salary gap between CEOs and average employees negatively impacts the financial performance of companies.

H4: CO_2 emissions have a negative effect on the financial performance of energy companies.

H5: ESG controversies have a negative effect on the financial performance of energy companies.

H6: The quality of accounting information has a positive effect on the financial performance of energy companies.

Chapter 2.

H1: The relationship between CSP and EAE is non-linear with U-shape.

H2: The environmental, social and corporate CRS pillars and their dimensions have a non-linear relationship with EAE with U-shape.

Chapter 3.

H1: D&I policies and practices positively influence the ECO of energy companies.

H2: Diversity policies and practices in the company positively influence the ECO of energy companies.

H3: People development policies and practices in the company positively influence the ECO of energy companies.

H4: Inclusion policies and practices in the company positively influence the ECO of energy companies.

H5: Labor controversies negatively influence the ECO of energy companies.

Chapter 4.

H1: There is a positive relationship between support for social SDGs and social performance in energy companies.

H2: There is a positive relationship between support for D&I SDGs and the implementation of diversity, equality, and inclusion policies in energy companies.

H2a: There is a positive relationship between commitment to SDG 5 and diversity performance in energy companies.

H2b: There is a positive relationship between commitment to SDG 8 and professional development performance in energy companies.

H2c: There is a positive relationship between commitment to SDG 10 and inclusion performance in energy companies.

H3: The level of environmental awareness in a company's home country enhances the impact of social SDG commitments on social performance.

H4: The level of economic development in a company's home country strengthens the relationship between social SDG commitments and social performance.

D. METHODOLOGY

This doctoral thesis adopts a rigorous and structured methodological design to effectively address its multifaceted research objectives.

The methodology employed in this thesis, in line with the nature of the specific objectives proposed, combines two scientific approaches: the analytical–synthetic method and the hypothetical–deductive method. The analytical–synthetic approach begins with a comprehensive and up-to-date review of the existing literature, which allows for the dissection of key concepts and dimensions. This is followed by the synthesis of those insights to build a coherent and well-founded understanding of the subject. The hypothetical–deductive method is applied to test theoretical assumptions by formulating hypotheses based on prior knowledge and subsequently validating them through empirical analysis.

This multi-method strategy ensures a comprehensive examination of the energy sector, allowing for the integration of theoretical perspectives with real-world evidence

and providing robust, policy-relevant insights into the interplay between corporate sustainability and performance.

Table 1. Relationship between objectives, methodology and research structure

Chapter	Objective	Methodology
Chapter 1	Analyzes the influence of human capital, environmental capital, and the quality of financial and non-financial disclosures on financial performance	Analytical-Synthetic Hypothetical-Deductive
Chapter 2	Evaluates the impact of the Environmental, Social, and Governance (ESG) Index and its components on environmentally adjusted efficiency	Analytical-Synthetic Hypothetical-Deductive
Chapter 3	Examine the relationship between workplace diversity and inclusion (D&I) initiatives and their effects on both financial performance and environmental outcomes	Analytical-Synthetic Hypothetical-Deductive
Chapter 4	Examines the relationship between corporate commitments to social Sustainable Development Goals (SDGs) and actual social performance	Analytical-Synthetic Hypothetical-Deductive

Source: Own production

Chapter 1.

Future energy sustainability efforts emphasize the shift from fossil fuels to renewables and greater efficiency, requiring energy companies to reduce their environmental and social impact. Energy companies must align financial performance with sustainability goals, and a key factor in achieving this is high-quality financial reporting, which strengthens reputation, builds investor trust, and supports effective decision-making through transparency and good governance.

Chapter 1 adopts a comprehensive, multi-method research approach that combines the Analytical–Synthetic, and Hypothetical–Deductive methods to investigate the impact of human capital efficiency, environmental capital, and financial reporting quality on the financial performance of multinational energy firms.

The Analytical–Synthetic method is first employed to conduct a thorough and updated review of the existing academic literature. Despite growing research on corporate social responsibility (CSR), ESG practices, and financial performance, significant gaps remain—particularly in understanding how these factors interact within the energy sector in emerging economies. While most studies focus on developed countries with advanced regulatory systems, developing economies face unique challenges such as weaker governance and limited sustainable capital.

This review helps deconstruct and understand the main theoretical concepts and indicators relevant to the study. The insights gained are then synthesized to identify research gaps and frame the conceptual model. This study examines the combined impact of human capital, environmental capital, and information quality on the financial performance of the energy sector, particularly during major crises such as the COVID-19 pandemic and the Russia-Ukraine war. Unlike previous research that focused on individual factors or specific regions, this study adopts a holistic and global approach, distinguishing between developed and emerging markets. It also integrates Resource-

Based Theory, Stakeholder Theory, and Institutional Theory to provide a comprehensive framework for understanding how firms can enhance performance while maintaining accountability to stakeholders.

Next, the Hypothetical–Deductive method is used to test the theoretical assumptions. The central research question addressed is: Do human capital efficiency, environmental capital, and financial reporting quality significantly improve financial performance in energy firms? From this question, a series of hypotheses are formulated based on prior empirical and theoretical contributions. These hypotheses are then validated using quantitative analysis of firm-level data.

This study analyzes data from listed energy companies across 50 countries, covering the 2016–2022 period and spanning subsectors such as coal, oil and gas, renewables, and uranium. The starting point, 2016, was selected as it marks the first full year following the adoption of the United Nations Sustainable Development Goals (SDGs) in 2015, while the end point, 2022, reflects both the most recent period of comprehensive data availability and the phase of heightened regulatory momentum around ESG disclosures. ESG and financial data were sourced from the London Stock Exchange Group's (LSEG) Data & Analytics database, which tracks over 90% of global market capitalization and includes more than 630 ESG indicators. To ensure consistency and comparability, the analysis focuses exclusively on companies with publicly available ESG scores in this database. To ensure data integrity and consistency, rigorous data cleaning procedures were applied to remove missing or implausible entries.

Key performance indicators were subsequently constructed. The main dependent variable in this chapter is Gross Profit Margin, which reflects the firm's operating profitability. The principal independent variables include Human Capital Efficiency, Professional Development, CEO–Employee Salary Gap, Variation of CO_2 Emissions, ESG Controversy Score and Earnings Quality (EQ), serving as a proxy for financial reporting quality. To control external influences, a wide set of control variables is incorporated: firm size, leverage, capital expenditures, family ownership, GDP growth, inflation rate, Human Development Index (HDI), and the legal system classification of the firm's home country.

This study includes several robustness variables to ensure the validity of the results: Return on Assets (ROA) as an alternative measure of financial performance; the Value Added Intellectual Coefficient (VAIC) as an alternative proxy for human capital efficiency; the Workforce subdimension of the social score to evaluate corporate commitment to employees; diversity and inclusion indicators to assess the quality of human capital management; the Environmental Score to represent environmental capital; and the existence of non-financial reports as a measure of accounting information quality. Unlike previous studies that focus primarily on developed countries, this research adopts a global perspective. To strengthen the analysis, we conduct subsample comparisons by classifying countries as developed or developing according to United Nations criteria.

Once the variables were defined, the chapter conducted both descriptive and econometric analyses to empirically test the proposed hypotheses and confirm the validity and robustness of the results. No collinearity issues were identified among

variables, as evidenced by acceptable correlation coefficients and Variance Inflation Factor (VIF) values.

From an econometric standpoint, chapter 1 applies Ordinary Least Squares (OLS) estimation with year and industry fixed effects to analyze the determinants of financial performance. To further verify the consistency of the findings, several robustness checks are performed, including the use of alternative variable specifications and the application of a random-effects Generalized Least Squares (RE GLS) model.

Chapter 2.

Chapter 2 explores the complex and multidimensional relationship between Corporate Social Performance (CSP) and corporate performance—both financial and environmental—within the energy sector. The analysis is framed by a robust theoretical foundation that integrates Stakeholder Theory, Resource-Based Theory (RBT), and Reinhardt's (1999) hypothesis on the conditional advantages of sustainability efforts.

From a neoclassical economic perspective (Friedman, 1970), investments in Corporate Social Responsibility (CSR) are viewed as costs that detract from profit maximization. However, this view is challenged by the social impact hypothesis (Cornell & Shapiro, 1987) and Stakeholder Theory (Freeman, 1984), both of which argue that CSR initiatives can enhance long-term corporate value by strengthening stakeholder trust and reputation. Crucially, recent literature suggests that the positive effects of CSR are only realized beyond a certain threshold of effectiveness—captured by the "Too Little of a Good Thing" (TLGT) effect. This metatheory posits a U-shaped relationship between CSP and firm performance, whereby low levels of CSR may generate inefficiencies, while more advanced CSR engagement contributes positively (Trumpp & Guenther, 2017).

The academic literature to date lacks consensus on the shape and strength of the CSP-performance relationship, with growing evidence pointing toward a non-linear, industry-specific interaction. Within the energy sector, an industry under considerable environmental scrutiny—only one recent study (Kumar et al., 2022) has explicitly examined this curvilinear relationship. This research gap constitutes the central motivation for the current chapter.

Building on these theoretical insights, this study formulates four research hypotheses that test for non-linear U-shaped relationships between environmentally adjusted efficiency (EAE) and each CSP dimension: global, environmental, social, and governance.

The empirical analysis is based on a panel dataset comprising 239 publicly listed energy companies across 46 countries over the 2016–2021 period. The study employs ESG scores, their three primary pillars (environmental, social, and governance), and ten sub-dimensions extracted from the Refinitiv Eikon (formerly Thomson Reuters) database as proxies for CSP. Macroeconomic indicators are sourced from the World Development Indicators database managed by the World Bank.

To evaluate firm performance, the study constructs a composite measure of environmentally adjusted efficiency (EAE) using Data Envelopment Analysis (DEA). This approach enables the integration of economic, financial, operational, and environmental performance into a single efficiency metric, offering a more accurate assessment of CSP outcomes in environmentally intensive industries like energy.

Independent variables include the overall ESG index and three disaggregated pillars. The environmental pillar includes emissions, innovation, and resource use; the social pillar includes ESG controversies, community engagement, human rights, and product responsibility; and the governance pillar comprises management effectiveness, CSR strategy, and shareholder relations.

To prevent model specification errors, the study incorporates two sets of control variables. The first group captures firm-level characteristics: R&D intensity, firm size, interest coverage ratio, return on assets, solvency ratio, and the percentage of strategic shareholders. The second group includes macroeconomic factors such as year-end oil prices and GDP growth—both shown in prior research to influence firm-level efficiency.

Following the definition and construction of all variables, descriptive and econometric analyses were conducted. Preliminary checks revealed no evidence of multicollinearity, as confirmed by variance in inflation factor (VIF) values.

For the econometric estimation, the chapter employs a truncated regression model to test for curvilinear relationships between CSP and EAE. Given the bounded nature of EAE scores between 0 and 1, a Tobit model is applied. Random effects are used in place of fixed effects to avoid estimation bias inherent in non-linear panel models (Sánchez-Robles et al., 2022).

In summary, this chapter contributes to the literature by applying a multidimensional and theory-driven framework to test whether socially responsible business practices yield measurable environmental efficiency gains in the energy sector, while also addressing the previously unexplored non-linear dynamics of these relationships.

Chapter 3.

Chapter 3 once again applies the analytical–synthetic method, beginning with a thorough review of the existing literature. Numerous studies emphasize the potential benefits of human resource management practices focused on diversity and inclusion (D&I). However, most of this research has centered on financial outcomes, often yielding inconclusive or mixed results.

The theoretical framework for this chapter is grounded in Stakeholder Theory and Resource-Based Theory (RBT). Stakeholder Theory suggests that companies adopt D&I policies to enhance their legitimacy, meet stakeholder expectations, and ultimately improve their reputation and financial performance. In contrast, RBT posits that socially responsible human capital practices can generate sustainable competitive advantages by developing valuable, rare, and hard-to-imitate capabilities.

The hypothetical–deductive method is used to empirically test the theoretical assumptions. Hypotheses are derived from literature and then validated through quantitative analysis using firm-level data. The empirical dataset comprises publicly listed energy companies from 53 countries, operating across the coal, oil & gas, renewables, and uranium subsectors, over the 2016–2022 period. Financial, environmental, governance, and D&I-related data were obtained from the London Stock Exchange Group (LSEG) Data & Analytics database. To ensure data reliability, the dataset was rigorously filtered to remove missing or implausible entries.

Key performance indicators were then constructed. First, Data Envelopment Analysis (DEA) was applied to estimate environmentally adjusted efficiency (ECO)a composite index combining economic, financial, operational, and environmental performance. This multidimensional approach addresses the limitations of previous studies that rely on unidimensional metrics. Additionally, performance was disaggregated into environmental (proxied by the Environmental Score) and financial (proxied by Return on Assets, ROA) components for complementary analysis.

Five explanatory variables were developed: four core dimensions—diversity, inclusion, people development, and labor controversies—and a fifth variable (D&I Global) capturing the company's overall D&I strategy. To ensure model robustness and avoid specification errors, the analysis includes a set of control variables, grouped into two categories: corporate governance-related variables and firm-specific characteristics.

Once the variables were defined and constructed, both descriptive and econometric analyses were conducted to empirically test the research hypotheses and ensure the validity and robustness of the results. Correlation coefficients between D&I indicators and control variables revealed no collinearity problems, and the variance inflation factor (VIF) confirmed the absence of multicollinearity.

Methodologically, a two-stage approach was implemented. In the first stage, bias-corrected ECO scores were estimated using DEA at the firm level. In the second stage, truncated regression models were employed to examine the relationship between D&I practices and ECO. To ensure robustness, additional estimations were carried out using Tobit random-effects models (given that ECO is bounded between 0 and 1), Ordinary Least Squares (OLS) regressions with one-year lags, and Two-Stage Least Squares (2SLS) models using lagged variables as instruments.

Chapter 4.

Chapter 4 also applies the analytical–synthetic method, using a systematic literature review as the specific methodological approach. Despite the central role energy companies play in the global economy, empirical research on their commitment to social Sustainable Development Goals (SDGs) remains limited—particularly regarding diversity, inclusion, and human capital development. Prior studies present mixed findings: some argue that corporate SDG commitments are largely symbolic, while others highlight substantial changes in organizational practices. This chapter is theoretically grounded in Legitimacy Theory, which examines whether corporate SDG engagement aims to enhance reputation through symbolic or substantive actions, and Institutional Theory, which posits that corporate sustainability behaviors are shaped by

external pressures—normative, mimetic, or coercive—such as a firm's country-level economic development and environmental governance.

To empirically test these theoretical assumptions, the hypothetical–deductive method is employed. Hypotheses are derived from literature and validated through quantitative analysis using firm-level data. The empirical sample consists of publicly listed energy companies from 51 countries over the 2016–2022 period. Financial, environmental, governance, and diversity and inclusion data were obtained from the London Stock Exchange Group (LSEG) Data & Analytics database. Country-level data for classifying nations as developed or developing were sourced from the United Nations, and national environmental governance was measured using the Environmental Performance Index (EPI) from the Yale Center for Environmental Law & Policy.

Key performance indicators were then constructed. Social performance was measured using ESG metrics that evaluate workforce well-being, community engagement, human rights practices, and product responsibility. Diversity and inclusion performance was assessed based on indicators reflecting gender and cultural diversity in leadership, inclusive workplace policies (such as flexible work arrangements and equal employment programs), and investment in training, career planning, and reskilling. Two composite indices were developed: one capturing overall corporate commitment to social SDGs, and another measuring company engagement specifically with SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), and SDG 10 (Reduced Inequalities).

Next, we examine how the relationship between corporate commitments to social Sustainable Development Goals (SDGs) and actual social performance may vary across different institutional contexts. Specifically, we incorporate two moderator variables: the level of economic development of the company’s home country and its Environmental Performance Index (EPI) score, which serves as a proxy for national environmental governance.

To ensure robustness, the model also incorporates control variables related to corporate governance (e.g., shareholder value orientation, CSR strategy, analyst following), firm-specific characteristics (e.g., profitability, age, leverage, capital expenditure, and size), and macroeconomic conditions (e.g., public debt levels as a proxy for financial constraints).

Once the variables were defined and constructed, both descriptive and econometric analyses were conducted to test the hypotheses and ensure the validity and robustness of the results. Correlation coefficients between D&I indicators and control variables revealed no collinearity issues, and Variance Inflation Factor (VIF) scores confirmed the absence of multicollinearity.

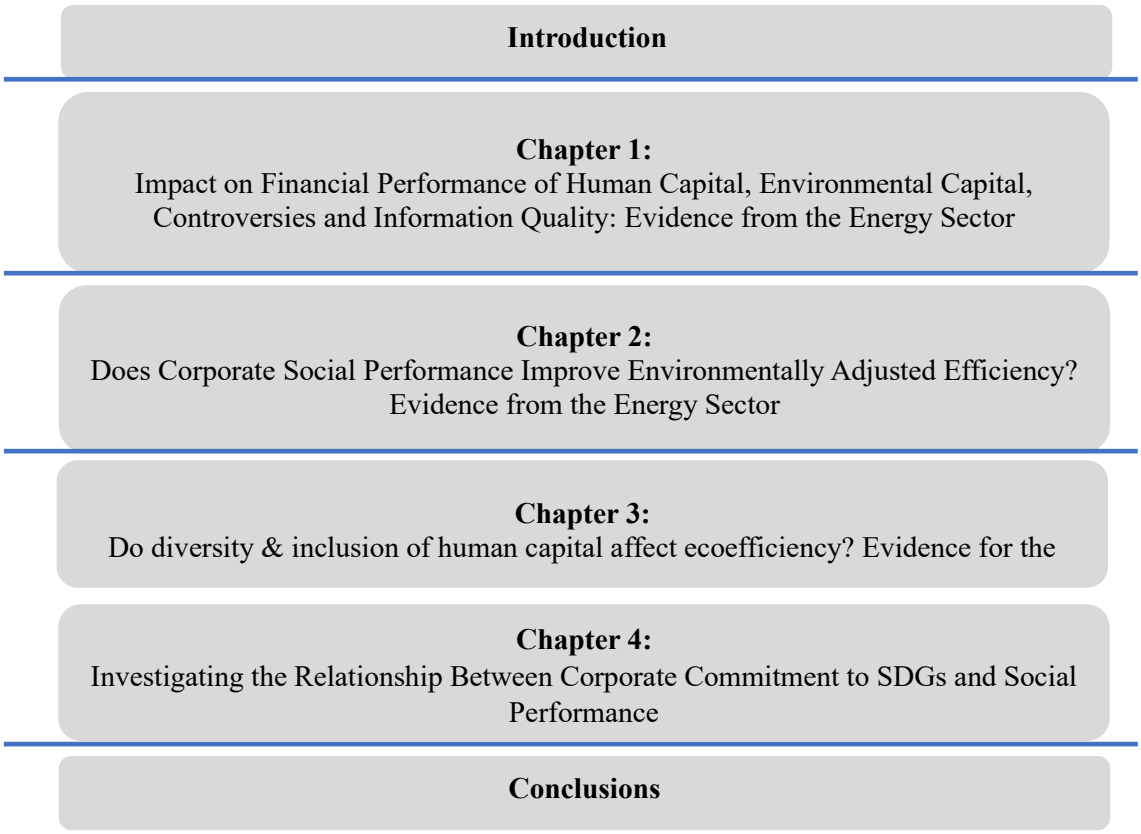
Methodologically, the study applies to a truncated regression model with year fixed effects to examine the relationship between SDG commitments and social performance, with special attention to the moderating role of institutional factors. To address potential endogeneity concerns, one-year lagged firm-level variables are introduced. In addition, Two-Stage Least Squares (2SLS) regression is employed using lagged values of SDG commitment and corporate governance variables as instruments.

Finally, given the bounded nature of ESG scores and the panel structure of the data, a Tobit random-effects model is used to account for data censoring.

E. STRUCTURE

This research is organized into four core chapters, each of which is dedicated to one of the above-mentioned research objectives, along with an introduction and a concluding section (Figure 1). The overall structure also incorporates a bibliography and relevant appendices.

Figure 1. Research Structure



Source: Own production

Chapter I: Impact on Financial Performance of Human Capital, Environmental Capital, Controversies and Information Quality

After the Introduction, the chapter proceeds with Section 2: Theoretical Framework and Hypothesis Development, which reviews the existing literature on sustainability, diversity, and firm performance, and formulates the hypotheses to be tested. Section 3: Research Design describes the sample of listed energy firms from over 50 countries, defines the dependent and independent variables—such as eco-efficiency, diversity, and ESG performance—and outlines the econometric methodology, including DEA and regression models. Section 4: Empirical Analysis presents the descriptive statistics, multivariate regression results, and a series of robustness checks, including

alternative specifications and subsample analyses. Finally, Section 5: Conclusions summarize the main findings, highlight their implications for theory and practice, and propose avenues for future research.

Chapter 2: Does Corporate Social Performance Improve Environmentally Adjusted Efficiency?

This chapter investigates whether corporate social performance (CSP) contributes to improving environmentally adjusted efficiency (EAE) within the energy sector. The chapter is organized into six main sections: Section 1: Introduction – Presents the background and motivation for examining the relationship between corporate social responsibility (CSR) and environmental efficiency, emphasizing the relevance of this topic in the context of the energy industry. Section 2: Literature Review – Summarizes key theoretical and empirical contributions on eco-efficiency, sustainability practices, and the role of corporate governance in shaping environmental performance. Section 3: Methodology – Describes the methodological approach, including the regression models used to evaluate the impact of CSP on EAE, and explains the choice of variables and analytical techniques. Section 4: Data Description – Details the dataset employed in the empirical analysis, including the sources, sample characteristics, and variables used. Section 5: Empirical Analysis and Results – Presents the results of the statistical analysis, interpreting how different dimensions of CSP influence eco-efficiency across firms in the energy sector. Section 6: Conclusions – Summarizes the main findings, discusses their implications for corporate management and public policy, and suggests directions for future research.

Chapter 3: Do Diversity & Inclusion Policies Drive Eco-Efficiency?

This chapter examines the impact of diversity and inclusion (D&I) policies on eco-efficiency, with the aim of assessing whether workforce diversity contributes to improved sustainability outcomes in the energy sector. The chapter is structured as follows: Section 1: Introduction – Introduces the relevance of diversity and inclusion in the context of corporate sustainability, outlining the motivation and objectives of the study. Section 2: Literature Review – Reviews the existing literature on the relationship between workforce diversity—particularly gender and ethnic diversity—and sustainability-oriented innovation and performance. Section 3: Methodology – Describes the empirical strategy adopted, focusing on the panel regression models used to assess the influence of D&I policies on eco-efficiency, along with the rationale for the variables and model specification. Section 4: Data Description – Provides a detailed overview of the dataset, including firm-level D&I indicators and environmental performance measures, as well as data sources and sample characteristics. Section 5: Empirical Analysis and Results – Presents the results of the econometric analysis, exploring the effects of workforce diversity on firms' environmental performance and eco-efficiency. Section 6: Conclusions – Summarizes the main findings and their practical implications for corporate management and public policy and offers recommendations for fostering inclusive and sustainable business practices.

Chapter 4: Investigating the Relationship Between Corporate Commitment to SDGs and Social Performance

This chapter explores the extent to which energy firms genuinely commit to the Sustainable Development Goals (SDGs) or, conversely, engage in SDG-washing to enhance their corporate image. The analysis focuses on the authenticity of corporate sustainability practices and their impact on social performance. The chapter is organized as follows: Section 1: Introduction – Introduces the relevance of the SDGs in corporate sustainability reporting, with a particular focus on the growing scrutiny over the sincerity of corporate commitments to sustainable development. Section 2: Literature Review – Reviews prior academic work on the relationship between corporate SDG commitments, social performance, and financial outcomes, with attention to the debate around symbolic versus substantive engagement. Section 3: Methodology – Describes the methodological approach, used to assess the impact of SDG commitments on corporate social performance, and discusses the justification for the selected variables and models. Section 4: Data Description – Provides a detailed overview of the dataset, which includes ESG disclosures, sustainability reports, and third-party audit information for energy companies across multiple countries. Section 5: Empirical Analysis and Findings – Presents the results of the empirical analysis, comparing the performance of firms that authentically implement SDG-aligned strategies with those whose efforts are largely symbolic. Section 6: Conclusions – Summarizes the key findings and offers practical recommendations for energy companies, regulators, and investors to strengthen the credibility and effectiveness of corporate SDG initiatives.

1

Impact on Financial Performance of Human Capital, Environmental Capital, Controversies and Information Quality: Evidence from the Energy Sector

1. IMPACT ON FINANCIAL PERFORMANCE OF HUMAN CAPITAL, ENVIRONMENTAL CAPITAL, CONTROVERSIES AND INFORMATION QUALITY: EVIDENCE FROM THE ENERGY SECTOR

ABSTRACT

The present work aims to examine the human capital, and environmental and informational factors impact on financial performance in a sample of 169 multinational companies in the energy sector between 2016 and 2022. Findings reveal that efficient management of human assets has a significant impact on enhancing financial performance through efficient use of assets, increased productivity, and boosting investor confidence. In contrast, high carbon dioxide emissions (CO_2) and ongoing ESG-related scandals have a detrimental impact on financial performance, suggesting that high-polluting enterprises have costly financial consequences. Finally, we find that the quality of accounting information has a positive effect on the financial performance of companies. Overall, these results confirm that internal factors such as human resource management, compliance with best practices in sustainability, and high-quality financial reporting are critical value and financial success drivers in the energy sector. Furthermore, we find that the development level of the country where an energy company is based plays a moderate role in these relationships. Our results yield multiple important implications for managers, policymakers, and investors.

Keywords: Energy Sector, Earning Quality, Human Capital, Salary Gap, Professional Development, Diversity, Inclusion, ESG, CO_2 Emissions, ESG controversies

1.1. INTRODUCTION

Energy is a fundamental pillar of modern societies and economies, influencing economic, social, and political dynamics. As a key driver of technological and industrial development, the energy sector plays a crucial role in meeting the growing global demand for energy. Beyond its economic significance, it operates at the intersection of social equity and environmental responsibility, as it both heavily relies on natural resources and is a major contributor to greenhouse gas (GHG) emissions (Fu et al., 2021; Stavytskyy et al. 2018). In part, its future viability will depend on its success in decarbonization at a low and sustained cost (European Union, 2024). The transition toward a decarbonized economy is not a uniform process; rather, it is shaped by profound geographical inequalities arising from diverse political, economic, and institutional conditions (Sovacool et al., 2017). Within the European Union, this process is framed by ambitious regulatory instruments, yet the degree of implementation diverges between more industrialized countries of the North and less developed or fossil-dependent regions of the South and East (Di Nucci & Krug, 2022; Arabadjieva, 2021). In the United States, the energy transition is driven primarily by fiscal incentives and industrial subsidies. By contrast, in Latin America and Asia, decarbonization remains a major challenge due to the structural dependence on natural resource exploitation and the persistence of energy poverty (OECD/CAF/EU, 2022; ETUI, 2022).

Traditionally, the energy sector has been portrayed as environmentally sensitive, high-carbon, and contentious, specifically in terms of its use of fossil fuels. In 2023, energy-related carbon dioxide emissions reached a record high of 37.4 billion tones, with the power generation sector emerging as a major contributor—particularly in emerging and developing economies-driven by continued reliance on fossil fuels such as coal (International Energy Agency, 2024). However, investments in low-carbon energy have already surpassed the capital flows directed toward oil, gas, and coal projects (MSCI, 2024a).

Future global energy sustainability trends focus on transitioning from fossil fuels to a diverse mix of renewable energy and improved efficiency, driven by the shared goals of combating climate change, reducing carbon emissions, and promoting sustainable development. With social and environment concerns becoming increasingly important, companies in the energy sector have an imperative to drive decarbonization and minimize its environment and social footprint, in an attempt to build a positive corporation name (Kasradze et al., 2023), maintain legitimacy, and gain public acceptance (Heffron et al., 2021), reduce operating risks, enhance competitive position, and maximize financial performance (Ekatah et al., 2011; Kasradze et al., 2023; Pinheiro et al., 2024b). Numerous studies indicate that high-quality financial and non-financial reporting reduces information asymmetry between an entity and its stakeholders while also facilitating decision-making for managers, influencing financial performance (MSCI, 2024a, 2024b; Peng, 2024).

That nuance re-emphasizes the necessity for companies in the energy sector to reconcile financial objectives with objectives of sustainability, and in the bargain,

become long-term resilient and competitive in a sector under increased scrutiny (Shahbaz et al., 2020). With increased worldwide concern regarding Corporate Social Responsibility (CSR) and sustainable development, companies in the energy sector have increased pressure to deliver financial success and, in the bargain, maintain environment and social requirements. Identification of financial performance drivers in such a critical sector is important in developing resilience, enhancing sustainable behavior, and reconciling business operations with aspirations of stakeholders (International Energy Agency, 2023).

The incorporation of Environmental, Social, and Governance (ESG) in a corporation's planning will in most cases be considered a source of long-term competitive edge and value creation. Energy companies' performance will rely on mastering both human, environment, and informational capital, significant in defining profitability and, in addition, strengthening organizational resilience and trust with stakeholders (Eccles et al., 2014).

Effective human capital management is essential. Both the value creation role of human resources within an organization and the company's social commitment to its employees are factors that, although closely related, can influence financial performance. Empirical research has supported those investments in training and development, which can boost productivity and competitiveness and enable companies to respond appropriately to emerging market requirements (Tran & Vo, 2020). On the other hand, moderate wage gaps can motivate performance, but excessive gaps have a negative impact on morale, cohesion, and overall productivity (Przychodzen & Gómez-Bezares, 2021).

Environmental capital, specifically the management of an organization’s long-term assets and the stewardship of ecological assets, is a critical element in ensuring long-term financial sustainability due to resource depletion and environmental pollution. As a result, high-emission enterprises face heightened operational risks that can significantly disrupt their operations (Wang, 2023), lead to increased expenses, and reduce profit margins (Wang, J et al., 2024; Zhong et al., 2024). ESG controversies can result in legal complications and activist targeting, making it more difficult for companies to conduct business (Freudenreich et al., 2020; Hamdani & Hannes, 2019), eroding trust in a company (Shakil, 2021), damaging its financial performance (Elamer & Boulhaga, 2024a), and drastically reducing its value (Wu et al., 2023). Therefore, managing ESG issues is crucial to maintaining a good company reputation, trust, and strong financial performance (Issa & Hanaysha, 2023).

High-quality financial reporting enhances a company’s financial performance and reputation by increasing trust in management and reducing information asymmetry (Peng, 2024). This fosters investor confidence and supports better decision-making. Reliable financial information also reflects strong management practices and good governance, helping to rebuild investor trust through accurate and timely disclosure (Ayagi & Salisu, 2023). Non-financial reporting, particularly ESG disclosures, plays a crucial role in communicating sustainability efforts, offering stakeholders a comprehensive view of corporate goals and societal impact. It also strengthens shareholder oversight, enhances corporate reputation, and supports economic performance (Jiang et al., 2023; Kudal et al., 2024; Christensen et al., 2021; Etim et al.,

2022). Recently, the EU has considered scaling back its sustainability agenda by softening the Directive on corporate sustainability reporting (CSRD) requirements. In this context, assessing the impact of the quality of financial information and the preparation of non-financial information on financial performance becomes increasingly relevant.

Although previous research has separately analyzed the effects of human capital efficiency, environmental performance, and information quality on corporate performance, they have not yet been studied together. This gap highlights the need for a comprehensive framework that jointly examines these elements to provide a deeper understanding of their synergetic and/or antagonistic influences on the financial performance of the energy industry, considering the level of development of the companies' country of origin as a moderating variable.

A significant portion of research in the field of CSR and ESG finds a positive relationship between environmental performance and financial performance. However, these conclusions are not uniform across sectors or markets (MSCI, 2024a). The energy sector was significantly impacted by the COVID-19 pandemic (2020) and the Russia-Ukraine war (2022). These events heightened concerns among energy companies regarding their financial stability. This study examines the financial impact of both crises on the energy sector. However, companies with higher ESG ratings demonstrated stronger financial performance, with ESG-related returns peaking during the pandemic. This study contributes to the literature by addressing key gaps in measuring the impact of human capital, environmental capital, controversies and information quality on the financial performance of the energy sector, which has a significant environmental and social footprint. Foremost, this study integrates human capital, environmental capital, and information quality into a single model to analyze their combined impact on financial performance in the energy sector. While past studies explored these concepts separately, this study presents a holistic approach that includes their synergetic and conflicting impacts. Second, drawing on a large multinational sample of 169 energy companies from over 50 nations between 2016 and 2022, this study offers powerful and generalizable results across different institutional and cultural contexts. Unlike previous studies focused on single-country analyses or developed markets, this study provides a broader perspective on the drivers of financial performance in the global energy sector. To deepen the analysis, it categorizes countries into developed and emerging markets. Third, this study integrates Resource-Based Theory (RBT), Stakeholder Theory and Institutional Theory to formulate a comprehensive theoretical framework for describing complex relationships between human capital, environmental capital, information quality, and financial performance. By synthesizing these theories, the study offers a more universal explanation of how firms can best utilize resources without sacrificing accountability to stakeholders.

The evidence of this study indicates that professional training, human capital efficiency, and fair compensation practices exhibit a very strong positive impact on financial performance, as proxied by Gross Margin. In contrast, increased CO_2 emissions and increased ESG controversies relate to poorer financial performance, illustrating the financial penalty for weaker environmental and governance performance. Furthermore, quality of financial reporting is found to be an essential driver, where transparent and trustworthy disclosures foster investors' confidence and encourage

better financial performance. Finally, we found that the effect of the studied variables varies depending on the level of development of the energy company's country of origin.

The findings highlight the need to integrate human capital management, environmental management, and enhanced accounting practices to ensure sustainable financial performance in the energy sector. Our study uncovers their complex impact on financial performance, providing valuable insights for executives and policymakers in balancing profitability and sustainability goals.

After the introduction, the study devotes the following section to presenting the theoretical framework, reviewing the existing literature, and formulating the hypotheses to be tested. The third section focuses on research design, including sample selection, variable description, and the methodology employed. The fourth section presents an analysis of the empirical results, both descriptive and multivariate, along with various robustness checks and complementary analyses. The article concludes with a summary of the main findings, their theoretical and practical implications, and recommendations for future research.

1.2. THEORETICAL FRAMEWORK, LITERATURE REVIEWS AND HYPOTHESIS

1.2.1. Theoretical Framework

A multi-theoretical framework is potentially more applicable to offer alternative explanation and comprehend the human, environmental and informational capital contribution to firms' financial performance.

Resource-Based Theory (RBT) is interested in utilizing idiosyncratic and scarce resources, both environmental and human resources, to attain a competitive advantage in a sustainable manner. The RBT holds the view that organizations can attain a competitive advantage through the utilization of valuable, inimitable, rare, and substitutable resources, which differentiate them (Surroca et al., 2010). Both physical assets, i.e., financial and technological assets, and intangible assets, i.e., stakeholder relations and brand equity, fall under these assets (Surroca et al., 2010). Organizational capabilities in this theoretical framework hold more significance compared to capabilities in a competitive context of an organization and thus make them critical in attainment of a competitive advantage (Ahenkora & Adjei, 2012).

The RBT offers a core theory for describing the role of intangible assets, e.g., human, environmental and informational capital—and their impact on financial performance through creating long-term competitive advantages. Human capital involves innovation capacity, fair compensation practices, and training programs that establish a culture of innovation and responsiveness within an organization. Environmental capital integrates sustainability into operational models through forward-looking approaches such as greenhouse gas emission reductions and green technology adoption. Environmental improvements carry two positive implications: mitigation of asymmetrical and regulatory risks, and improvement in the reputation of an entity, both of which make it easier to attract environmentally responsible investors and consumers

and turn environmental challenges into financial opportunity (Khanra et al., 2022). Informational capital, in the form of transparent and honest financial reporting, establishes trust and reduces information asymmetry between an entity and stakeholders, and, by extension, eases decision-making processes and assets efficiency maximization, which has a consequential impact on financial performance, through operating efficiency improvement and increased investors' confidence (Surroca et al., 2010).

In certain industries, such as in the energy industry, use of RBT enables firms to concentrate on leveraging enduring alterations and sophisticated technology setups as valuable resources to maximize efficiency and respond to the needs of investors and stakeholders (Khanra et al., 2022). Essentially, RBT demonstrates that informational, environmental, and human resources' bundling and enhancement are accountable for superior financial performance and generate enduring competitive advantages.

In the RBT framework, social and environmental practices, in congruence with moral principles, at the same time increase competitive advantage by developing capabilities in an organisation (Surroca et al., 2010; Davis & Simpson, 2017). Active concern for social and environment-based issues strengthens the reputation of an organization, and thereby, its position with respect to a variety of stakeholder groups, including investors, customers, and society in general, is strengthened (Duque-Grisales & Aguilera-Caracuel, 2021; Weston & Nnadi, 2023).

Stakeholder Theory contends that developing relations with various stakeholders such as employees, customers, suppliers, and societies is central to organizational prosperity in the long run. As a departure from shareholder-centric models, Stakeholder Theory advocates for embedding social, environmental, and economic objectives into business strategy, thus simplifying organizational and societal objective balancing (Marcon et al., 2023). In the energy industry, stakeholder management is important because it is highly socially and environmentally impactful, in search of a consensus between the purpose of an organization and its stakeholders, and one best pursued through accountability and transparency, especially in issues regarding the integrity of financial reports. Poor handling of social and environmental concerns can generate activist interventions, attract regulators, and contribute to consumer boycotts. These impacts can be potentially disruptive to central financial and social reallocations, as well as be threats to the firm's position in its marketplace. Initiation of successful dialogue programs with key stakeholders plays a significant role in mitigating such problems and enhancing long-term viability and profitability (Talbot et al., 2020; Zhou et al., 2020).

Institutional quality and institutions shape corporate practice in sustainability terms, in the case of, say, the energy sector. Institutional context, in its proxy of education levels, economic freedom, and openness to international trade, determines ESG performance. In well-functioning economies with high institutional quality, companies have a greater margin of expansive ESG practice with a proper regard for stakeholder issues. Institutional Theory, which supposes that companies have an external legitimacy and competitiveness requirement, agrees with such a situation. Institutional mandates-driven ESG disclosures enhance transparency, along with the firmness of companies and investor confidence (Pinheiro et al., 2024a). As an eco-

sensitive sector, the energy industry provides a favorable scenario on how institutional quality can drive even under a complex-regulation environment.

By embracing the principles of RBT, Stakeholder Theory and Institutional Theory energy companies can maximize resource allocation and enjoy sound stakeholder relationships. A multi-theory approach not only generates financial performance but also adheres to sustainability and transparency objectives, and therefore it is a basic framework for contemporary energy business.

1.2.2. Human Capital and Firm Performance

Among the three ESG factors (environmental, social, and governance), the social dimension is the most complex. The COVID-19 pandemic highlighted the critical importance of workers' welfare, underscoring the urgent need for a people-first approach to driving economic growth and promoting social justice (Febrianty et al., 2023). Human capital is a crucial determinant of an organization's financial performance, primarily due to the value generated by its human resources, which are increasingly recognized as a driving force for long-term business growth and sustainability (Nimtrakoon, 2015; Rossi et al., 2016). It is important to note, however, that human capital is not synonymous with the entire social pillar of ESG. Instead, it forms a key component of the “Workforce” element within the social dimension, which also encompasses diversity and inclusion, training and career development, working conditions, and health and safety. Clarifying this distinction helps to situate human capital as part of the broader framework of social sustainability.

Management of manpower through efficient use of Human Resources (HR) enables companies to boost operational effectiveness, drive innovation, and maintain a long-term competitive edge, specifically in technology-intensive industries such as the energy sector (Rahim et al., 2017). Enterprises with high Human Capital Efficiency (HCE) have a propensity for delivering high financial performance through increased motivation for workers, continuous development of capabilities, and harmonization of HR with organization strategies. Xu and Liu (2019) show that improvement in Value-Added Intellectual Coefficient (VAIC) leads to higher firm value through improvements in human capital and capital assets that stand as the main drivers of intellectual capital towards sustainable economic performance.

Empirical data collected by Weqar et al. (2024) reveal HCE playing a large and positive role in India's wind power companies, but not solar companies, however.

Tran and Vo (2020) conducted studies in Vietnam's energy sector using the VAIC and demonstrated a positive relationship between HCE, operational efficiency, and financial performance. The empirical evidence provided by Cindiyasari et al. (2022) confirm the significant and positive impact of Intellectual Capital on Indonesian finance companies' financial performance. Additionally, the study conducted by Selfiani (2024) confirms that human capital contributes significantly to financial performance in the listed property and real estate segment of the IDX. Similarly, Okere and Igba (2023) examined the impact of human capital investment on financial performance among Nigerian manufacturing firms and found that, while human capital development is

crucial for long-term competitiveness, its impact on financial performance is complex and industry specific. In addition, Bryl's (2018) study confirms that human capital-oriented firms yield above-average financial performance, particularly in equity growth, profitability, and stock market value, to support the argument that long-term financial benefits accrue from strategic investment in human resources. These findings indicate that more utilization of human capital may enhance financial performance. Therefore, we propose the following hypothesis:

Hypothesis 1: Human capital efficiency has a positive effect on the financial performance of energy companies.

The training and development (TD) domains form critical dimensions of human capital, with a direct impact on productivity and profitability in an institution. Transition to renewable sources of energy involves not only technology development for generating power but also improvements in consumption and production processes to respond to changing skill gaps. One of the key impediments to renewable energy development is a lack of appropriately trained human resources (Lucas et al., 2018).

Training and development programs play a crucial role in effectively utilizing human assets, enhancing job satisfaction, and driving financial performance, with empirical studies confirming their significant impact on high productivity, reduced turnover, and a more flexible workforce (Aleem & Bowra, 2020). Organizations in industries with high-tech development and changing marketplace requirements, such as in the case of companies in the energy sector, require constant training to develop adaptability and tackle specific requirements in the sector (Quartey, 2012).

Professional development programs have a critical role in curbing attrition and enhancing employee commitment. For instance, Thoresen et.al (2004) identifies training with a development orientation, creating a sense of belonging for workers, and enhancing morale and productivity and, at the same time, lessens recruitment expenses. All these factors form a basis for long-term competitiveness in the energy sector, with a high demand for technical expertise and compliance with regulating frameworks (Tran & Vo, 2020).

Well-designed training programs promote improvements in competencies, adaptability, and job satisfaction, and in return, contribute to a rise in financial performance. By fostering key competencies among employees and creating a culture of lifelong learning, organizations can build operational effectiveness and realize better profitability (Elnaga & Imran, 2013). Empirical studies by Rahman & Akhter (2021) demonstrate that investments in training, skill development, and capability enhancement are positively linked to better performance in banking operations. Additionally, several studies emphasize that investing in professional development is essential for promoting organizational flexibility and responsiveness, particularly in business environments with high levels of innovation (Rahim et al., 2017). Rahim et al., (2017) affirms that training intervention is effective in building adaptability and resilience in an organization and to long-term financial performance. Additionally, Arlita (2022) on Indonesian listed banking companies during the years 2018-2021, employee training has a positive effect on financial performance.

Recent research confirms that implementation of some training and development practices generates more innovation and financial performance in organizations. Diaz-Fernandez et.al (2015) note that employment security and firm-specific training are the strongest determinants of firm performance and innovation. According to Manresa et al. (2019), evidence shows that training and development for creativity and innovation positively impacts firm performance by enhancing innovative outcomes, i.e., in creating new products and new services.

This is evidence in support of the assumption that investment in human capital through formalized human resources policies triggers sustainable competitive advantage and long-term business development. In such a scenario, investing in training and development is important for creating awareness and raising motivation level in workers. Green human resource management principles serve as a guiding model for operations in industries such as the energy sector and must therefore be incorporated in processes in a shared value environment (Vardarlıer & Türk, 2022). These findings imply that a higher human capital professional development improves financial performance. Therefore, we propose the following hypothesis:

Hypothesis 2: Human capital professional development has a positive effect on the financial performance of energy companies.

Polluting industries are under immense pressure to reduce their carbon emissions, which increases the salary gap between executives and employees (Ho et al., 2024). Relative Deprivation Theory argues that an internal salary gap, if excessive, can create feelings of exploitation among employees and have negative impacts on growth (Xie et al., 2024).

The regulatory frameworks of executive compensation are undergoing profound changes due to recent regulatory interventions aimed at aligning incentives with long-term corporate objectives. For instance, the European Shareholders' Rights Directive (European Unión, 2017) emphasizes transparency in determining executive remuneration and encourages the application of non-financial performance metrics, such as Environmental, Social, and Governance (ESG) metrics. While these processes are intended to enhance accountability and sustainability, they, paradoxically, can widen the remuneration gap between higher bosses and rank-and-file staff. Adding ESG drivers to executive remuneration packages typically implies increased overall rewards for top bosses without a corresponding change to staff compensation plans. This discrepancy asks fundamental questions about the effectiveness of governance in ensuring internal equity, especially in capital-intensive industries such as energy, where disparities in compensation are exaggerated by an emphasis on multifaceted performance metrics that do not always translate into overall contributions by the general workforce (European Unión, 2017; Elamer & Boulhaga, 2024a; Martono et al., 2022).

In general, the literature shows that while justified salary disparities could foster productivity and motivation, when they are excessive, they could compromise employee trust in company management. This loss of trust has been found to lead to lower employee commitment, morale, and job satisfaction, as well as higher employee turnover rates and lower team cohesion, ultimately affecting productivity and financial

performance (Chuang et al., 2018; Osiichuk, 2022; Przychodzen & Gómez-Bezares, 2021; Rahim et al., 2017). The findings highlight the importance of investing in maintaining fair compensation systems to promote organizational effectiveness and employee satisfaction. Therefore, we propose the following hypothesis:

Hypothesis 3: A high salary gap between CEOs and average employees negatively impacts the financial performance of companies.

1.2.3. Environmental Capital, Controversies and Firm Performance

Among ESG and CSR studies, a substantial body of literature indicates a positive relationship between environmental performance and financial performance (Duan et al., 2023; Hang et al., 2019; Huang, 2021; Siwiec & Karkowska, 2024; Trumpp & Guenther, 2017; Velte, 2017; MSCI, 2024a). However, some studies have identified a negative relationship between the two variables (Alareeni & Hamdan, 2020; Busch & Hoffmann, 2011). In this context, we specifically examine the variables most strongly associated with such relationships in the energy sector: CO_2 emissions and ESG controversies.

As a response to environmental concern, energy companies are more and more concerned about greenhouse gas emissions, but the transition to low-carbon operations is not risk-free (Zhong et al. 2024). These risks can lead to unhealthy business environments (Wang, 2023), increased operating costs, damaging financial performance (Wang, J et al., 2024). All these issues can cause significant financial risks, including interruptions to cash flows, greater uncertainty regarding financial performance, and reduced financial stability (Andersson et al., 2016).

The impact of carbon risk varies by company, depending on its financial metrics and industry (Wang, 2023). Carbon emissions, as a primary source of carbon risk, influence financial performance in different ways. Several studies show a negative relationship between carbon risk and financial performance (Al-Fakir Al Rabab'a et al., 2024; Busch & Lewandowski, 2017; Loohuis, 2022; Gallego-Álvarez et al., 2015; Lee et al., 2015; Sariannidis et al., 2013; Zhong et al., 2024), while other research suggests a positive relationship (Busch et al., 2022; Misani & Pogutz, 2015). Additionally, Brouwers et al. (2018) found no significant impact on ROA and ROE. Alternatively, Trumpp and Guenther (2017) propose a non-linear (U-shaped) relationship between profitability and carbon risk. Therefore, it is crucial to assess whether a reduction in carbon emissions could influence the financial performance of the energy sector.

Therefore, we propose the following hypothesis:

Hypothesis 4: CO_2 emissions have a negative effect on the financial performance of energy companies.

Controversies related to ESG issues can significantly diminish a company's value (Freudenreich et al., 2020; Hamdani & Hannes, 2019). Specifically, ESG-related

environmental issues can lead to substantial legal costs and penalties, which in turn can cause a sharp increase in expenses (Bang et al., 2023). Additionally, such incidents erode consumer trust and brand equity—both of which, as intangible assets, play a crucial role in a company's long-term success (Klein & Dawar, 2004). The resulting asset destruction can trigger a cascading effect, including diminished market presence and an increased cost of capital, posing significant risks to long-term profitability and survival (Sklenarz et al., 2024). Furthermore, a lack of transparency and insufficient attention to ESG matters can undermine financial stability over the long term (Etim et al., 2022).

Numerous studies have extensively explored the impact of ESG controversies on firm valuation (Aouadi & Marsat, 2018; Bang et al., 2023; Dorfleitner et al., 2020; Shakil, 2021; Nirino et al., 2021). Overall, these studies have demonstrated a negative relationship between ESG controversies and firm valuation. These findings align with Jucá et al. (2024), which concluded that ESG controversies negatively affect the financial performance of companies, with a more pronounced impact on firms operating in environmentally sensitive industries, such as the energy sector, and those in developed countries.

According to previous studies, environmental controversies negatively impact the profitability of the energy sector. Therefore, we propose the following hypothesis:

Hypothesis 5: ESG controversies have a negative effect on the financial performance of energy companies.

1.2.4. Quality of Accounting Information and Firm Performance

Information asymmetry between internal and external stakeholders, combined with limitations in auditing practices and the discretionary nature of accrual accounting, creates conditions that allow executives and managers to report earnings that deviate from the company's actual financial position. This manipulation may serve personal interests or convey selective and potentially misleading signals to stakeholders, a practice widely recognized as earnings management (Prencipe & Viarengo, 2022; Burcă et al., 2024; Habib et al., 2022).

Theoretical frameworks such as Agency Theory and Stakeholder Theory provide key insights into this phenomenon. From an Agency Theory perspective, earnings management is primarily linked to short-term strategies aimed at maximizing immediate financial gains. However, this approach poses significant risks to long-term organizational sustainability, as it undermines the credibility of financial reporting and may mislead stakeholders, leading to increased scrutiny and potential reputational damage. In contrast, Stakeholder and Legitimacy Theories emphasize a long-term perspective, suggesting that firms committed to transparency and sustainable business practices reduce incentives for earnings management. By prioritizing long-term stability over short-term financial manipulation, these organizations cultivate trust-based relationships with stakeholders, thereby mitigating the risks associated with earnings management (Ehsan et al., 2020; Palacios-Manzano et al., 2021a).

High-quality financial information is essential for reducing information asymmetry between stakeholders and corporations, as transparent and accurate reporting enables investors and managers to make informed decisions, thereby enhancing market confidence (Luo & Bhattacharya, 2006). Moreover, the quality of accounting information plays a crucial role in minimizing agency conflicts between shareholders or creditors and managers by aligning their interests (Bushman & Smith, 2001; Wang, 2006).

These practices not only improve corporate reputation but also contribute to better financial performance (Dong et al., 2016), with high-quality accounting data offering more reliable insights into financial outcomes and reducing stock price volatility (Dechow et al., 2010). This demand for high-quality financial information ultimately incentivizes companies to disclose more accurate and transparent financial reports (Ball & Shivakumar, 2005; Wang, 2006).

Previous research confirms that companies with higher earnings quality tend to receive more favorable ratings and experience reduced information asymmetry (Bhattacharya et al., 2013). Several studies have explored the economic benefits associated with improved earnings quality, including a reduction in the cost of capital and debt (Francis et al., 2008), enhanced market valuation (Petroni et al., 2000), and better long-term financial performance (Behl et al., 2022; Burcă et al., 2024). Therefore, we propose the following hypothesis:

Hypothesis 6: The quality of accounting information has a positive effect on the financial performance of energy companies.

1.3. RESEARCH DESIGN

1.3.1. Data

This study uses information for 169 listed energy companies that operate in 50 countries between 2016-2022.[1] They operate in various subsectors of energy, i.e., coal, oil and gas, renewable energy, and uranium. The ESG performance indicators and the financials were provided by the London Stock Exchange Group's (LSEG) Data & Analytics database, previously Refinitiv of Thomson Reuters.

[1] Details of countries and number of observations as a percentage: Argentina 0.48%; Australia 3.86%; Austria 0.48%; Belgium 0.48%; Brazil 1.93%; Canada 12.32%; Chile 0.24%; China 8.70%; Colombia 0.48%; Cyprus 0.24%; Denmark 0.24%; Finland 0.24%; France 1.93%; Germany 0.72%; Greece 0.48%; Hong Kong 1.21%; Hungary 0.24%; India 4.11%; Indonesia 1.93%; Israel 0.24%; Italy 0.97%; Japan 1.93%, Jersey 0.24%; Kazakhstan 0.48%; Korea, Republic 0.97%; Luxembourg 0.48%; Malaysia 3.14%; Mexico 0.24%; Monaco 0.24%; Mongolia 0.24%; Netherlands 0.7%2; New Zealand 0.48%; Nigeria 0.24%; Norway 3.14%; Philippines 0.24%; Poland 0.72%; Portugal 0.24%; Romania 0.24%; Russia 2.17%; Saudi Arabia 0.24%; Singapore 0.72%; South Africa 0.48%; Spain 0.72%; Sweden 0.97%; Switzerland 0.24%; Taiwan 0.24%; Thailand 2.42%; Turkey 1.21%; United Arab Emirates 0.97%; United Kingdom 5.07% and United States of America 28.99%.

This database is extremely comprehensive, tracking more than 90% of worldwide market capitalization and covering more than 630 distinct ESG drivers (LSEG, 2022). In the interest of data consistency and comparability's, the study confines itself to listed companies that have public ESG scores on the LSEG platform.

1.3.2. Variables

In Table A of Appendix A, the definitions, source, expected sign, and main references of the variables for the chapter are presented.

1.3.2.1. Dependent Variable

This research's dependent variable is Gross Profit Margin (GPMargin), a measure of a firm's profitability. It is a ratio measure of net operating income to operating cost. The higher the value of GPMargin, the greater the company's profitability and overall financial performance, with better management of operating costs. This measure is widely used in the literature to examine the relationship between operating and environmental strategies and financial performance (Gangata et al., 2024; Novy-Marx, 2013; Zhang & Xie, 2022).

In addition to GPMargin, this study also employs Return on Assets (ROA) as a complementary measure of financial performance in the robustness checks. ROA is one of the most widely used indicators in the literature, capturing a firm's operational efficiency by relating net income to total assets. Including ROA provides an additional lens to validate the consistency of results and enhances the robustness of the analysis (Issa, 2024; Tran & Vo, 2020; Xu et al., 2023).

1.3.2.2. Independent Variable

We have included various independent variables that impact GPMargin, each representing distinct dimensions of human capital, environmental capital, and information quality.

Human Capital

This study specifically deals with the factors that best explain human capital management and its link to financial performance: Human Capital Efficiency, Professional Development, and Salary Gap.

Human Capital Efficiency (HCE): While taking value-added intellectual coefficient (VAIC) into account, we have focused on value-added human capital (HCE). HCE measures how much an organization is leveraging its human capital to generate value. It is calculated through the formula:

$$HCE = \frac{ValueAdded}{Human\ capital}$$

Here, Value Added is attained by adding salary expense and compensation to EBITDA (Iazzolino & Laise, 2013). Human capital is measured based on total employee costs. A higher Human Capital Efficiency (HCE) indicates that a company is effectively leveraging its workforce to drive productivity and overall performance. This metric is especially relevant in the energy sector, where technological advancements and expertise are key drivers of competitiveness. Moreover, it has been widely used in prior research (Tran & Vo, 2020; Xu & Liu, 2019; Weqar et al., 2024).

Professional Development (PD): PD measures the company's investment in training and development initiatives, ranging from 0 to 100%. The closer the value is to 100%, the higher the company's investment in professional development. Companies that invest in training and development programs tend to have employees who are more competent, innovative, and adaptable, which can lead to improved financial performance. These investments have been shown to enhance employee productivity and contribute to long-term profitability (Suciu et al., 2020; Saks, 2019; Yertas, M. (2024).

Salary Gap (Salary Gap): The Salary Gap is utilized to quantify the pay difference between the CEO and the median employee. A large gap can indicate internal inequalities, which can negatively impact employee morale, productivity, and overall organizational cohesion. Large wage differentials have been found to lead to worse firm performance through the loss of employee trust and commitment (Anderson , 2021; Przychodzen & Gómez-Bezares, 2021).

Environmental Capital and Controversies

In this study, we have identified key factors representing environmental capital in the energy sector, specifically carbon risk, measured through CO_2 emissions, and ESG controversies.

CO_2 Emissions (CO2_Var): CO2_Var computes the percentage change in a company's yearly CO_2 emissions, including direct emissions from operations (Scope 1) as well as indirect emissions from the consumption of energy (Scope 2). The indicator illustrates the carbon risk proxy in this study, with lower value reflecting more sustainable operations. In the high environmentally impacted energy sector, emissions variation can affect financial performance due to regulatory pressure and consumers' requirement for greener firms (Wang, 2023; Bending et.al., 2023).

ESG Controversies (ESG_Con): ESG_Con quantifies the extent of a company's exposure to ESG controversy. This is expressed as a percentage, and the higher the score, the fewer the controversies. Those companies with lower exposures to ESG controversy are said to enjoy good reputations, fewer exposures to litigation, and greater investor confidence. The ESG controversy score is based on negative news coverage, such as lawsuits, fines, and regulatory scandals, and is widely used in research to quantify the impact of ESG policies on firm performance (Dorfleitner et al., 2020; Shakil, 2021).

Information Quality

Earnings quality (EQ) has been widely employed as a proxy measure of accounting information quality (Boachie & Mensah, 2022; Behl et al., 2022; Li et al, 2021; Rahman et al., 2024), which is "the degree to which historical earnings are reliable and more likely to persist" (LSEG, 2022). High-quality earnings suggest that the earnings reflect the firm's true financial health and will be maintained in the future. This study uses the LSEG database's StarMine Earnings Quality Model, which utilizes a quantitative multi-factor approach to predict earnings persistence, with a focus on accrual adjustments, cash flow generation, operating efficiency, revenue recognition, and indicators of management manipulation. These metrics are adjusted to account for the distinctive characteristics of each industry, as evaluations are conducted relative to sector-specific benchmarks that reflect the structural differences inherent to each industry.

1.3.3. Control variables

Control variables are also considered to address other variables that could influence the relationship between independent and dependent variables so that the findings would not be subject to any external factor. Based on previous research on the topic, we employed leverage, capital spending, firm size, and family firm ownership as control variables.

According to prior research (Lee et al., 2015; Alareeni & Hamdan, 2020), firm leverage (Lev) was defined as total debt divided by total assets. Similarly, capital expenditure (LnCapex), was defined as the natural log of capital expenditure, which is a firm's investment in fixed and intangible assets. More capital expenditures are revealed to be positively correlated with more operating efficiency and plans for expansion to enhance profitability (Tran & Vo, 2020; Rahim et al., 2017; Moussa & Elmarzouky 2023). Firm size (Size) was determined as the natural logarithm of total assets, which is used to eliminate the size effect of the firm on profitability. Big firms operate economies of scale, thus enhancing financial efficiency (Yadav et al., 2022; Zhong et al., 2024). Family_Sh is a dummy for family control. Family firms possess some governance and operating procedures, and these should influence performance. For energy companies, family businesses can place long-term survival ahead of short-term gain (Misani & Pogutz, 2015; Agnese et al., 2023).

As for the macroeconomic factors, GDP Growth Rate (GDP), reflects the overall economic environment in which the firm operates (Klein & Weill; 2022), Inflation, measures the impact of price changes on firm performance, Human Development Index (HDI), indicates the level of social and economic development in the nation where the company conducts business (Yilmaz, 2021) and Legal System (Civil_Com) is a dummy variable for whether the firm is located in a civil law regime, which may affect governance practices and regulatory compliance (Singh & Jaiwani, 2024).

1.4. EMPIRICAL RESULTS AND DISCUSSION

1.4.1. Reference Model

The study uses the following econometric model to estimate the impact of human capital, environmental capital, and accounting information quality on Gross Profit Margin:

$$\begin{aligned}\text{GPMargin}_{it} = \alpha + \beta_1 \text{HCE}_{i,t} + \beta_2 \text{PD}_{i,t} + \beta_3 \text{Salary\_Gap}_{i,t} + \beta_4 \text{CO2\_Var}_{i,t} \\ + \beta_5 \text{ESG\_Con}_{i,t} + \beta_3 \text{LNTA}_{i,t} + \beta_6 \text{EQ}_{i,t} + \beta_7 \text{Controls}_{i,t} + \eta \text{Year}_t \\ + \delta \text{ Industry} + \varepsilon_{it}\end{aligned}$$

Where GPMargin_{it} is a measure of the Gross Profit of a firm i in year t and $\text{HCE}_{i,t}$ is a metric of Human Capital Efficiency; $\text{PD}_{i,t}$ is a measure of a firm's investment in employee training and development programs, $\text{Salary\_Gap}_{i,t}$ is the pay gap between the CEO and the median employee, $\text{CO2\_Var}_{i,t}$ is an indicator of the carbon risk, annual variation in CO_2 emissions; $\text{ESG\_Con}_{i,t}$ is the ESG controversy score and $\text{EQ}_{i,t}$ is the Earnings Quality score. $\text{Controls}_{i,t}$ is a vector of control variables which are used to explain firm Gross Profit (firm variables: leverage, capital expenditure, size, family business ownership, and macroeconomic variables: GDP Growth Rate, Inflation, Human Development Index, and Legal System). $Year_t$ is a year dummy vector (from 2016 and 2022); Industry_t signifies the fixed-effect control of the industry, and εit is the random disturbance. α, β's, η and δ are the parameters which were to be estimated.

1.5. RESULTS AND DISCUSSION

1.5.1. Descriptive Analysis

In this first, to mitigate the potential influence of extreme observations, we minorized our firm data at the 2.5th and 97.5th percentiles. Table 2 presents the descriptive statistics for the overall sample, encompassing both the dependent and independent variables used in the main analysis as well as in the robustness checks.

The main dependent variable in our models, GPMargin (%), has a mean value of 20.81, which is relatively moderate for the sample, with a standard deviation of 67.52. The other dependent variable, ROA (%), has a mean of 2.71 and a standard deviation of 13.60. The average ROA in this study is lower than the values reported by Narwal and Yadav (2017), who found 3.8% in the Indian electricity sector. The lower profitability observed in global energy companies may be attributed to higher capital intensity, geopolitical risks, or stricter environmental regulations impacting margins. When comparing these figures with the findings of Behl et al. (2022), who reported an average ROA of 3.4% for 62 listed Indian energy firms—surprisingly close to the mean ROA of our sample.

For the independent variables, the mean values of HCE and VAIC are 6.11 and 6.28, respectively. Contrasting these results with those of Behl et al. (2022), who reported lower average values for VAIC (5.42) and HCE (4.86), our findings suggest that multinational energy firms demonstrate higher intellectual capital efficiency. This

disparity may be explained by the broader international coverage of our sample, which spans over 50 countries and includes firms from both developed and developing economies, reflecting greater diversity in organizational practices and resource allocation.

Regarding workforce-related indicators, the mean values for Workforce, PD, Diversity and Inclusion score (%) are 61.47, 34.94, 28.62, and 16.30, respectively. The Salary_Gap (%) shows a mean value of 44.18 with a standard deviation of 107.64. Concerning environmental aspects, the Environmental Score (%) has a mean value of 47.07, the ESG Controversies Score (%) averages 90.70, and the annual CO_2 variation (%) is 13.40. Suciu et al. (2020), in their examination of European firms, reported comparable levels of inclusion (18%) and ESG controversies (85%) to those found in our study. However, their figures for diversity, gender pay gap, and professional development were notably lower than ours. These differences may reflect a greater emphasis among energy companies—especially multinational ones—on employee training and the structuring of executive Asimakopoulos et al. (2020) compensation, even though inclusion outcomes remain an area of ongoing challenge.

Finally, regarding the quality of accounting information, the average EQ is 50.26%, and CSR_Report has an average of 0.81. When comparing EQ values using the same LSEG metrics, Rahman et al. (2024) reported an EQ of 57.31%, slightly higher than our sample's, with similar variability (SD = 27.24). This suggests comparable disclosure reliability across both studies. However, found a significantly lower EQ of 33.24%, indicating better accounting transparency and earnings persistence in the global energy sector. This disparity may be due to our sample's larger multinational firms, with stronger reporting standards and greater international exposure, compared to the smaller, domestically focused Greek firms in their study.

Additionally, firms in our sample exhibit a moderate reliance on debt (0.56), reflecting prudent financial management aimed at balancing growth and risk. Capital investment (Capex) is notably high (18.98), which is essential for expansion in the capital-intensive energy sector. The average firm size (22.00) suggests a diverse representation of both medium and large companies. Interestingly, the low proportion of family-owned firms (9.58%) indicates that most companies are not under family control, despite the significant role that family firms play in key industries such as oil and gas in certain countries.

Regarding macroeconomic variables, GDP growth rate (1.85%) and inflation (2.21%) are low, though they exhibit high standard deviations, reflecting variation in the economic environments in which firms operate. The Human Development Index (HDI) is high (0.87), indicating that most firms are based in countries with acceptable levels of social and economic development, which may positively impact labor productivity and resource availability. Finally, the heterogeneity of legal systems—38.68% based on civil law—highlights the diversity of regulatory contexts in which firms operate.

Table 2. Descriptive Statistics of Variables

Variable	Mean	Standard Deviation	Minimum	Maximum	Obs.
GPMargin (%)	20.81	67.52	-100	432.83	2,867
ROA (%)	2.71	13.60	-47.93	51.17	2,831
HCE	6.11	9.70	-14.98	57.51	1,805
VAIC	6.28	9.94	-16.75	56.87	1,806
PD (%)	34.94	21.63	0.00	91.00	1,851
Diversity (%)	28.62	13.65	0.00	70.00	1,851
Inclusion (%)	16.30	19.91	0.00	95.00	1,851
Environmental score (%)	47.07	24.71	0.00	96.92	2,178
Workforce score (%)	61.47	25.40	0.94	99.84	2,178
CO2_Var (%)	13.40	83.77	-83.00	688.60	1,515
Salary Gap (%)	44.18	107.64	0.25	870.83	1,077
ESG_Con (%)	90.70	22.78	0.67	100.00	2,178
EQ (%)	50.26	29.88	1.00	100.00	2,671
CSR_Reporting	0.81	0.39	0.00	1.00	2,177
Lev	0.56	0.24	0.06	1.63	2,866
Capex (Ln)	18.98	2.14	13.39	23.75	2,836
Size (Ln)	22.00	1.84	17.62	26.52	2,866
Family_Sh (%)	9.58	29.43	0.00	100.00	2,704
GDP (%)	1.85	3.23	-11.00	7.80	2,898
Inflation (%)	2.21	3.45	-2.10	58.40	2,898
HDI	0.87	0.11	0.00	0.96	2,898
Civil_Com (%)	38.68	48.71	0.00	100.00	2,898

Source: own elaboration

Table 3 shows generally low values, indicating the absence of strong linear relationships among the independent variables. This suggests that multicollinearity is unlikely to be a serious concern. To confirm this, a Variance Inflation Factor (VIF) analysis can be conducted, which would further validate the absence of multicollinearity issues.

Table 3. Correlation Matrix

	EQ	CSR_Rep.	VAIC	HCE	Salary Gap	Workforce	PD	Diversity	Inclusion	Envi. Sc	CO2_Var	Lev	LnCapex	Size	Family_Sh	GDP	Inflation	HDI	Civil_Com
EQ	1.0000																		
CSR_Rep.	0.0666	1.0000																	
VAIC	0.0944	-0.0102	1.0000																
HCE	0.0514	-0.0009	0.9255	1.0000															
Salary_Gap	-0.0885	0.0437	0.2236	0.2337	1.0000														
Workforce	0.0070	0.3637	-0.0102	-0.0119	-0.0400	1.0000													
PD	0.0759	0.2802	-0.0418	-0.0389	0.0823	0.5265	1.0000												
Diversity	0.1155	0.1705	0.0287	0.0456	0.1144	0.3832	0.2726	1.0000											
Inclusion	0.1083	0.1484	0.0805	0.0862	0.1443	0.3573	0.1430	0.3091	1.0000										
Env. Sc	0.0436	0.2606	-0.0025	-0.0199	0.0887	0.6653	0.5443	0.3343	0.2677	1.0000									
CO2_Var	-0.0180	0.0223	-0.0095	-0.0253	-0.0254	-0.0810	-0.0128	-0.0408	-0.0292	-0.0911	1.0000								
Lev	0.0640	-0.0125	-0.1692	-0.1659	-0.0374	-0.0018	-0.0340	0.0350	0.1065	0.1030	0.0251	1.0000							
LnCapex	-0.0159	0.1117	0.1750	0.1525	0.1793	0.3023	0.1544	0.1696	0.3480	0.4414	0.0080	0.0104	1.0000						
Size	0.0508	0.1597	0.1767	0.1472	0.1904	0.4017	0.2486	0.2315	0.3755	0.5875	0.0004	0.0643	0.7107	1.0000					
Family_Sh	-0.0127	-0.0733	0.0091	0.0277	-0.0115	-0.1894	-0.1308	-0.1157	-0.1087	-0.1841	0.0875	0.1680	-0.1193	-0.1688	1.0000				
GDP	-0.1857	-0.0788	-0.0434	-0.0400	-0.0413	-0.0114	0.0526	-0.3344	-0.1119	0.0204	0.0367	-0.0217	0.0609	0.0496	-0.0928	1.0000			
Inflation	-0.1505	-0.0171	-0.0344	-0.0383	-0.0148	-0.0792	0.0091	-0.2667	-0.0787	-0.0382	0.0122	0.0611	0.1202	0.1085	-0.0564	0.2405	1.0000		
HDI	0.0339	-0.0247	0.0121	0.0370	0.0476	-0.1371	-0.1023	0.2502	0.0191	-0.2380	0.0383	-0.1415	-0.1488	-0.1831	-0.0889	-0.2455	-0.2797	1.0000	
Civil_Com	0.0843	0.1300	-0.0271	-0.0580	-0.1166	0.3508	0.2867	0.1331	0.0331	0.4471	-0.0277	0.0776	0.2054	0.2428	-0.0499	0.0249	-0.1551	-0.1526	1.0000

Source: own elaboration

1.5.2. Multivariate Analysis

The study employs Ordinary Least Squares (OLS) estimation with year and industry-fixed effects to analyses the determinants of the Gross Profit Margin. This approach accounts for unobserved heterogeneity, as well as time and industry influences, while obtaining robust standard errors from white cross-sectional error variances mitigate potential heteroscedasticity.

Table 4 shows the results of our regression models, which examine the effects of different factors on the GPMargin of energy companies. The following are the interpretations of the results against the theories and literature presented previously in the paper. Model 1 examines the effect of the independent and firm control variables on the dependent variable, GPMargin. Model 2 introduces the macroeconomic variables—GDP Growth Rate, Inflation, Human Development Index, and Legal System. Model 3 introduces year and industry-fixed effects.

Table 4. OLS Regression Analysis

	GPMargin (1)	GPMargin (2)	GPMargin (3)
HCE	3.241*** (0.568)	3.229*** (0.568)	2.970*** (0.593)
PD	0.468*** (0.139)	0.506*** (0.149)	0.501*** (0.160)
Salary_Gap	-0.066** (0.033)	-0.072** (0.033)	-0.073** (0.033)
CO2_Var	-0.032*** (0.011)	-0.035*** (0.012)	-0.028** (0.012)
ESG_Con	0.137** (0.064)	0.137** (0.064)	0.160** (0.073)
EQ	0.212*** (0.068)	0.213*** (0.067)	0.202*** (0.077)
Lev	-22.702*** (8.359)	-21.475** (8.554)	-21.339*** (8.111)
LnCapex	2.297 (2.401)	2.171 (2.399)	2.167 (2.860)
Size	-3.707 (3.276)	-3.084 (3.242)	-3.277 (3.785)
Family_Sh	31.451*** (10.797)	32.713*** (11.387)	30.784*** (10.643)
GDP		-0.133 (0.445)	-0.656 (0.788)
Inflation		0.986 (1.127)	1.042 (0.987)
HDI		22.614 (13.983)	5.298 (12.168)
Civil_Com		-3.871 (4.166)	-4.506 (4.990)
Year			YES
Industry			YES
Constant	10.511	-22.686	30.309
	(42.088)	(47.843)	(74.735)
N	573	573	573
R^2	0.3145	0.3182	0.3626

Source: Own elaboration

Note: Data enclosed in () are robust standard error. Dummy variables for time and industry have been used in model (3). Asterisks indicate significance at the 10 per cent (*), 5 per cent (**) and 1 per cent (***) levels

1.5.2.1. Human Capital and Financial Performance

The analysis reveals in Table 5 a positive and significant relation between HCE and GPMargin. These results validate Hypothesis 1; human capital effectiveness positively impacts financial performance. This is in line with Bryl (2018), Cindiyasari et al. (2022), Okere and Igba (2023), Tran and Vo (2020), and Xu and Liu (2019), who highlighted that effective human resource management enhances operational efficiency and profitability across various economic sectors. Additionally, studies such as Weqar et al. (2024), which investigated a significant impact of human capital effectiveness in Indian wind power companies, also validate this result.

Similarly, there is a positive relation between professional training and GPMargin, confirming Hypothesis 2. Our results are in line with Diaz-Fernandez et.al (2015), Elnaga and Imran, (2013), Manresa et al. (2019), Noreen and Imran (2021), Rahim et al. (2017), and Quartey's (2012) who argued that investments in employee training and development enhance productivity and innovation, leading to better financial outcomes. The positive impact of professional training can also be seen in studies like Aleem and Bowra (2020), Rahman and Akhter (2021), and Thoresen et al. (2004), which all refer to the importance of systematic training in restricting turnover, improving job satisfaction, and increasing profitability.

Regarding differentials in wages, there is the negative and significant relationship between CEO-employee wage gaps and GPMargin. Hypotheses 3 and the Relative Deprivation Theory are therefore supported by our findings. Consistent with prior research (Chuang et al., 2018; Osiichuk, 2022; Przychodzen & Gómez-Bezares, 2021; Wang, M.C et al. 2024), excessively large pay gaps negatively impact employee morale, commitment, and job satisfaction, ultimately weakening organizational cohesion. Additionally, although good corporate governance contributes to firm value, it also can enhance wage inequalities, which have negative financial consequences. Additionally, while good corporate governance enhances firm value, it can also exacerbate wage inequalities, leading to negative financial consequences. Martono et al. (2022) suggest that while moderate pay differences may benefit financial performance, excessively large disparities—particularly at the executive level, disrupt communication and cooperation, ultimately resulting in financial inefficiencies.

1.5.2.2. Environmental Capital, Controversies and Financial Performance

The empirical results of the research provide a strong and negative relationship between profitability and CO_2 emissions, confirm Hypothesis 4. This is also asserted by Al-Fakir Al Rabab'a et al., (2024), Busch and Lewandowski (2017), Loohuis (2022), Gallego-Álvarez et al., (2015); Lee et al., (2015), Sariannidis et al., (2013), Zhong et al. (2024), Wang (2023), and Wang, J et al. (2024), who demonstrate that carbon risks not only increase operating costs but also destabilize financial performance.

Our findings reveal a strong positive correlation between ESG controversy scores and financial performance, supporting Hypothesis 5. Companies entangled in ESG scandals and governance issues tend to experience poor financial performance, consistent with prior research by Dorfleitner et al. (2020), Gillan et al. (2021). These studies highlight that ESG controversies result in reputational damage, regulatory

scrutiny, and loss of investor confidence, all of which contribute to financial underperformance. Additionally, Jucá et al. (2024) found that ESG controversies have a particularly severe negative impact on firms operating in environmentally sensitive industries, with the energy sector being the most affected.

1.5.2.3. Accounting Information Quality and Financial Performance

The analysis reveals a positive and significant relationship between earnings quality (EQ) and GPMargin, confirming that high-quality financial reporting enhances financial performance and supporting Hypothesis 6. This finding aligns with prior research by Boachie and Mensa (2022), Li et al. (2021), and Rahman et al. (2024), which demonstrates that transparent financial disclosures contribute to stronger financial outcomes. Furthermore, Bushman and Smith (2001) and Wang (2006) highlight that high-quality earnings reports reduce information asymmetry and mitigate agency conflicts between managers and shareholders, ultimately fostering improved financial performance—a conclusion strongly reinforced by this study.

The findings highlight the critical role of managerial decisions regarding earnings management in sustaining firms' financial resilience. This underscores the need for stronger corporate governance frameworks and the implementation of more effective and high-quality regulatory and institutional mechanisms.

1.5.2.4. Control Variables

This study identifies key control variables that affect financial performance in the energy sector. These variables were analysed to enhance the robustness of the results and offer a deeper insight into the factors influencing GPMargin.

The results indicate that high leverage negatively impacts financial performance, confirming findings from previous studies (Makridou et al., 2024; Okere & Igba, 2023). Additionally, this study finds that capital expenditures have an insignificant relationship with financial performance. While long-term investments in assets are essential for sustainable firm growth, their short-term impact on profitability is not necessarily substantial. This aligns with Tran and Vo (2020), who demonstrated that investments in human capital can yield greater financial returns than capital expenditures in energy-intensive industries. Their findings suggest that while capital investments enhance infrastructure, returns from intellectual and human capital investments play a more critical role in shaping financial performance. Similarly, Cindiyasari et al. (2022) highlight that intellectual capital efficiency is a key driver of financial performance, reinforcing the notion that physical capital investments alone do not guarantee profitability.

The study finds that firm size does not necessarily translate into higher profitability, as larger firms are more prone to bureaucratic inefficiencies and operational inflexibility. This aligns with Okere and Igba (2023), who demonstrated that the relationship between human capital investment and financial performance is industry-specific, making firm size an unreliable indicator of profitability. Similarly, Weqar et al. (2024) provide empirical evidence that intellectual capital efficiency is a more significant driver of financial success than firm size alone. Diaz-Fernandez et al. (2015) further argue that employee security and firm-specific training, rather than firm

size, are key determinants of financial performance, reinforcing the importance of employee development.

Additionally, the study finds a positive relationship between family ownership and financial performance. This supports the findings of Bryl (2018) and Watkins Fassler (2018), who highlight that family-owned firms tend to have long-term strategic goals, which contribute to sustained profitability.

Regarding macroeconomic factors, the study finds that GDP growth rate, inflation, the Human Development Index (HDI), and the legal system type do not significantly impact financial performance. As the energy sector becomes increasingly globalized, many energy companies are expanding their operations beyond their home countries. Cai et al. (2016) supporting the notion that financial globalization reduces the relevance of national factors. Instead, internal firm-specific factors play the most significant role in shaping the financial profitability of companies in the energy sector.

1.5.2.5. Robustness and Complementary Analysis

We carried out extensive additional analyses to strengthen the robustness of our findings and address any potential concerns. These evaluations focused on confirming the reliability and consistency of our results while reducing the impact of alternative explanations and methodological limitations.

1.5.2.5.1. Alternative measures of core variables

First, we re-estimated (see Table 5) Equation (1) using alternative measures for our main variables. The following robustness table provides a detailed analysis of the stability and consistency of the results obtained in our study.

Table 5. Robustness Check Results.OLS

	ROA (1)	ROA (2)
CSR_Report	2.621** (1.154)	2.799** (1.224)
VAIC	0.563*** (0.052)	0.527*** (0.056)
Workforce_Score	-0.014 (0.019)	
Diversity		-0.079*** (0.025)
Inclusion		-0.003 (0.015)
Environmental_Score	0.046** (0.020)	0.035* (0.018)
CONTROL	YES	YES
Year	YES	YES
Constant	5.029	7.862
	(5.626)	(6.021)
N	1,311	1,099
R^2	0.3850	0.3663

Source: Own elaboration

Note: Data enclosed in () are standard error. Dummy variables for time have been used. Asterisks indicate significance at the 10 per cent (*), 5 per cent (**) and 1 per cent (***) levels

In Equation (1), we use ROA as an alternative measure of financial performance, calculated by dividing net income after taxes by average total assets. ROA is a widely recognized metric for evaluating operational efficiency and overall financial performance, as demonstrated in previous studies by Issa (2024), Tran and Vo (2020), Yilmaz (2021), and Xu et al. (2023).

Regarding the independent variables related to human capital, Model (1) incorporates the total value added by intellectual capital (VAIC) as an alternative measure of human capital efficiency. To assess the company's overall commitment to its employees, we used the Workforce subdimension of the social score. In Model (2), we include diversity and inclusion indicators, recognizing the growing body of research highlighting the significant impact of these effective human capital management practices on corporate performance (Suárez-Fernández et al., 2024).

Although VAIC remains a significant variable in the model, positively influencing ROA, consistent with the findings of Tran and Vo (2020) for the energy sector, the Workforce subdimension score does not show a statistically significant effect. Moreover, a stronger focus on diversity and inclusion policies does not necessarily lead to better financial performance; in some cases, these diversity policies may even negatively impact ROA. In this regard, Beraki et. al., (2022) highlights the complexity of the relationship between diversity and financial efficiency, noting that greater female representation may initially increase operational costs and require capacity-building efforts. However, despite these challenges, gender diversity remains essential for fostering more inclusive governance structures (Baker et al., 2021).

This implies that company's social commitment to its employees, including workforce-related indicators, may influence financial performance indirectly or over time. Moreover, the lower variability of workforce scores across firms, compared to the environmental pillar, may have constrained their measurable impact on financial outcomes. Notably, as seen in the base model, only opportunities for employee training and development exhibit a positive and significant association with financial performance.

In relation to environmental capital, we utilized the environmental score as a primary variable. The findings indicate that higher environmental scores are associated with increased ROA, consistent with previous studies across various sectors (Duan et al., 2023; Hang et al., 2019; Huang, 2021; Siwiec & Karkowska, 2024; Trumpp & Guenther, 2017; Velte, 2017). However, limited research has examined the firm-level factors influencing ESG performance in the energy sector (Shahbaz et al., 2020).

In the base model, companies with elevated CO_2 emissions tend to see a decline in gross margin, underscoring the detrimental effects of environmental damage on financial performance. In contrast, initiatives aimed at enhancing environmental performance, reflected in improved environmental scores, positive impact. Strong ESG performance not only helps companies cultivate a positive reputation, but also mitigates operational risks, boosts market competitiveness (Zhou et al., 2022; He et al., 2022; Dasgupta, 2022). Consequently, it plays a crucial role in shaping corporate performance (Ellili & Nobanee, 2023).

These findings reveal a complex interplay between the environmental and social pillars and their impact on financial performance in the energy sector. They emphasize the importance of understanding how sustainability practices translate into financial outcomes. While environmental strategies appear to be most directly linked to profitability, particularly as companies actively manage climate change risks to enhance financial performance, social factors, especially those related to the workforce, show a more nuanced effect.

In the short term, workforce-related social factors cannot be considered a tangible source of financial performance, as their impact often requires longer time horizons to fully materialize. However, specific aspects, such as a company's commitment to training and development, demonstrate a more immediate influence on operational efficiency and financial performance in the energy sector.

In relation to accounting information quality, we have included the preparation of non-financial reports by companies as a measure of this quality. CSR reporting plays a crucial role in enhancing financial transparency and aligning corporate strategies with societal expectations. As a key tool for communicating a company's sustainability efforts, non-financial reporting, particularly ESG disclosures, provides stakeholders with a comprehensive view of corporate goals and societal impact.

Our results demonstrate a positive and significant relationship between sustainability reporting and ROA. This finding aligns with Christensen et al. (2021) and Etim et al. (2022), who emphasize that such disclosures attract socially responsible investors, enhance corporate reputation, and foster financial stability. Furthermore, transparency mitigates information asymmetry, strengthens shareholder oversight, and boosts market confidence, ultimately leading to improved economic performance (Jiang et al., 2023; Kudal et.al., 2024).

1.5.2.5.2. Sub-sample comparison and alternative model

Previous research examining the relationship between human, environmental and informational capital and economic performance is mainly based in developed countries. Our primary analysis is conducted within an international framework, enabling a more comprehensive examination. To enhance the analysis further, countries are categorized as either developed or developing based on the criteria set forth by the United Nations[1].

The results presented in Table 6 show that for developed countries, the results are the same as for the full sample. However, for developing countries the only significant variable is the HCE, and all other variables are not significant. In other words, the effects of Professional Development, salary gap, a high CO_2 emission, ESG controversy and Earnings Quality are only significant in developed countries.

It is important to note that the number of observations for the developed-country group is considerably higher than for the developing-country group. This difference in sample size may partly explain why certain variables show stronger statistical significance in developed markets, while fewer variables appear significant in

developing markets. As such, the comparative interpretation of results should take this imbalance into account.

Although the energy sector is becoming increasingly global as companies expand beyond their home countries, institutional differences between developed and developing nations remain significant (Gómez-Bolaños et al., 2022). While financial globalization reduces the influence of national factors, home-country conditions still shape the relationship between Corporate Social Performance (CSP) and financial performance in energy companies. Our findings align with those of Naeem et al. (2022), who studied environmentally sensitive industries and found that firms in developing countries often engage in social and environmental initiatives primarily to comply with legal requirements.

Additionally, research from MSCI ESG Ratings in Global Equity Markets: A Long-Term Performance Review (MSCI, 2024a) highlights a striking contrast in ESG performance across regions. In carbon-intensive sectors like energy, companies with stronger ESG ratings outperformed their peers in advanced economies. However, in emerging markets, the opposite was observed firms with higher ESG ratings underperformed (MSCI, 2024a). This disparity stems from the different stages of the fossil fuel transition. Many emerging economies remain heavily reliant on coal and continue to expand its use for power generation, even as they gradually integrate renewable energy sources (Shakdwipee et al., 2023).

Table 6. Robustness Check Results: OLS and RE GLS

	GPMargin	**GPMargin**	**GPMargin**
	Developed (1)	Developing (2)	RE GLS (3)
HCE	3.307*** (0.664)	2.697*** (0.705)	3.814*** (0.282)
PD	0.679*** (0.196)	0.267 (0.204)	0.415*** (0.158)
Salary_Gap	-0.088** (0.042)	0.022 (0.033)	-0.057** (0.026)
CO2_Var	-0.037*** (0.012)	-0.045 (0.058)	-0.037* (0.020)
ESG_Con	0.168* (0.090)	0.155 (0.116)	0.147 * (0.096)
EQ	0.320*** (0.086)	0.049 (0.100)	0.113 * (0.073)
CONTROL	YES	YES	YES
Constant	-0.602 (61.856)	-118.961 (88.446)	-0.362 (69.462)
Year	YES	YES	YES
Industry			YES
N	391	182	573
R^2	0.3826	0.3685	0.4419

Source: Own elaboration

Note: Data enclosed in () are standard error. Dummy variables for time have been used. Asterisks indicate significance at the 10 per cent (*), 5 per cent (**) and 1 per cent (***) levels. In model (3) we use the Random-effects GLS regression model has been estimated with the independent variables lagged by one period.

Finally, we assess the robustness of our initial results by applying alternative estimation methods. Specifically, we employ a random-effects generalized least squares (RE GLS) model to analyze the impact of firm-specific characteristics on the response variable within a panel data set. Despite spanning a seven-year period, the dataset is highly unbalanced, with numerous missing observations. By controlling for year and industry effects, this model provides a more precise evaluation of the relationship between sustainability, information quality, and financial performance.

Unlike fixed-effects models, the random-effects approach preserves covariates with minimal variability over time and mitigates omitted variable bias by accounting for unobserved firm-specific variations through the term ε_{it}. The results, presented in Table 6, Model 3, are highly consistent with those obtained using the original estimation method, reinforcing the robustness of our findings.

Our findings are strongly supported by consistent results across various analyses and model specifications. Robustness tests further strengthen our conclusions and address potential concerns regarding alternative explanations or methodological limitations.

1.6. CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH DIRECTIONS

This study integrates Resource-Based, Stakeholder, and Institutional Theories to examine the combined effect of human capital, environmental capital, controversies and information quality on the financial performance of 169 multinational energy firms (2016–2022), within the context of the global energy crisis and the shift toward a sustainable energy future.

The findings indicate that human capital is a central driver of corporate profitability, with efficient human capital management and investment in professional development positively associated with improved financial performance. Conversely, excessive CEO–employee pay gaps undermine employee morale, cohesion, and organizational trust, thereby reducing overall productivity and profitability. On the environmental side, higher CO_2 emissions were found to have a detrimental effect on firm performance, reflecting the hidden financial costs of environmentally unsustainable practices. ESG-related controversies also emerged as a significant source of reputational damage, legal risk, and diminished investor confidence, further weakening corporate value. In contrast, transparent and high-quality financial reporting was shown to play a pivotal role in enhancing trust, reducing information asymmetry, and providing firms with a competitive edge.

Taken together, these results validate the multi-theoretical framework and suggest that a general strategy—combining human capital development, environmental stewardship, and transparent reporting—offers the most sustainable pathway to long-term competitiveness in the energy sector. Firms that balance financial objectives with sustainability imperatives are better placed to navigate regulatory pressures, address stakeholder expectations, and secure enduring market advantages. Although the energy industry is increasingly globalized, the results highlight that institutional differences between developed and developing countries continue to shape how corporate social performance translates into financial outcomes.

The implications of these findings extend to multiple stakeholder groups. For managers, the results emphasize the need to prioritize employee training and development, reduce pay inequities, adopt sustainable practices, and ensure transparency in both financial and non-financial reporting. Policymakers and investors, in turn, must recognize the critical role of these practices in promoting resilience, strengthening competitiveness, and ensuring long-term value creation in an industry subject to unprecedented scrutiny and transition pressures. Importantly, fair compensation systems and targeted professional development initiatives not only enhance human capital effectiveness but also stimulate innovation and productivity—factors vital for energy companies competing in rapidly evolving markets. Similarly, proactive measures to reduce carbon emissions and strengthen governance frameworks mitigate regulatory and reputational risks while positioning companies to attract sustainability-focused capital.

The evidence also highlights the importance of robust governance mechanisms in preventing ESG scandals, which can otherwise impose substantial financial and reputational costs. Transparent reporting—both financial and ESG-related—strengthens investor confidence, enhances corporate reputation, and provides stakeholders with a comprehensive understanding of organizational strategy and societal impact. In this way, firms that embrace financial transparency and sustainability disclosure are better equipped to maintain market stability and long-term growth.

Beyond managerial implications, the findings point to policy directions. Regulators should reinforce frameworks that encourage carbon reduction, professional development investment, and stringent ESG disclosure, thereby harmonizing economic performance with environmental and social objectives. Tighter enforcement of sustainability reporting requirements and incentives for green innovation can further support the transition to a low-carbon economy while improving firms' financial standing. Moreover, policies addressing wage disparities can promote greater organizational cohesion and productivity, ultimately benefiting both corporate performance and broader social outcomes.

Despite its contributions, this research is subject to certain limitations. The analysis is confined to publicly listed energy companies—across coal, oil and gas, renewables, and uranium subsectors—meaning the findings may not be generalizable to privately held firms or other industries. Furthermore, the study focuses on the period 2016–2022, which, while extensive, may not fully capture the longer-term impacts of emerging environmental regulations, technological advancements, or shifts in social policy.

Future research could address these limitations by broadening the sample to include firms in other industries, incorporating smaller or privately owned companies, and extending the time horizon to account for new developments in the global sustainability landscape. Moreover, comparative country-level analyses would provide deeper insight into how national institutional frameworks mediate the relationship between ESG practices and financial outcomes. Finally, exploring the interplay between human capital, environmental strategies, and information quality under evolving economic, political, and technological conditions would offer a more comprehensive understanding of the mechanisms linking sustainability to financial performance.

2

Does Corporate Social Performance Improve Environmentally Adjusted efficiency? Evidence from the Energy Sector

2. DOES CORPORATE SOCIAL PERFORMANCE IMPROVE ENVIRONMENTALLY ADJUSTED EFFICIENCY? EVIDENCE FROM THE ENERGY SECTOR

ABSTRACT

This study analyses the impact of corporate social performance (CSP), proxied by the Environmental, Social and Governance (ESG) Index and its pillars and dimensions, on the environmentally adjusted efficiency (EAE) of 239 listed companies, over the period 2016–2021, in the global energy sector. The EAE index, estimated via data envelopment analysis (DEA), assesses the efficiency of companies by considering economic aspects alongside CO_2 and energy consumption reduction targets. Our results support the hypothesis that only above a certain level of performance, do CSP practices positively influence EAE, so there is a non-linear U-shaped association between the overall ESG score and EAE. The same holds for the social and governance pillars, and the human rights and management subspecific dimensions, on EAE. Other ESG attributes show a positive linear relationship with EAE, namely the environmental pillar, the environmental innovation dimension and the shareholder dimension. Our paper has significant implications for companies, policy makers and researchers insofar as it estimates EAE and indicates which CSP practices should be invested in over the long term to have a positive effect on it.

Keywords: corporate social performance, data envelopment analysis, energy sector, environmental firm efficiency, ESG, U-shaped.

2.1. INTRODUCTION

Energy is essential for the development of any economic activity and, therefore, for the social and economic progress of any society. The price of energy is an important component of the cost of production of many goods and services and, although it varies by sector, its fluctuations have a great influence on its profitability (European Commission, 2020). For this reason, the sector that encompasses energy-producing and -distributing companies is considered of strategic importance. Moreover, the energy sector plays an essential role in the fight to mitigate the harmful effects of climate change since, firstly, fossil energy sources are responsible for 80% of CO_2 emissions (Iernational Energy Agency [IEA], 2018), and secondly, thanks to technological advances, the development of the renewable energy industry is one of the pillars that will prevent the worst effects of rising temperatures from becoming a reality.

With this in mind, and because of the concern about the impact of their activity on society, energy companies have followed Corporate Social Responsibility (CSR) practices for decades to meet regulatory requirements and international initiatives and agreements, such as the Sustainable Development Goals (SDGs) (Curran, 2017). In addition to regulatory compliance, and due to their high visibility, companies in this sector also invest in CSR activities to improve their public image and reputation (Aguilera et al., 2017), which could influence the value of companies, which arouses interest among researchers.

Although the relationship between Corporate Social Performance (CSP) and Financial Performance (FP) has been the focus of numerous studies since the seminal paper of Bragdon & Marlin (1972), this nexus had not specifically been examined in the energy sector until last decade (e.g., Sepúlveda & Mendizabal, 2011; Ekatah et al., 2011; Pätäri et al., 2014; Bracco, 2015; Shahbaz et al., 2020).The results from these studies are inconclusive, nevertheless, and almost all of them were conducted under the assumption of there being a linear relationship between the two variables.

Our work makes significant contributions to different aspects of literature on the subject. The first one we propose adopting is environmentally adjusted firm efficiency (EAE) by employing data envelopment analysis (DEA); this is unlike previous studies on the energy sector that use accounting and/or market measures as proxies for FP given that firms are also expected to contribute to environmental sustainability by improving their environmental efficiency. In this regard, we include the use of environmental variables such as energy use and carbon dioxide emissions at the same time as accounting and market traditional financial measures.

Secondly, the lack of consensus in the existing literature suggests a non-linear relationship between CSP and efficiency, as well as a high specificity by industry. The industry's sensitivity to the environment is linked to the harm that its activity does to it (Kludacz-Alessandri & Cyganska, 2021). Since the recent study of Kumar et al. (2022) is the only one that analyzes the curvilinear effect of the performance of CSR activities on FP in the energy sector, our work makes a significant contribution to this field of research.

Thirdly, since the CSR activities developed in an oligopolistic industry are very varied, our paper is pioneering in that it analyzes the effect of conducting a range of these (e.g., use of resources and human rights) on the energy sector, and specifically on EAE.

Based on stakeholder theory and Reinhardt's (1999) hypothesis, which asks "when it pays to be green", since this question has been answered, our work aims to analyze the influence of CSP on EAE in the energy sector. We divide the empirical analysis into two stages: in the first one, to obtain a more reliable measure of EAE, we use the bootstrap method introduced by Simar & Wilson (2007). In the second stage, truncated regression is used to explore the relationship between CSP and EAE. We employ the Tobit methodology with random effects to test for robustness, and the results support our primary findings. We consider several profitability and liquidity metrics as well as macroeconomic factors like GDP growth and oil prices.

The results obtained support the "too little of a good thing" (TLGT) metatheory, thus indicating a non-linear U-shaped relationship between CSP and EAE, with the latter being positively influenced when there is a minimum level of the former. The performance of the environmental component does not appear to have an impact on EAE in the disaggregated assessment of the performance of the dimensions that make up the overall CSP index, but we can see the similar curvilinear relationship in both the social and corporate governance dimensions. These results are in line with those obtained by Ren et al. (2022) in the industrial sector, López-Penabad et al. (2022) in the financial sector, Wang et al. (2016) in the construction sector, and Franco et al. (2020) in the hospitality sector. In the detailed analysis of the subcomponents, we find the same TLGT effect of the activities "resource use", "human rights" and "management" for the ESG index dimensions, respectively. The implemented three-step method proposed by Lind & Mehlum (2010) allows us to confirm our results.

The rest of the paper is organized as follows: section 2.2 presents the theoretical framework and the hypotheses based on previous literature; section 2.3 describes the methodology used in the study; section 2.4 presents and discusses the main empirical results; finally, section 2.5 highlights the main conclusions, discusses the limitations, and makes suggestions for future research to expand upon the analysis performed.

2.2. THEORETICAL FRAMEWORK AND DEVELOPMENT HYPOTHESES

As the neoclassical perspective argues (Friedman, 1970), investing in CSR activities entails costs, but, according to the social impact hypothesis of Cornell & Shapiro (1987), investment in CSR practices may be an important driver that leads to FP improving. The latter hypothesis is supported, for example, by Coelho et al. (2023), but Reinhardt's hypothesis states that the sign of this interaction depends on the CSP level (Reinhardt, 1999). Stakeholder theory (Freeman, 1984) analyses the relationship between CSR activities and FP, and from this perspective, the former may leave a favorable impression of the firm to its stakeholders (e.g., employees, customers, suppliers or environmentalists). Nonetheless, stakeholders might value efforts in CSR activities made by companies only when a minimum threshold is exceeded (Trumpp & Guenther, 2017), known as the U-shaped effect, or "too little of a good thing" (TLGT). This implies that CSR activities have a negative impact on FP at first then a positive one. The change from negative to positive may be due to the CSR strategy carried out by companies. According to Fuji et al. (2013), businesses that adopt reactive CSR strategies, conducting more CSR activities only when they are legal requirements, make

more costs than profits, while those that use a proactive CSR strategy, which goes beyond regulatory requirements, see the opposite financial situation occur. By undertaking CSR activities to reduce the environmental impact of the company's operations, meeting stakeholders' expectations may initially cause additional drawbacks that outweigh the upsides, but at a certain point it may also lead to an improvement in the corporate reputation among stakeholders, resulting in higher profits.

2.2.1. Global CSR performance and FP

One of the main reasons companies in the energy sector engage in CSR activities is to comply with the regulatory framework which they are subject to (Dilling & Harris, 2018). However, companies also engage in CSR activities voluntarily, to, among other reasons, forge their corporate culture (Ngoasong, 2014), or safeguard their public image due to the reputational risk to which this sector is exposed (Oh et al., 2018; González-Ramos et al., 2018). All these reasons are ultimately reflected in the income statement, either positively or negatively.

Most research examining how impactful CSR firm initiatives are, positively links them to business value, but this effect seems to be more pronounced in industries with a greater effect on the environment, such as those in the energy sector (Arslan-Ayaydin & Thewissen, 2015). According to many studies (Pätäri et al., 2012; Bracco, 2015; Shukla &Geetika, 2022), the sustainability practices of energy companies increase their value. The execution of CSR initiatives can positively influence FP, either through cost savings, for example, by not being financially penalized for climate change risks (Sepúlveda & Mendizabal, 2011), or, directly, through increased revenues (Ekatah et al., 2011).

In the energy sector, research on the effects of performance measures for CSR activities on FP has received considerable attention. These effects maybe positive (Zhou & Wei, 2016; Sidhoum & Serra, 2017; Lee, 2021), negative (Filbeck & Gorman, 2004; Sueyoshi & Goto, 2009; Tuppura et al., 2016; Cho et al., 2019; Kaupke & zu Knyphausen-Aufseß, 2022) or neutral (Pätäri et al., 2014; Shahbaz et al., 2020).

The discrepancy among the results of earlier studies is owing to there being a non-linear relationship between the two variables, i.e., the relationship may be positive or negative, depending on the level of CSR activity performed. Hence, what is known as the "too much of a good thing" (TMGT) effect, which is based on the law of declining marginal returns, exists if the connection between CSP and FP presents an inverted U-shape. This metatheory states that there is a maximum level of CSR activity performance beyond which financial performance declines (Pierce & Aguinis, 2013). This effect is found in the only paper to date that analyzes the curvilinear effect between CSP and FP in the energy sector. Thus, Kumar et al. (2022), in their study of 3,211 energy sector observations from an international sample in the period from 2006 to 2018, conclude that the performance of CSR activities has an inverted U-shaped nexus with varying measures of profitability. The same conclusion is reached by other papers on both the manufacturing (Sun et al., 2019) and hospitality sectors (Chen & Lin, 2015).

It is also possible that CSP leads to negative FP up to a certain level, reflecting a U-shaped relationship between the two variables; this is the "too little of a good thing"

(TLGT) effect. This impact is confirmed by Nollet et al. (2016) for Standard& Poor's (S&P) listed companies, where, in the short term, profitability decreases as CSR activities increase, whereas in the long term it rises. This metatheory is also confirmed in papers on specific sectors, such as Wang et al. (2016) in construction, Franco et al. (2020) in hospitality, and López-Penabad et al. (2022) in the financial sector. The same conclusion is reached in multi-sector studies conducted in different geographical contexts such as India (Maqbool & Bakr, 2019) and Germany (Nuber et al., 2020).

In summary, previous studies on the connection between CSP and FP show contrasting results, both for linear and curvilinear relationships. One of the possible reasons for the disparity in results is the measure of FP used, which is proxied by accounting and/or market information and whose values are more accessible than those based on firms' operating performance (Huang, 2019). However, as demonstrated by several literature review papers (Hou et al., 2016; Busch & Friede, 2018), operational performance measures are more closely related to CSR activities, having, therefore, a stronger correlation with these than with accounting or market measures.

Following this perspective, the study by Ren et al. (2022) conducted on customers, suppliers, and partners of Apple Inc., uses the measure for the company's EAE for FP, finding a curvilinear U-shaped effect between CSP and EAE. Our work also adopts EAE as a measure because we consider that it is closely related to the field of activity, particularly that of the energy sector, which is analyzed in this paper, and to the CSR activities carried out, leading us to put forward the following hypothesis:

Hypothesis 1: The relationship between CSP and EAE is non-linear with a U-shape.

2.2.2. CSR activity performance and FP

Not all CSR practices have the same impact on business performance; Feng et al. (2017) find that in the energy sector, practices related to the environment have a positive impact whereas those related to employees have none. Other papers note the existence of a non-linear relationship between environmental dimension performance and FP. The implementation of practices to reduce the environmental footprint of companies in the energy sector is imposed by regulation, which may weigh down FP in the short term but have positive effects in the long term (Xie et al., 2018). Chen and Ma (2021) point out that financial performance improves dramatically in the third year following investments made in energy savings and emission reductions, based on data from China between 2008 and 2017. Trumpp & Guenther (2017), in their study of an international sample over the period 2008 to 2012, find evidence of a U or TLGT effect for both carbon performance and waste intensity on profitability, which is observed for the sample as a whole and for the manufacturing sector in particular. The concern in Japan about carbon emissions from manufacturing companies motivated papers such as those of Tatsuo (2010) and Hatakeda et al. (2012), whose conclusions include the TLGT effect with respect to profitability. The same relationship is observed by Grassmann (2021) between environmental performance, measured through expenditures on these actions, and Tobin's Q. Finally, Ghosh et al., (2023) note the same curvilinear relationship between environmental performance, measured in this case by content analysis, and FP measured by Tobin's Q.

In contrast, there are papers that find an inverted U-shaped relationship between various environmental performance measures and a range of accounting and market variables in either multisectoral or industrial company samples (Misani & Pogutz, 2015; Fuji et al., 2013; Broadstock et al., 2018; Lahouel et al., 2022). The study by Kumar et al. (2022) on energy firms also reports that environmental performance and profitability have an inverted U-shaped relationship.

Therefore, we propose the following hypothesis:

Hypothesis 2: The environmental dimension and its subcomponents have a non-linear U-shaped relationship with EAE.

Due to the impact of the energy sector's field of activity on the environment, in additionto the investments made in environmental initiatives, action is taken on social issues (by way of defending human rights and making donations, among others) to improve its corporate reputation and, ultimately, FP (Liu & Lu, 2011). Several studies analyze the influence of successful social activity performance on FP and, although the most recent research agrees that the relationship is non-linear, there is no consensus on whether high performance in social practices is beneficial for FP in the short or long term. It should also be mentioned that studies such as Kumar et al. (2022) on energy companies and Grassmann (2021) on a multi-sector sample record a non-linear inverted U-shaped relationship between both magnitudes.

In contrast, Barnett & Salomon (2006), in their analysis of 61 investment funds that made socially responsible investments between 1972 and 2000, conclude that the relationship between social performance and FP follows a U-shape. Years later, Barnett & Salomon (2012) also find the same relationship between social and financial performance in their multisectoral study of an international sample of companies. This finding is corroborated by Brammer & Millington (2008), who point out that companies' expenditure on socially responsible investments only sees positive effects in the long term. Lopez-Penabad et al. (2022) note a U-shaped relationship between social activity performance and the financial efficiency of the financial sector. Finally, Ren et al. (2022) state that socially responsible activities only have positive effects on EAE in the long term. Therefore, based on the above papers, we propose the following hypothesis:

Hypothesis 3: The social dimension and its subcomponents have a non-linear U-shaped relationship with EAE.

Regarding the effectiveness of systems and processes aimed at developing best corporate governance practices, Nollet et al. (2016) confirm a U-shaped relationship with various accounting measures of performance. The same result is found in studies that address their influence on efficiency, both in the financial area of the banking sector (Lopez-Penabad et al., 2022), and in the EAE of industrial companies (Ren et al., 2022). Therefore, based on previous papers, we propose the following hypothesis:

Hypothesis 4: The corporate governance dimension and its subcomponents have a non-linear U-shaped relationship with EAE.

2.3. EMPIRICAL RESEARCH

2.3.1. Data

Our unbalanced data panel consists of 239 listed energy companies for the period 2016-2021 from a total of 46 countries operating in coal, multi-line utilities, oil, gas, renewables and uranium sub-sectors. It is appropriate to start in 2016 as this is when the Global Reporting Initiative (GRI) G3 guidelines were introduced, which offered "greater corporate awareness of CSR practices" (Kumar et al., 2022, p. 6).

The ESG score, its three pillars, and ten of its dimensions extracted from the Thompson Reuters Refinitiv Eikon company database are used as proxies for CSP. This database is widely used in previous literature (e.g., Lahouel et al., 2022; López-Penabad et al., 2022; Ren et al., 2022) and is also employed to obtain the financial data of the companies. The macroeconomic data is extracted from the World Development Indicators database managed by the World Bank.

To perform the sample selection, we incorporate companies classified in the energy sector in the Thompson Reuters Refinitiv EIKON database with net assets greater than $2 billion in 2021. After discarding observations lacking data for some of the variables necessary to perform the analysis, the final sample comprises 973 company-year observations. It can be seen in Appendix B: the distribution of sample observations by country (Table B.1) and a detailed description of the sample selection (Table B.2).

2.3.2. Methodology

A widespread approach to assessing the performance of an industry involves estimating its efficiency. Traditionally, the efficiency of companies in the energy sector has been evaluated only in relation to operational and financial measures using different methodologies that can be grouped into two types: (1) the traditional analysis of accounting ratios; (2) the distance function approach. In the latter, the best practice output is represented by a "production frontier" and efficiency scores for the remaining (non-frontier) companies are calculated by comparing them with the best performers. Efficiency is typically calculated using two methods: the Data Envelopment Analysis (DEA) (non-parametric) and the Stochastic Frontier Analysis (SFA) (parametric).

The use of traditional one-dimensional financial indicators may not adequately reflect business performance. In order to incorporate multiple inputs and outputs to estimate firm performance, different methodologies have been devised. This paper applies a non-parametric approach, DEA, as a tool to estimate operational efficiency. The impact of ESGs on performance can vary depending on the proxies used. There is a gamut of measures of financial performance, mainly using both accounting and market measures. We estimate environmental efficiency scores by including energy use as an input and CO_2 emissions as a bad output in combination with traditional operational and financial measures.

DEA is widely used for indicator construction, including energy (see Emrouznejad & Yang, 2018) and environmental assessment as two of the most popular application areas, the latter being so especially since the introduction of the concept of undesirable output (Sueyoshi et al., 2017).

The DEA methodology also has some limitations, one of which is worthy of note being that it tends to generate biased estimates. To eliminate problems, in the first stage, we employ a bootstrap procedure proposed by Simar & Wilson (2007) to estimate environmental efficiency and, in the second stage, the environmental efficiency scores evaluated are regressed on a set of ESG explanatory factors, utilizing the truncated regression.

The DEA is a mathematical method for estimating a firm's efficiency based on observed data on specified inputs/outputs of a set of firms known as Decision Making Units (DMUs). Charnes et al. (1978) consider the constant returns-to-scale (CRS) hypothesis, and Banker, Charnes & Cooper (1984) propose an alternative model to include variable returns-to-scale (VRS), which means that the relative competence of each DMU is calculated by comparing it to other DMUs similar in size to the firm under evaluation which have similar operational resources. The CRS assumption is applicable only when all DMUs are running at optimal scale, therefore assuming that VRS is more appropriate, due to the fact that the energy industry benefits from economies of scale[2].

At each period t (t = 1,...,t), each DMU (i = 1, 2,..., n) has its own inputs (s = 1, 2,..., j) that expend $X_{it} = \{x_{sit}\}$ and outputs (r = 1, 2,..., m) that create $Y_{it} = \{y_{rit}\}$. To calculate operational efficiency, we employ the output orientation of the VRS model because economic units typically aim to get the most out of earnings with an appropriate combination of inputs.

$$Max\ \theta_{0t}: x_{s0t} - \sum_{i=1}^{n_t} \lambda_{it} x_{sit} \geq 0;\ \sum_{i=1}^{n_t} \lambda_{it} y_{rit} - \theta_{0t} y_{r0t} \geq 0;\ \sum_{i=1}^{n_t} \lambda_{it} = 1;\ \lambda_{it} \geq 0 \qquad (1)$$

θ_0 is the efficiency score for DMUs and λ is the weight. The DMU is efficient if θ_0 is equal to 1 (located on the frontier), whereas it is inefficient (located inside the frontier) if θ_0 is less than 1. One of the problems with DEA is that it can produce biased estimates of θ. To obtain bias-corrected efficiency estimations of $\hat{\hat{\theta}}_{it}$, we use the smoothed bootstrap method following the procedure of Simar & Wilson (2007).

Next, the study employs truncated regression to examine the nonlinear relationship between CSP (measured through ESG scores) and EAE. To achieve the study's objectives, the research equation models are as follows:

$$\hat{\hat{\theta}}_{it} = \alpha + \gamma ESG_{it} + \delta {ESG^2}_{it} + \beta Z_{it} + \eta D_t + \varepsilon_{it} \qquad (2)$$

where $\hat{\hat{\theta}}_{it}$ is the dependent variable, the bias-corrected bootstrapped environmental efficiency score for DMUi of each year t. ESG and Z_{it} are vectors of

independent/control variables efficiency determinants anticipated to interpret efficiency fluctuations and D_t is a year dummy vector (from 2016 to 2021). In the second stage, which links independent variables to efficiency, besides the yearly effects on efficiency, γ, β, δ and η are the parameters which are evaluated; ε_{it} is an independent error term with a zero mean σ_{ε}^2 variance $N(0, \sigma_{\varepsilon}^2)$ with left-tail truncation $(1 - \gamma ESG_{it} - \delta {ESG^2}_{it} - \beta Z_{it} - \eta D_t)$.

2.3.3. The Environmental Efficiency Measure

Given the significant environmental impact of the energy sector, and the growing concern with it from the public and from the authorities, we employ DEA models with desirable and undesirable outputs (operational and polluting), in line with previous literature (e.g. Lu et al. 2023; Ren et al. 2022; Sueyoshi et al, 2017).

Following other studies (Lu et al., 2023; Ren et al., 2022; Sánchez-Robles et al., 2022; Sueyoshi et al., 2017; Stefanoni & Voltes-Dorta, 2021) and since energy efficiency is essential for combating global warming and climate change, we incorporate "energy use" as an input in the calculation of operating efficiency (total number of employees, property plant and equipment (PPE), and operating cost).

Taking into account that in addition to producing desirable outputs, the production process can also generate the opposite outcome, for undesirable or bad output, we also incorporate CO_2 emissions in the model, which have already been used in previous studies, in addition to operating revenues and market value (Sueyoshi & Goto, 2012 a, b; Sueyoshi et al, 2017; Du et al., 2018; Otani & Yamada, 2019; Lu et al., 2023; Ren et al., 2022). Therefore, we differentiate between operational and environmental efficiency. To aid the descriptive analysis, we calculate the operating efficiency and the EAE, although in the multivariate analysis we only use the latter. Table 7 shows the inputs and outputs of both efficiencies[2].

Table 7. DEA Models: Operational and Environmental Efficiency

Categories	Operational efficiency	Environmental efficiency
Inputs	Employees, Property plant and equipment, Operating cost	Operational efficiency inputs + Energy use
Outputs	Operating revenues, Market capitalization	Operational efficiency outputs + CO_2 (bad output)

Source: own elaboration.

Table 8 presents the descriptive statistics of our inputs/outputs and Table 9 collects the Spearman correlation coefficients of all the input and output variables to assess the validity of the model. The proposed DEA model satisfies the isotonicity conditions, which require outputs not to decrease as inputs increase. There is a statistically significant and positive correlation between inputs and outputs (Golany & Roll, 1989), and coefficients are below 0.90 within each of them (Bowline, 1998).

[2] A definition of the inputs and outputs can be found in Appendix B, Table B.3.

Table 8. Descriptive statistics of inputs and outputs for the EAE model

Variable	Obs.	Mean	Std. Dev.	Min	Max
Employees	973	24,051.24	57,388.75	8	477,600
Property, Plant and Equipment (USD millions)	973	21,147.13	41,689.16	31.60	259,651
Operating Costs (USD millions)	973	21,945.44	47,920.53	16.40	414,382.20
Use Energy (gigajoules millions)	973	174.33	1,388.70	0.0024	42,472
Operating Revenue (USD millions)	973	23,515.81	50,451.23	0.40	431,492.60
Market Capitalization (USD millions)	973	692,089.40	7,260,996	23.72	136,301,842
CO_2 (Ton's millions)	973	11.70	24.55	0	176.65

Source: Own elaboration.

Table 9. Spearman rank correlation coefficients

	Inputs				Outputs		
	Employees	PPE	Operating costs	Energy use	Operating revenues	Market capitalization	CO2
Employees	1.0000						
Property, Plant and equipment (PPE)	0.5009	1.0000					
Operating costs	0.7805	0.6642	1.0000				
Energy use	0.4495	0.6330	0.6269	1.0000			
Operating revenues	0.7866	0.6826	0.9789	0.6426	1.0000		
Market capitalization	0.5619	0.7069	0.6423	0.4777	0.6828	1.0000	
CO_2	0.4677	0.7201	0.6124	0.7535	0.6327	0.5454	1.0000

Source: Own elaboration. Note: The coefficients are significant at the 1% level.

2.3.4. Corporate Social Performance and Control Variables

Following previous studies (e.g., Ren et al., 2022; López-Penabad et al., 2022; Ahmad et al., 2021), we analyze the impact of each the ESG dimensions on EAE as independent variables, incorporating the dimensions that the literature considers most relevant for each of the three pillars into the models. Therefore, we consider the following categories: the ESG overall index, Environmental pillar (including Emissions, Innovation and Resource use), Social pillar (ESG controversies, Community, Human rights, and Product responsibility) and Governance pillar (Management, CRS strategy, and Shareholders).

To avoid specification problems in the model, we incorporate certain control variables already identified in the literature that can be divided into two groups: the first one employs those related to specific characteristics of the companies; the second one adopts macroeconomic variables. Among the company-specific variables, we include R&D expenses measured as R&D expenses divided by operating cost (e.g. Nollet et al., 2016), size as the logarithm of total assets (e.g. Xie et al., 2018), interest coverage ratio as EBIT divided by financial expenses (Yildirim, 2020), ROA as net income divided by average total assets, expressed as a percentage (e.g. Ren et al., 2022), and the solvency

ratio as current assets divided by current liabilities (e.g. Sánchez-Robles et al., 2022). Additionally, the percentage of strategic shareholders in the company is included (De Mesnard, 2022).

At the macroeconomic level, we include two variables that previous studies have shown influences efficiency: the end-of-year oil price (Sánchez-Robles, et al., 2022) and GDP growth (López-Penabad et al., 2022). In Table 10, the descriptive statistics for the control variables are presented.

Table 10. Descriptive statistics of control variables

	Obs.	Mean	Std.Dev	Min	Max
Size	973	23.4152	1.3187	20.8011	26.7425
ROA	973	0.0249	0.0880	-0.5233	0.7324
Innovation	973	0.0565	0.4988	0	1.0843
Strategic shareholders (%)	973	34.69	44.23	0	100
Solvency ratio	973	1.4867	1.2264	0.13505	24.3418
Interest coverage ratio	973	10.5250	22.8857	-14.3720	166.8395
Oil Price	973	56.7855	11.4240	41.2578	69.0706
GDP growth	973	1.6411	4.2216	-11.3254	11.6682

Source: Own elaboration.

2.4. EMPIRICAL RESULTS AND DISCUSSION

2.4.1. Descriptive Statistics

Table 11 shows the descriptive statistics for the two types of efficiency calculated in the first stage of our analysis. The average operational efficiency is 42.64%, which may be considered a moderate level due to its capacity for improvement, whereas the results of Sánchez-Robles et al., (2022) in their analysis of the European oil sector are lower, at 27%. In relation to EAE, its mean is 60.11%, which is high according to the averages Ren et al., (2022) report for the 29 industrial companies studied.

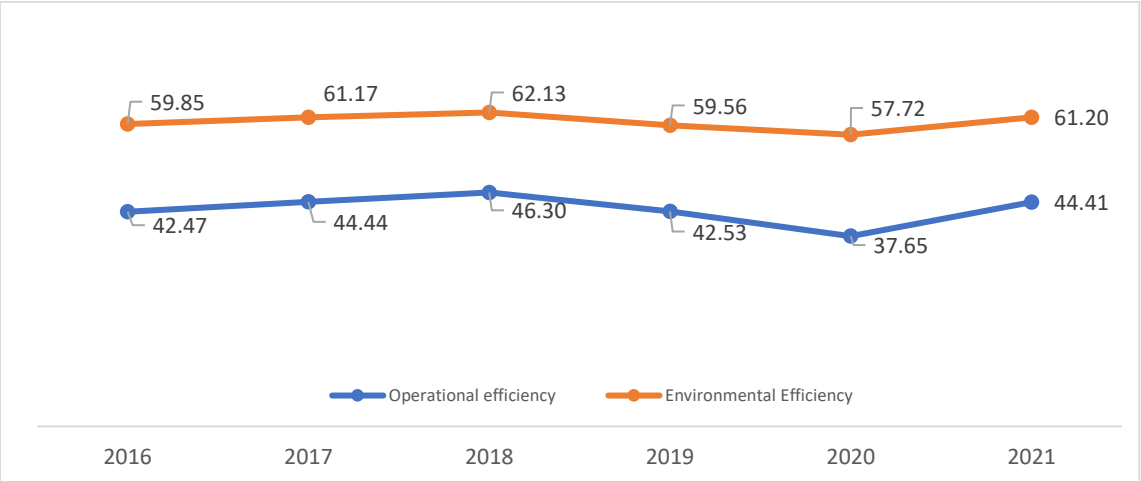
Table 11. Descriptive statistics of operational and environmental efficiency

	Obs.	Mean	Std.Dev	Min	Max
Operational efficiency (%)	973	42.6390	24.9516	0.1676	100
Environmental efficiency (%)	973	60.1114	14.1130	10.2861	100

Source: own elaboration.

Regarding their evolution over time (Fig. 2), both types of efficiency show a similar trend that is consistent with research done by Ismail et al. (2013) for 17 oil companies. These results showed that both types of efficiency decreased in the year prior to the start of the COVID health crisis and decreased again in 2020, before improving in 2021.

Figure 2. Efficiency over time



Source: own elaboration.

Table 12 presents the descriptive statistics for the ESG category scores (ranging from 0 to 100). The energy sector shows moderate levels of performance both in the overall ESG score and in the pillars and their dimensions. The average ESG score is 62.06%. The results for each of the pillars, namely, environmental, social and governance, are: 62.88%, 62.30%, and 60.73%, respectively. As for the dimensions, there are significant variations. In the environmental pillar, Innovation (31.26) has the worst result. The highest scores are Emissions (73.48), in the environmental pillar, ESG controversies (83.08), in the social one, and, CSR strategy (69.66), in the governance one. There is, therefore, considerable scope for many companies in the energy sector to improve their current commitment to CSR.

Table 12. Descriptive statistics of independent variables: the ESG index and its pillars and dimensions

	Obs.	Mean	Std.Dev	Min	Max
ESG score	973	62.0626	15.0355	0.9055	92.8378
Environmental pillar	973	62.8753	19,3723	0.4434	95.7089
Emissions	973	73.4850	19.7656	0	99.8141
Innovation	973	31.2644	32.1516	0	98.7500
Resource use	973	70.4045	21.9629	0	99.8141
Social pillar	973	62.3037	17.9297	0	98.9074
ESG controversies	973	83.0811	29.2573	0.7692	100
Community	973	66.3916	26.9866	13.5135	99.8423
Human rights	973	52.7347	31.3188	0	98.7500
Product responsibility	973	58.0370	29.7308	0	99.8055
Governance pillar	973	60.7333	21.8123	26.1905	98.5652
Management	973	60.7147	28.5096	10.8696	99.8778
CSR strategy	973	69.6614	24.4472	0	99.9064
Shareholders	973	54.8430	27.2445	0.4587	99.8350

Source: own elaboration.

We examine the correlation between ESG index scores, the three individual ESGs and the control variables. The ESG index and pillar scores are highly correlated but are not incorporated into the same models. Following the rule stated by Brooks (2008), the correlation coefficients do not indicate any collinearity problems, with absolute values below 0.8 in all cases. This is also supported by the Variance Inflation Factor (VIF), which is less than 1.5 in all our analyses, indicating no evidence of multicollinearity.

2.4.2. Truncated regression analysis for environmental efficiency

The truncated regression results, which are presented in Table 13, allow us to examine the non-linear relationship between CSP and EAE as measured by the DEA model. As noted above, we use the bootstrapped bias-corrected environmental efficiency score as the dependent variable. As a U-shaped relationship was found, we performed the method proposed by Lind and Mehlum (2010) to test the significance of the coefficients obtained from the U-shaped quadratic specification (antepenultimate row) and to check whether the turning point of the curve lay in the interval of the data (penultimate row). In addition, in Figure B1 (Appendix B), we have plotted the data based on the truncated regression model in Table 13 to visualise the U-shaped relationship in the subfigures, showing the mean change in EAE when ESG scores changed, holding other covariates constant.

The results shown in the regression (1) of Table 13 indicate that the coefficient of the ESG index variable is negatively significant whereas the coefficient of the squared ESG index variable is positively significant, allowing us to draw the conclusion that there is a U-shaped relationship, i.e. convex and upward oriented, between CSP and EAE. The CSP-EAE relationship depends on the level of ESG investment. ESG initiatives have a negative impact on environmental efficiency in their initial phase as marginal costs outweigh marginal benefits, up to the lowest point of the curve, after which the relationship reverses and becomes positive. This is because the ESG initiatives reinforce competitive advantages and build up a reputation and legitimacy (Buallay, 2021). In other words, the most environmentally efficient companies are those with the lowest or highest levels of CSP while those with intermediate levels are the least eco-efficient. Hence, the statistical evidence supports hypothesis.

The U-shaped relationship between CSP and EAE is consistent with the findings of Ren et al. (2022) and Nollet et al. (2016) for multisectoral samples and with those of Wang et al. (2016), Franco et al. (2020), and López-Penabad et al. (2022) for the construction, hospitality and financial sectors, respectively. In addition, Nuber et al. (2020) for German companies and Maqbool & Bakr (2019) for Indian ones come to the same conclusion.

The results of regressions (3)-(4) in Table 13 allow us to draw the same conclusion for the social and governance pillars, respectively; that is, firms with low or high performance in those two dimensions are the most efficient. The evidence supports hypotheses 3 and 4, namely that firms with intermediate performance levels in social and governance dimensions are the least efficient. These results are in line with those obtained by Ren et al. (2022) and López-Penabad et al. (2022) in other sectors.

However, the environmental dimension is not significant (regression 2). Therefore, the evidence means that hypothesis 2 cannot be confirmed. The relationship between efficiency and the environmental dimension is not clear. If there were more

advanced technology available that allowed a reduction of inputs and undesirable outputs, efficiency and environmental aspects would likely be positively related (Sánchez-Robles et al. 2022). On the other hand, if environmental management were considered only as greenwashing, or processes were already optimized, additional measures would not have significant effects on efficiency gains (Finger et al., 2018).

In order to gain a deeper understanding of the impact of ESG activities on EAE, and bearing in mind that certain environmental, social and corporate governance practices may have a greater effect than others, we show the relationship between the performance of three environmental, four social and three corporate governance practices on EAE (regressions 5, 6 and 7).We find a U-shaped relationship between resource use (the environmental pillar) and EAE, implying that the ability to reduce energy, water and material use, as well as having better eco-efficient management of the supply chain, benefits EAE in the initial phase and beyond a certain level. This finding is consistent with Ren et al., (2022) for the industrial sector.

The management dimension (the governance pillar) and EAE have a convex relationship, in that a company's effectiveness and its commitment to implement corporate governance practices improve EAE both when these practices are implemented and when there is a trend towards excellence in following them. Ren et al. (2022) come to the same conclusion in their study of Apple's partners, suppliers and customers.

Nielsen's multisectoral research (2022) on companies in the S&P 500 index shows that the human rights dimension (the social pillar) has a positive effect on FP; according to our findings, a U-shaped effect on EAE can be seen. Therefore, high corporate commitment to human rights conventions has a positive effect on EAE. Other dimensions, however, display a positive linear relationship with environmental efficiency, i.e., innovation in the environmental area and shareholder score.

Lind & Mehlum (2010) point out the inadequacy of the analysis of the coefficients' significance obtained in a quadratic (U-shaped) specification and the checking procedure for making sure that the inflection point of the curve lies in the date range. Hence, we conduct the U-test suggested by these authors for all the variables that meet these requirements. All the tests are significant (antepenultimate row), and the maximum point is in the range of the variable in all cases (penultimate row), confirming the U-shaped relationships discussed above.

Firm size positively and considerably influences environmental efficiency when the results of the control variables are considered; larger enterprises are more environmentally friendly. Some studies show that a company's size influences how effective ESG is (Ramecesse, 2021). López-Penabad et al. (2022) and Martínez-Conesa et al. (2017) show that the larger the firm, the stronger the nexus between the ESG and FP. Waddock & Graves (1997) and Ruggiero & Cupertino (2018) state that this relationship in large companies is driven by the greater availability of resources and higher stakeholder expectations of sustainability. Furthermore, it is perceived that firms with higher profitability have higher EAE, since more profitable firms tend to reduce production costs thus improving financial efficiency (Guo et al., 2020) and obtaining resources that can be applied to improve their CSR.

Regarding the link between R&D and EAE, it is positive, confirming the results of previous papers that show the moderating effect of innovation on the relationship between CSP and FP (Martínez-Conesa et al., 2017; Palacios-Manzano et al., 2021b)

and between innovation and environmental performance (Uyar et al, 2022). Our results coincide with those of the study by Sánchez-Robles et al. (2022) on the energy industry, the liquidity ratio and efficiency have a statistically positive relationship. Our results also find that those companies with a higher interest coverage ratio are more efficient, as is the Yildirim (2020) study conducted on the banking sector and measuring operational efficiency. The presence of strategic investors has positive effects in different models, although the results are not conclusive.

Table 13. Results of truncated regressions for Corporate Social Performance-Environmental Efficiency relationship

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ESG score	-0.0035**						
ESG score^2	0.0000***						
Environmental Pillar		-0.0003					
Environmental Pillar^2		0.0000					
Social Pillar			-0.0028***				
Social Pillar^2			0.0000***				
Governance Pillar				-0.0027***			
Governance Pillar^2				0.0000**			
Emissions					0.0010		
Emissions^2					-0.0000		
Innovation					0.0008**		
Innovation^2					-0.0000		
Resource Use					-0.0015*		
Resource Use^2					0.0000**		
ESG Controversies						0.0009	
ESG Controversies^2						-0.0000	
Community						0.0005	
Community^2						-0.0000*	
Human rights						-0.0012***	
Human rights^2						0.0000***	
Product Resp.						0.0006	
Product Resp^2						-0.0000	
Management							-0.0023***
Management^2							0.0000***
CRS Strategy							0.0003
CRS Strategy^2							-0.0000
Shareholders							0.0011*
Shareholders^2							-0.0000
Size	0.0469***	0.0469***	0.0473***	0.0543***	0.0435***	0.0485***	0.0551***
ROA	0.1855***	0.1704***	0.1774***	0.1489***	0.1720***	0.1743***	0.1428***
R&D	0.0281***	0.0291***	0.0293***	0.0285***	0.0295***	0.0293***	0.0294***
Strategic Share	0.0189**	0.0136	0.0185**	0.0088	0.0118	0.0102	0.0171*
Solvency Ratio	0.0062*	0.0058*	0.0052	0.0055*	0.0053*	0.0074**	0.0058*
Interest Coverage	0.0004**	0.0005**	0.0004**	0.0004**	0.0004**	0.0004**	0.0004**
Year dummy	YES	YES	YES	YES	YES	YES	YES
Constant	-0.4682***	-0.5586***	-0.5005***	-0.6174***	-0.4967***	-0.6017***	-0.6922***
Sigma	0.1196***	0.1195***	0.1190***	0.1198***	0.1183***	0.1159***	0.1189***
Number of obs.	973	973	973	973	973	973	973
U-Shape test	2.41***		2.59***	1.28*	1.62**	2.61***	1.62**
Turning point	46.40		44.02	73.06	51.90	29.84	73.39
95% Fieller interval for extreme point	(0.90; 92.84)		(0 .44; 95.71)	(2.62; 98.57)	(0; 99.81)	(0;98.75)	(1.09; 99.88)

Source: own elaboration.

Note: The dependent variable is the bootstrapped environmental efficiency score obtained by applying the BCC model with output orientation in the first stage. Inputs (Employees, Property plant and equipment, Operating costs, and Energy use). Outputs [Operating Revenues, Market Capitalization and CO_2 (bad output)]. 2,000 bootstrap replications are used for the bias correction of the DEA scores. Estimates are made with the observed information matrix (OIM) corrected to account for potential heteroskedasticity.

2.4.3. Robustness Analysis

In this section, we examine whether our initial results with the baseline model are robust by applying an alternative estimation method. Since environmental efficiency can be affected by the omitted variable bias, we modify the control variables and add the macroeconomic variables to our main model that are commonly used in previous literature. Regarding the control variables, we incorporate ROE as a measure of profitability, and the free cash flow to assets ratio as a measure of liquidity. As macroeconomic variables we add external variables related to economic activity, oil prices and GDP growth.

Regarding the estimation method, we follow another model that is widely used in the literature on efficiency, the Tobit model, since the environmental efficiency values are censored between 0 and 1. The model is specified using random effects since fixed effects in non-linear models lead to inconsistent estimates (Sánchez-Robles et al., 2022).

In general, the results of the Tobit random effects model are similar to those of the reference model (Table 14), and the estimates of most of the coefficients are stable in both models. The U-shaped relationship is confirmed between the ESG score and the social pillar and that of environmental efficiency, confirming the robustness of our findings to changes in the empirical model. However, for the governance pillar, the result indicates a negative linear relationship with environmental efficiency since the coefficient of the quadratic variable is positive but not statistically significant. Therefore, overall, the results match those from the truncated regression.

Additionally, the control variables are, by and large, consistent with the truncated regression. The conclusions on environmental efficiency and alternative measures of profitability and liquidity are the same as for the indicated model. Nonetheless, neither the coverage ratio nor the percentage of strategic shareholders is significant.

Regarding macroeconomic variables, oil price and GDP growth are positively and significantly related to environmental efficiency, in agreement with the findings of other authors such as Sueyoshi & Wang (2018) and Sánchez-Robles et al., (2022) who point to there being procyclical behavior when it comes to efficiency.

Table 14. Robustness test for Corporate Social Performance-Environmental Efficiency relationship

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ESG	-0.0027**	-0.0025*						
ESG^2	0.0000**	0.0000**						
Environmental Pillar			-0.0006	-0.0007				
Environmental Pillar^2			0.0000	0.0000				
Social Pillar					-0.0031***	0.0030***		
Social Pillar^2					0.0000***	0.0000***		
Governance Pillar							-0.0016*	-0.0018**
Governance Pillar^2							0.0000	0.0000
Size	0.0408***	0.0412***	0.0414***	0.0412***	0.0402***	0.0403***	0.0463***	0.0463***
ROE	0.0251**	0.0263**	0.0214*	0.0225*	0.0255**	0.0274**	0.0189	0.0180
R&D	0.0326***	0.0325***	0.0324***	0.0323***	0.0333***	0.0331***	0.0331***	0.0330***
Strategic shareholder	0.0033	0.0063	0.0020	0.0054	0.0045	0.0076	0.0008	0.0041
Free cash flow ratio	0.0975*	0.0860	0.1036*	0.0913*	0.1025*	0.0900	0.1012*	0.0890
Interest coverage	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
GDP growth	0.0023***		0.0022***		0.0024***		0.0023***	
Oil price		0.0008***		0.0009***		0.0008***		0.0010***
Constant	-0.3181**	-0.3726***	-0.3860***	0.4261***	-0.3044**	0.3536***	-0.4401***	0.4842***
Wald chi^2	154.00	154.83	150.99	153.86	169.97	169.90	151.55	157.77
Prob > chi^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Log likelihood	858.314	858.881	857.022	858.491	865.290	865.360	857.378	860.364
Number of obs.	973	973	973	973	973	973	973	973

Source: own elaboration.

Note: The table reports the estimation results for the Tobit model with random effects. Estimates are made with the observed information matrix (OIM) corrected to account for potential heteroskedasticity. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

2.5. CONCLUSIONS

As an environmentally sensitive industry, the energy sector is subject to greater public exposure than others (Beck et al., 2018) since it attracts the interest of stakeholders, such as environmentalists, shareholders, investors, and regulators (Florini & Saleem, 2011). This study focuses on the analysis of the energy sector, as its activity has a high impact on the environment. Therefore, ESG activities play an important role in this industry, its influence on financial efficiency being much higher than in other sectors (Iazzolino et al., 2023a).

CSR has become an important source of corporate risk and may affect a company's value. Given the relevance of sustainability in today's business world, it is more important than ever to have an in-depth understanding of this relationship and what it means for a company. This study analyzes the association between several CSR activities, which are measured by ESG performance, and environmental efficiency, in a worldwide sample of companies in the energy sector.

One stream of research advocates a linear relationship between CSP and EAE, but the results are not conclusive about its sign (positive, negative, or neutral). Thus, our hypotheses are based on the relationship between the two variables being nonlinear, and, indeed, our results confirm this relationship, which is U-shaped. In particular, the social and governance pillars and some dimensions of ESG index performance (resource use in the environmental pillar, human rights in the social pillar, and management in the governance pillar) are non-linearly related to environmental performance. In other words, companies need to reach a minimum level of the ESG index to note the positive effects of environmental performance. Therefore, our empirical results provide evidence for the theoretical framework of a "too little of a good thing" effect (Trumpp & Guenther, 2017), meaning that ESG index actions should be designed to prioritize the long term over the short term. Other ESG index dimensions show a positive linear relationship with environmental efficiency, that is, innovation in the environmental area and shareholder score.

2.5.1. Managerial implications

In terms of the practical implications of this research, our results allow managers to discover what kinds of activities could increase the value of companies, and, therefore, help them decide on which ESG aspects they should focus.

Since non-linear effects among these variables are the most common relationship, CSR can only adequately serve stakeholders' interests if the resources allocated to it by the company are optimally distributed. On the one hand, we may find that in the energy sector part of CSR resources do not have significant effects. On the other hand, there are increasing returns for different variables from a certain point; it is therefore essential that managers be aware of this to intervene in all dimensions of CSR in the most effective way. By the same token, reactive strategies are found to be counterproductive for corporate profitability (Gollop & Roberts, 1983; Jiang et al., 2018) and the shift from a negative to a positive association would perhaps be achieved with proactive (Trumpp & Guenther, 2017) and long-term strategies.

Our analysis provides ideas that may be useful for guiding industrial policy in this sector and which could be applied to most countries or regions. Industrial policy for this sector should, in any case, be designed and implemented very carefully. A transition to clean energy will allow us not only to avoid the catastrophic effects of climate change, but also to reduce the vulnerability of certain countries or regions to energy price volatility. The sector's modest levels of efficiency and ESG suggest that there is significant room for improvement through rationalization and better allocation of ESG resources.

Moreover, increasing the size of a company by encouraging the consolidation of the most environmentally efficient companies, showing innovation or improving financial management, are factors that should be considered. The high energy prices of recent years should drive this sector towards higher efficiency, which would have a positive impact on the rest of the economy. In addition, public policies that prevent the disappearance of environmentally inefficient companies should be phased out. Last of all, our analysis provides some ideas for investors looking for guidance on evaluating companies according to Socially Responsible Investment criteria.

2.5.2. Limitations and future research avenues

Although this study improves on the existing literature where the relationship between CSR engagement and performance is concerned, the results should be considered as having several limitations. Firstly, the sample is limited to listed energy companies, and the results cannot be generalized for other sectors or for unlisted energy companies. Secondly, as for the period under study, the conclusions reached cannot be extended to CSR practices of energy companies prior to 2016, the year in which the GRI G3 guidelines were introduced, which made a significant contribution to corporate awareness of sustainability. Thirdly, the results could also be affected by the indicators used to measure a range of ESG aspects. Fourthly, our study focuses on financial and ESG characteristics at the company level and does not incorporate institutional factors or the regulatory and institutional environment of the home country of operation, which may also affect CSP. It could be wise to analyze the CSP relationship in different sub-sectors or geographical areas and according to the institutional environment of the country of operation. Finally, we have incorporated two green aspects into the environmental efficiency model (CO_2 and resource use) for which a lot of data is available, although the model results could be sensitive to the use of different inputs/outputs; therefore, future research could expand upon our results by using other factors.

3

Do Diversity & Inclusion of Human Capital Affect Ecoefficiency? Evidence for the Energy Sector

3. DO DIVERSITY & INCLUSION OF HUMAN CAPITAL AFFECT ECOEFFICIENCY? EVIDENCE FOR THE ENERGY SECTOR

ABSTRACT

The aim of this study was to assess the impact of diversity and inclusion (D&I) initiatives in workplaces on both financial performance and environmental considerations (referred to as ecoefficiency, ECO). We focused on the energy sector, a significant environmental contributor, and the research spanned from 2016 to 2022, analyzing a broad global sample of 373 firms from 53 countries. ECO was evaluated by integrating environmental scores and conventional financial metrics using data envelopment analysis (DEA).

The findings revealed a significant positive relationship between the collective indicator of diversity, inclusion, people development, and the absence of labor incidents on ECO. Specifically, practices related to workforce diversity, cultural and gender implementation, and investments in employee training and development opportunities were found to be beneficial for ECO. Additionally, we found that these policies impact the environmental component of ECO. However, no significant relationship was observed between practices related to inclusion policies and controversial labor, and ECO.

Furthermore, the results suggested that ECO within the energy sector is influenced by factors such as board size, the integration of environmental, social, and governance (ESG) aspects into executive remuneration, the adoption of a corporate social responsibility (CSR) strategy, alignment with the United Nations (UN) Environmentally Sustainable Development Goals (SDGs), and the implementation of quality management systems. Conversely, CEO-chairman duality and the presence of independent board members do not significantly impact ECO in energy companies.

These research findings provide valuable insights and recommendations for industry managers pursuing sustainable business practices, particularly through effective talent management strategies. Additionally, they offer guidance for investors interested in constructing environmentally conscious portfolios.

Keywords: diverse workplace; inclusive workplace; environmental performance; ecoefficiency; energy sector.

3.1. INTRODUCTION

Energy is the engine that drives economic growth in any modern economy, as it is one of the essential inputs in the development of any economic activity. In recent decades, both the production and consumption of energy from fossil fuels have led to an exponential increase in greenhouse gas emissions, resulting in undesirable environmental consequences (International Energy Agency, 2018). Therefore, the development of a green economy with environmental awareness has become necessary, involving more sustainable forms of energy production and consumption. The energy sector has become a key axis in achieving internationally agreed-upon goals on climate change (Kim et al., 2022).

As an industry that provides an essential good for any economy and concurrently plays a crucial role in initiatives to mitigate climate change (European Commission, 2020), studying the energy sector and its environmental impact is of interest. However, the primary challenge facing modern societies in the 21st century is achieving sustainable development (United Nations, 2012). Therefore, environmental commitment alone is insufficient for business survival; it must be coupled with economic growth and socially responsible behaviors, constituting the so-called triple bottom line: profit, people, and planet.

Among socially responsible practices, particular emphasis has been placed on those associated with human resources management. The examination of their impact on the generation of corporate value has garnered attention in prior literature, given that human capital constitutes a key element in realizing both economic goals and a company's climate strategy (Camilleri, 2017). In the study of the effect of workplace diversity and corporate performance, past research has yielded inconclusive findings. Some papers found that gender diversity had a positive effect on financial performance (McKinsey, 2015; Ahmadi et al., 2018), while others concluded the opposite effect (Provasi and Harashah, 2020). Additionally, some authors have pointed out that cultural diversity can have negative effects (Giannetti and Zhao, 2019). If the measure of business performance is based on environmental parameters, studies have shown mixed results: some found that gender diversity has a positive effect (Webb, 2004; Walls and Hoffman, 2013), others indicated that cultural diversity positively affects it (de Klerk and Singh, 2023), while others found no impact (Zaid et al., 2020).

Likewise, the effect of training and promotion policies on employee productivity has also been investigated (Guthrie, 2001), having a positive effect by reducing absenteeism and employee turnover (Aziri, 2011; Katou, 2011). Regarding inclusion policies, the results of previous research indicate that their implementation leads to an increase in financial productivity (Bengisu and Balta, 2011) and environmental performance (Habib and Khalid, 2019), by increasing employee engagement and performance. Finally, analyses on the impact of incidents related to social, environmental, and corporate governance aspects on corporate performance yield mixed results. While studies such as Krüger's (2015) point out that negative news related to corporate social responsibility (CSR) has adverse effects on investors, others like Suciu et al.'s (2020) research on labor controversies did not yield conclusive results.

Considering previous research, we have identified gaps in studying the impact of diversity, inclusion, and people development policies on corporate performance, which this paper aims to address. First, most of the previous literature has measured corporate performance using one-dimensional measures that capture only one aspect, such as financial (e.g., ROE) or environmental (e.g., CO_2 emissions). Studies like those by Lu et al. (2022) and Ren et al. (2022) highlight the importance of using aggregate measures incorporating both financial and environmental factors, being especially important in the analysis of a sector like the energy sector, which is highly environmentally sensitive (Beck et al., 2018). Second, it is necessary to study certain human resource management policies in the energy sector, such as those related to diversity and inclusion, for the entire company, not just the board of directors, which are connected to the reputational risk faced by this sector due to the increased public scrutiny of its activities (González-Ramos et al., 2018). Third, previous research has addressed the relationship between inclusion and people development policies with financial performance but not with environmental performance, making its analysis necessary.

As a result, research gaps still exist regarding the relationship between diversity, inclusion, and people development policies and corporate performance, particularly in the energy sector, and which justify the need for the analysis conducted. This article aims to investigate and assess the impact of diversity and inclusion initiatives in workplaces on ECO of 373 listed firms covering the period from 2016 to 2022 across 53 countries in the global energy sector.

This study makes significant contributions to the analysis of the relationship between human capital management and financial and environmental sustainability, with valuable implications for regulators, managers, and investors. First and foremost, it proposes the adoption of an environmentally adjusted measure of business efficiency using the data envelopment analysis (DEA) technique. This measure is an aggregate indicator that includes economic, financial, and operational aspects, as well as, innovatively in this field of study, environmental performance. The latter is a composite indicator consisting of a total of 286 values that gauge both the environmental impact of the company's activities and its practices to mitigate environmental risks. This approach contrasts with the use of one-dimensional measures employed in previous research in this field.

Second, this study employs a measure of diversity that encompasses diversity at all levels of the company, not just the board of directors, consisting of a total of eight different indicators. The measure of workplace inclusion used is composed of 5 indicators. The measure of people development consists of 7 indicators, and finally, a measure of labor controversies consists of 2 indicators. This study is pioneering in analyzing the relationship of all the aforementioned D&I measures in the workplace with an aggregated financial performance measure such as ECO. The use of combined measures assessing the degree of diversity, inclusion, and people development in the company has been sparingly explored in previous research, and only in relation to financial performance (Suciu et al., 2020) or investment decisions (Bax, 2023).

Third and finally, to the best of our knowledge, this paper proposes the analysis of human resource management strategies in a crucial sector (the energy industry) for the first time.

The results obtained indicate that the ECO of companies in the energy sector increases when human resource management policies focus on criteria of diversity, inclusion, and people development. Specifically, the implementation of gender and cultural diversity policies, as well as practices of promotion and professional training, has a catalytic effect on ECO. Additionally, only employee development practices impact financial performance, while environmental performance is influenced by policies that promote diversity and people development, as well as inclusion. The results obtained are consistent across various robustness tests implemented.

The remainder of the paper is organized as follows: Section 3.2 outlines the theoretical framework and hypotheses derived from the literature review; Section 3.3 details the methodology employed in the study; Section 3.4 presents and analyzes the main empirical findings; and finally, in Section 3.5, key conclusions are highlighted, limitations of the study are outlined, and suggestions are provided for expanding the analysis in future research.

3.2. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

3.2.1. Theoretical Framework

In this research, we explore the impact of diversity, inclusion, and people development policies, as well as the level of labor controversies on ECO from the perspective of stakeholder theory and resource-based theory.

Stakeholder theory (Freeman, 1984) is grounded in the concept that a company should meet the needs of all stakeholder groups, not just shareholders. Therefore, its activities should aim to achieve not only accounting-related outcomes but also social and environmental goals. Hence, both financial and non-financial performance metrics are necessary to evaluate the value created for all stakeholders (Harrison and Wicks, 2013). Diversity and inclusion policies are geared toward satisfying various stakeholders. As indicated by Nyeadi et al. (2021), the female management style is oriented toward all stakeholders, not just shareholders, like boards of directors with greater cultural diversity. Furthermore, the implementation of inclusive policies in the workplace, such as support for the LGBT community, sends a signal to diverse stakeholders, including employees and markets, of socially responsible behavior, particularly regarding minority support policies (Pichler et al., 2018). This, ultimately, enhances the corporate reputation (Kim et al., 2018), creating a valuable, intangible asset that improves financial performance (Li et al., 2019).

Considering that human capital in an organization plays a fundamental role in improving company performance (Naciti et al., 2022), resource-based theory (Wernerfelt, 1984) serves as a foundation to understand that socially responsible human resource management practices and policies create a competitive advantage for the company. In the case of human resources, this advantage materializes in the development of unique skills and competencies, allowing companies to possess difficult-to-imitate intangible resources (Sgrò, 2021), thereby enhancing the corporate reputation.

3.2.2. Diversity, Inclusion, People Development, Labor Controversies, and ECO

Previous research demonstrates that business performance is positively affected by corporate social responsibility activities implemented by companies (Jo and Harjoto, 2011; Gherghina et al., 2015; Adeneye and Ahmed, 2015). According to the paper of Iazzolino et al. (2023a), this effect is greater in sectors that engage in polluting (energy) or harmful (alcohol, gambling, arms, etc.) activities, which attract the attention of multiple stakeholders. The effect of certain policies, such as D&I, on business performance has not been a prolific field of research.

Various studies attribute the implementation of D&I policies in companies to reasons of social justice (Dahanayake et al., 2018) and to ethical and moral motivations (Gotsis and Kortezi, 2013), but the argument regarding the impact of such policies on business performance has been the focus of most investigations, yielding inconclusive results. The variety of findings is largely attributable to the diversity of methods and measures used (Urwin et al., 2013). Nevertheless, most studies in this field of research highlight the benefits of human resource management practices centered on diversity and inclusion. For example, Rohwerder's (2017) review of the literature on D&I in organizations indicates that failing to promote diversity and inclusion in companies, thereby allowing discrimination, leads to lower employee commitment to the organization, lower job satisfaction, higher work stress, absenteeism, lower talent retention, and increased litigation, with consequent repercussions in terms of image. The same conclusions are reached by the paper of Özbilgin and Tatli (2011) based on 66 interviews with key actors in the field of equality and diversity in the United Kingdom. Drawing from these findings, we suggest the following hypothesis:

Hypothesis 1: D&I policies and practices positively influence the ECO of energy companies.

Since D&I policies and practices can vary, we analyze them below by breaking them down into four categories: three that we believe can have positive effects (diversity, inclusion, and people development) and one aspect that can have negative effects on ECO (labor controversies).

Specifically, the impact of diversity on corporate performance has been extensively researched, with demographic diversity (gender, culture, age, etc.) being the most analyzed. It indicates a greater availability of cognitive resources and knowledge within teams, translating into competitive advantages that can have positive financial (Choi et al., 2017) and environmental (Liu, 2018) effects. However, conclusions regarding the impact of diversity on financial performance are inconclusive. Diverse groups offer different perspectives, beneficial for solving complex problems or fostering creativity (Prieto et al., 2009). For instance, Farrel and Hersch (2005) suggested that increased female participation in boards enhances corporate image and attracts new investors. McKinsey (2015) demonstrated that companies with greater gender equality in their boards achieve a 41% higher financial return than those with less equality, a conclusion also reached by Ahmadi et al. (2018) regarding financial and economic profitability. In contrast, Provasi and Harashah (2020) found no relationship between gender diversity on the board and financial performance, based on the idea that

heterogeneous groups are less productive and have lower internal cohesion due to tensions and conflicts arising from differences among members (Horwitz, 2005).

Regarding the impact of gender diversity on environmental performance, previous research suggests that women are more concerned about aspects related to CSR, particularly the environment, due to their lower inclination toward power than men (Burkhardt et al., 2020). Kemp et al. (2015), Li and Nagar (2013), and Williams (2003) demonstrated that women have greater environmental awareness than men. The findings of Webb's study (2004) suggested that companies with greater gender diversity in their boards adopt sustainable environmental policies. Walls and Hoffman (2013) found a positive relationship between gender diversity and CSR policies. Evidence suggests that gender diversity in the board is associated with early adoption of SDGs (Rosati and Faria, 2019), increased commitment to SDGs (Zampone et al., 2024), particularly environmental goals (Taglialatela et al., 2023).

Concerning cultural diversity, individuals' behavior and decision-making are influenced by culture. Its potential influence on board activities can be positive or negative for stakeholders. It can provide different perspectives, greater creativity, and diverse skills and knowledge, contributing to improving corporate results. Studies like Harjoto et al. (2019) in the United States argue that an increase in cultural diversity on boards improves corporate social responsibility, and de Klerk and Singh (2023) found a positive relationship between cultural diversity and sustainability performance in healthcare institutions. However, other studies found the opposite relationship, arguing that cultural diversity can cause friction within the board. Zaid et al. (2020) concluded that foreign board members do not influence a company's sustainability activity. The relationship of cultural diversity with financial performance also yields mixed results. Wang and Clift (2009) measured board cultural diversity based on racial diversity and concluded that it has no effect on financial results. Giannetti and Zhao (2019) highlighted the pros and cons of cultural diversity, suggesting high but volatile performance, implying inefficiencies and conflicts on the board. The only study using an aggregated measure of diversity, integrating gender and cultural dimensions, is that of Suciu et al. (2020), which concluded that it has a positive effect on financial performance. Drawing from these findings, we suggest the following hypothesis:

Hypothesis 2: Diversity policies and practices in the company positively influence the ECO of energy companies.

On the other hand, training and promotion aim to improve employees' professional skills, a systematic process called human resource development (Nadler, 2012). Despite criticism of training as too costly (Kraiger et al., 2004) and doubts about its relationship with business performance (Wright and Geroy, 2001), previous research mostly considers that a company's human resource development plays a fundamental role in achieving sustainable competitive advantages (Kareem and Hussein, 2019), influencing reduced employee turnover, absenteeism, and conflicts (Salas and Cannon-Bowers, 2000), and increasing job satisfaction, which has a positive effect on productivity and business profitability (Aziri, 2011; Katou, 2011). Syed et al. (2020), who measured human resources recruitment and training practices through surveys, found that they are related to environmental performance but not to financial performance. Based on previous research, we believe that our index, which is an aggregate measure of internal promotion indicators,

training, and employee satisfaction, may have a positive relationship with ECO. Therefore, we propose the following hypothesis:

Hypothesis 3: People development policies and practices in the company positively influence the ECO of energy companies.

In terms of inclusive policies aimed at integrating workers with family responsibilities, disabilities, or chronic illnesses into the company, previous research indicates a positive impact on business performance. Human resource management practices that promote the inclusion of minorities in the workplace have been associated with effects such as retaining talented and creative employees, and fostering innovation, which can positively influence the company's financial performance (Sears and Mallory, 2011). Hossain et al. (2019) found that companies with anti-discrimination policies in the workplace encourage innovation, which can positively influence the company's financial performance. Li and Nagar (2013), using the corporate equality index developed by the Human Rights Campaign, argued that policies supporting the LGBT community improve company performance, adding value to such policies. Pichler et al. (2018) reached the same conclusion using other CSR policies as a control variable, in addition to inclusion. In the same vein, Jiraporn et al. (2019) demonstrated that policies supporting the LGBT community in the company increase financial performance, measured by the Tobin's Q, both in the short and long term, as investors consider the value of such policies. Regarding employees with disabilities, despite being stereotyped as dependent and inefficient (Colella and Bruyére, 2011), it has been shown that companies implementing inclusive policies witness increased productivity (Bengisu and Balta, 2011). Additionally, flexible working hours for family reconciliation increase employee commitment and performance (Meyer et al., 2001), having a positive effect on the company's environmental performance (Habib and Khalid, 2019). The study by Suciu et al. (2020) on European companies, which used an aggregate index like ours to measure inclusion policies, found that these policies negatively impact both economic and financial profitability, but positively affect outcomes. However, in the present study, focusing on a sector under high public scrutiny where projected image is crucial, and incorporating financial and environmental performance measures that previous research has shown to be positively influenced by inclusion policies, we propose the following hypothesis:

Hypothesis 4: Inclusion policies and practices in the company positively influence the ECO of energy companies.

Regarding the effect of the level of labor controversies on business performance, incidents, especially those related to environmental or labor aspects, can damage corporate image and reputation when made public (Krüger, 2015; Aouadi and Marsat, 2018), leading to negative consequences on corporate performance (Nirino et al., 2021). Kang and Kim (2013) found a positive relationship between the negative tone of CSR news and market share loss, and Krüger (2015) observed that negative CSR news leads to a negative investor response. However, the evidence from previous literature is inconclusive. Studies like Rodríguez-Fernández et al. (2018), analyzing the effect of controversies related to top management in a global sample of 119 travel agencies, did not find them to be related to financial performance, measured both as economic and financial profitability, as well as Tobin's Q. Also, in the study of Suciu et al. (2020), which used the

same indicator as this study, the results were inconclusive regarding financial performance. For example, when controversies are related to a company's human resources, they positively affect financial and economic profitability and negatively affect results measured by earnings before interest, taxes, depreciation, and amortization (EBITDA) and earnings before interest and taxes (EBIT). In the energy sector, subject to intense public scrutiny due to the impact of its activities on the environment, controversies are particularly important because they have a greater negative effect on reputation and credibility compared to other sectors, rendering environmental policy efforts futile (García-Amate et al., 2023). Therefore, we propose the following hypothesis:

Hypothesis 5: Labor controversies negatively influence the ECO of energy companies.

3.3. MATERIALS AND METHODS

3.3.1. Sample and Data Collection

Our dataset comprises listed energy companies spanning the period 2016–2022, hailing from 53 countries and operating within the coal, oil and gas, renewables, and uranium sub-sectors. Commencing our analysis in 2016 aligns with the introduction of the Global Reporting Initiative (GRI) G3 guidelines (Kumar et al., 2022).

Financial, environmental, governance, and diversity and inclusion (D&I) scores were obtained from the London Stock Exchange Group (LSEG) Data & Analytics company database, previously known as Thomson Reuters' Refinitiv database, widely recognized in scholarly research (Lahouel et al., 2022; Ren et al., 2022). This database covers over 90% of global market capitalization and encompasses more than 630 distinct ESG criteria (LSEG Data and Analytics, 2022). In order to select the sample, our analysis was confined to firms that were listed and reported their environmental, social, and governance scores on the LSEG platform. We start with a dataset of 2,898 observations. The descriptive statistics shown have been calculated based on the full sample for each of the variables analyzed. After excluding observations lacking essential variables for analysis, our final dataset comprised 373 companies and 1,062 company-year observations. This data represents 90% of the firms in the energy sector included in the LSEG database. Further details on the distribution of sample observations by country (Table C.1) and the sample selection process (Table C.1) are provided in Appendix C.

3.3.2. Methodology

The empirical model used to investigate the relationship between human capital management and financial and environmental sustainability (ECO) is presented below. It also provides an overview of the different variables used. In Table C.5 of Appendix C, the definitions, source, expected sign, and main references of the variables for the chapter are presented.

3.3.2.1. Variables

3.3.2.1.1. Dependent variable: Ecoefficiency (ECO).

The dependent variable in this study is the measure of the company's ECO. A common method for assessing industry performance entails measuring efficiency. Traditional financial indicators often fall short in fully capturing a business's overall performance. To address this limitation, we use frontier methods, which consider multiple inputs and outputs. The main frontier methods used to measure efficiency are data envelopment analysis (DEA), which is non-parametric, and stochastic frontier analysis (SFA), which is parametric. Specifically, this study employs DEA to estimate efficiency. This model uses linear programming which results in a set of production possibilities in which the efficient units are represented by an "efficient frontier", against which the inefficiency of other firms is measured.

For efficiency estimation in this paper, we employ DEA with variable returns to scale (VRS) and an output-oriented perspective. By adopting VRS, the group of energy firms used for comparison remains similar in size to the firm under evaluation. The VRS model, with output orientation, was mathematically represented as follows:

$$Max\ \theta_{0t}: x_{s0t} - \sum_{i=1}^{n_t} \lambda_{it} x_{sit} \geq 0;\ \sum_{i=1}^{n_t} \lambda_{it} y_{rit} - \theta_{0t} y_{r0t} \geq 0; \sum_{i=1}^{n_t} \lambda_{it} = 1;\ \lambda_{it} \geq 0 \qquad (1)$$

We evaluated n DMUs (i = 1, 2,..., n) for every time period t (t = 1,..., t), considering m outputs (r = 1, 2,..., m), which produced Yit = {yrit}, and j inputs (s = 1, 2,..., j), which consumed Xit = {xsit}. The efficiency score for each DMU was denoted by θ_0 and lambda (λ) was the input and output multipliers (weight).

The DMU was efficient if θ_0 was equal to 1, and the DMU was inefficient if θ_0 was greater than 1. We have inverted the efficiency scores, (1/ θ_0), to express them on a scale from 0 to 1.

We assume that the behavior of energy firms is oriented toward maximizing output, considering that environmental scores, financial performance, and market performance represent the primary variables of interest that managers seek to enhance. Thus, we differentiate between operational efficiency and ECO. Table 15 presents the inputs and outputs used for each efficiency measure.

Table 15. Inputs and outputs for operational efficiency and ECO.

Categories	Operational Efficiency	ECO
Inputs	Operating cost, Employees, PP&E*	Operating cost, Employees, PP&E*
Outputs	Operating revenues, Market capitalization	Operating revenues, Market capitalization, Environmental score

Source: own elaboration. * Property, plant, and equipment.

Operational performance measures encompass a variety of metrics, predominantly utilizing accounting and market indicators. In line with previous studies, the inputs considered were operating cost; property, plant, and equipment (PP&E); and the number of employees, while operating revenues and market capitalization served as output. Then, we calculate ECO scores by including environmental scores (Env. Score) as outputs alongside traditional operational and financial measures (Iazzolino et al., 2023b; Lu et al., 2023; Ren et al., 2022; Sánchez-Robles et al., 2022; Stefanoni and Voltes-Dorta, 2021; Sueyoshi et al., 2017).

Table C.3 (in Appendix C) presents the descriptive statistics for the variables used in calculating efficiency, and we winsorized the variables at level 1% and 99%. The environmental score is calculated by assigning weights to three categories, which vary by industry: innovation, emissions, and resource use; for their calculation, 57, 190, and 39 variables are used, respectively. The pillar weights are normalized to percentages ranging between 0 and 100, with higher values indicating better performance. The approach for calculating the different ESG pillars can be found in the LSEG methodology document. All data was obtained from the LSEG database. The proposed models fulfill the isotonicity requirement, ensuring that the outputs not decrease as the inputs increase (Golany & Roll, 1989). This criterion is essential to ensure coherence and reliability within the model framework. There is a statistically significant positive correlation between inputs and outputs. Additionally, the selected combinations of inputs and outputs-maintained Spearman's rank correlation coefficients below 0.9 (Lee and Seo, 2017) (Table C.4, Appendix C).

3.3.2.1.2. Independent variables: Diversity and inclusion scores

Building on prior research that employed the same measure of a company's diversity and inclusion policies and practices (Suciu et al., 2020; Bax, 2023), we examined the impact of each dimension of D&I as independent variables on ECO. The explanatory variables in this research consist of five elements, four key pillars, and a fifth one that encompasses these (D&I Global), offering a comprehensive view of the company's diversity and inclusion policies and practices. The four pillars address various aspects of diversity (D&I Div), inclusion (D&I Incl), people development (D&I PD), and controversies (D&I Contr), and include of 24 metrics outlined in Table 16. These metrics are sourced from the LSEG database, where data are manually collected and verified by experienced analysts (LSEG, 2024). The 5 indices range from 0 to 100 points, with lower scores indicating poorer ratings. The approach for calculating diversity and inclusion scores is detailed in the Refinitiv methodology document.

Table 16. Composition of D&I scores.

Diversity Pillar	Inclusion Pillar	People Development	News & Controversies
Board Gender Diversity	Flexible Working Hours	Internal Promotion	Diversity and Opportunity Controversies
Board Member Cultural Diversity	Day Care Services	Average Training Hours	Wages or Working Conditions Controversies
Women Employees New Women Employees	Employees with Disabilities	Management Training	
Women Executive Employees	HRC Corporate Equality Index	Career Development Processes	
Women Managers	HIV/AIDS	Employee Satisfaction	
Diversity Process		Skills Training of Employees	
Diversity Objectives		Training Cost per Employee	

Source: LSEG. Note: The LSEG database also includes controversies published since the company update last fiscal year. These are two additional data points for the frame News & Controversies measures shown but in a more recent timeframe.

3.3.3. Control Variables

To avoid specification errors in the model, we include control variables that have been identified in the literature as relevant. These variables are divided into two categories: the first group comprises characteristics associated with firms' corporate governance mechanisms, while the second group consists of firm-specific control variables.

The board of directors holds a key role in ensuring effective control of significant environmental and financial risks. Previous literature suggests that corporate ECO may be influenced by various factors related to board composition and governance practices. Therefore, as the control variables, we considered factors such as board size (B_Size), the presence of independent members on the board of directors (IndpBMemb), and the duality of CEOs and chairman roles (CEO_Duality). Additionally, we incorporated other relevant aspects of corporate governance, including the integration of ESG objectives into executive compensation (Sus_Comp), the presence of a CSR strategy (CSR_Stra) and committee (CSR_Com), or the adoption of quality management systems (QMS).

We have also incorporated the extent to which a company's ECO can be influenced by supporting environmental SDGs (Env_SDGs). Adopted by the United Nations in 2015, the 17 SDGs are a global call to end poverty, protect the planet, and ensure peace and prosperity for all (UN, 2024). In terms of environmental SDGs, following Taglialatela et al. (2023), we have considered the following SDGs: 6, Clean Water and Sanitation; 7, Affordable and Clean Energy; 11, Sustainable Cities and Communities; 12, Responsible Consumption and Production; 13, Climate Action; 14, Life Below Water; and 15, Life on Land. We have developed an environmental SDG index calculated as the ratio between the number of environmental SDGs the company

has adopted, and the full set of environmental SDGs available. This index ranges from 0 to 1, depending on the company's contribution to the environmental SDGs.

We have included various firm-specific control variables previously identified in the literature, such as the economic profitability (ROA), capital expenditure (Capex), market risk (Beta), leverage (Lev), firm size (Size), and firm age (Age). The definitions of these variables, their expected signs concerning the dependent variable, and the bibliographic references by which they were selected can be found in Table C.5 (Appendix C). All variables were sourced from the LSEG database.

3.3.4. Model Settings

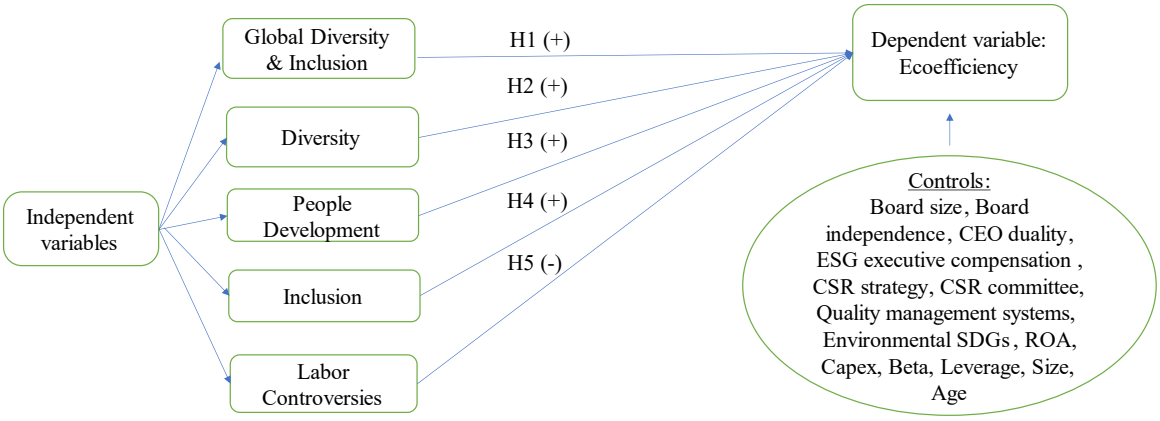
Next, the analysis uses truncated regression to examine the relationship between D&I and ECO. The econometric model is outlined as follows:

$$\widehat{\widehat{ECO}}_{it} = \alpha + \gamma DIV_{it} + \beta Z_{it} + \eta D_t + \varepsilon_{it} \quad (2)$$

where $\widehat{\widehat{ECO}}_{it}$ is the dependent variable, the ECO score for DMUi of each year t. DIV_{it} is a vector of each of the D&I Index and Z_{it} is a vector of control variables that are expected to explain ECO and D_t is a vector of year dummies from 2016 to 2022. $\gamma, \beta,$ and η are the parameters which are evaluated, and $\mathcal{E}_{it}$ is an error term that is normally distributed with a zero mean, σ_{ε}^2 variance, and left truncation $(1 - \gamma DIV_{it} - \beta Z_{it} - \eta D_t)$.

The study framework is illustrated in Figure 3 below:

Figure 3. Study framework.



Source: own elaboration.

3.4. RESULTS

3.4.1. Descriptive Statistics

As we indicated in the previous section, in the initial stage, we calculated two types of efficiency, the descriptive statistics of which are shown in Table 17. The average operational efficiency is 44.80%, suggesting a moderate level with room for improvement. These findings align with the results of Maside-Sanfiz et al. (2023a) for the global energy sector but are lower than those found in the analysis of the European energy sector conducted by Sánchez-Robles et al. (2022), which reported an average of 27%. Regarding ECO efficiency, the mean is 64.64%, consistent with the averages reported by Ren et al. (2022) and Maside-Sanfiz et al. (2023b).

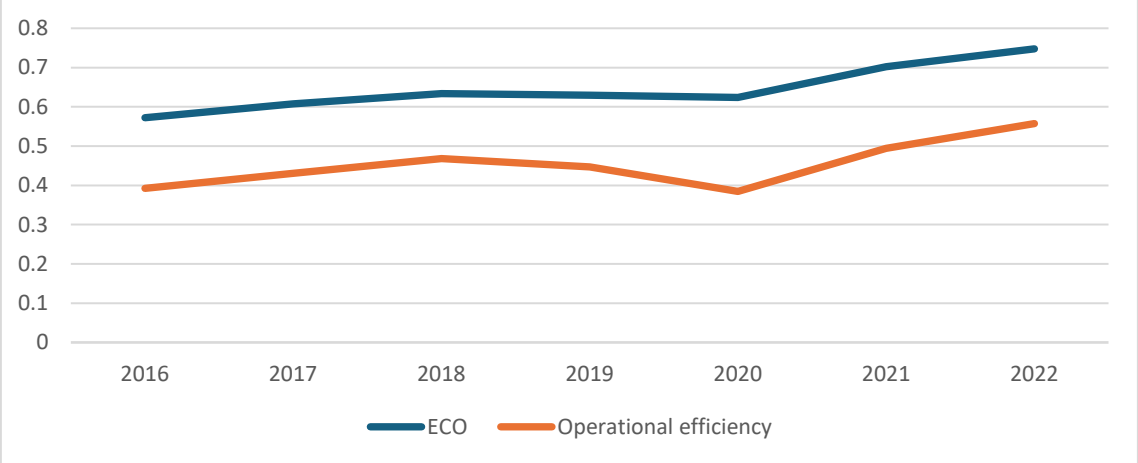
Table 17. Descriptive statistics of operational efficiency and ECO.

	Mean	Std.Dev.	Min.	Max.	Obs.
Operational efficiency (%)	44.7962	23.3313	0	100	2,345
ECO (%)	64.6438	22.6991	0	100	1,964

Source: own elaboration.

Figure 4 shows the evolution over time of both types of efficiency, which follow a similar trend. The COVID health crisis of 2020 had a negative impact on the evolution of both types of efficiency, which subsequently improved in 2020 and 2021.

Figure 4. Evolution of efficiency over time.



Source: own elaboration.

Table 18 presents descriptive statistics for the D&I scores and Figure 5 the evolution of D&I scores over time. As can be observed, low levels of performance are evident across both the overall D&I score and its dimensions (Fig. 5). The average D&I global score is 44.69%. The results for each of their dimensions, namely, diversity (D&I Div), people development (D&I PD), inclusion (D&I Incl), and controversies (D&I Contr), are as

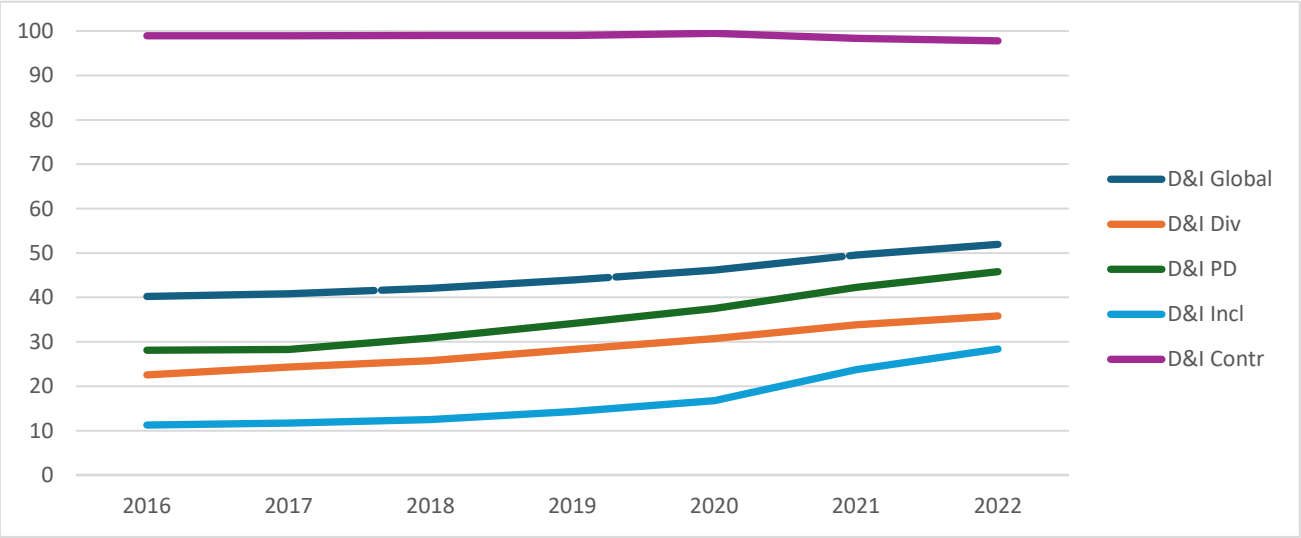
follows: 28.63%, 34.94%, 16.30%, and 98.89%, respectively. A study conducted by Suciu et al. (2020) on a sample of European companies for the year 2020 reported values of 32.28%, 40.88%, 15.76%, and 99.01%, respectively. Therefore, it is noted that the dimensions of inclusion and controversies exhibit very similar values, while the magnitudes of diversity and people development are notably lower in our study. In line with previous research, there is considerable variability in the values across dimensions. For instance, while controversies exhibit minimal variation, 4.97 versus 5.08 in Suciu et al. (2020), inclusion scores demonstrate significant variability, 19.90 versus 20.49 in Suciu et al. (2020). As a result, we observed significant room for improvement in human resource management policies through the implementation of measures that promote professional development, diversity, and especially inclusion in the workplace.

Table 18. Descriptive statistics of independent variables.

	Mean	Std.Dev.	Min.	Max.	Obs.
D&I Global	44.69034	10.21319	22	72.75	1,851
D&I Diversity	28.62669	13.65103	0	70	1,851
D&I People Development	34.93664	21.63004	0	91	1,851
D&I Inclusion	16.30391	19.90899	0	95	1,851
D&I Controversies	98.89411	4.976336	50	100	1,851

Source: own elaboration.

Figure 5. Evolution of D&I scores over time.



Source: own elaboration.

Regarding the control variables (Table 19), the board size of the companies in our sample has a size of 9.12 directors. In relation to the levels of independence of this body, it is worth noting that in 32.78% of the companies, the CEO is also the chairman of the board, and 62.70% of its members are independent directors. 33.65% already

apply ESG metrics in their senior management incentive plans, 35.73% have implemented a quality management system, 53.42% have defined CSR strategies, and 51.96% have a CSR committee. In terms of sustainable development objectives, the percentage of environmental SDGs that a firm support is 37.52%. In terms of size, the average assets are 1.95e+10, the average age is 24.48 years old, the ROA is 2.86%, the Capex is 1.24e+09, the leverage is 57.27%, and the Beta is 1.43.

In summary, although companies in the energy sector have made progress in CSR-related areas such as appointing independent directors and women executives, a significant proportion of firms have yet to define CSR strategies or establish sustainability committees. Additionally, only a small percentage of companies incorporate ESG metrics into senior management incentive plans or actively support environmental SDGs.

Table 19. Descriptive statistics of control variables.

Variable	Mean	Std.Dev.	Min.	Max.	Obs.
B_Size	9.119908	3.021639	1	26	2,185
CEO_Duality	0.3278237	0.469528	0	1	2,178
IndpBMemb (%)	62.69972	23.6498	0	100	2,172
Sus_Comp	0.3365473	0.472637	0	1	2,178
QMS (%)	35.73083	39.76922	0	90.90909	2,178
CSR_Stra (%)	53.42132	31.57636	0	99.84177	2,178
CSR_Com (%)	51.96271	33.86232	0	92.59259	2,308
Env_SDGs	0.375224	0.3834094	0	1	1,355
ROA	0.0286333	0.1604271	-0.9189032	1.719715	2,831
Capex	1.24e+09	3.74e+09	0	4.69e+10	2,793
Beta	1.427232	0.8599068	-2.427832	9.45791	2,631
Lev	0.5727568	0.3878766	0.0015434	8.820139	2,866
Size	1.95e+10	5.42e+10	10,034.31	6.64e+11	2,866
Age	24.47688	24.69391	0	140	2,898

Source: own elaboration.

We examine the correlation between D&I scores and the control variables. While the D&I global index and its dimensions exhibit high correlation, they are not included in the same models. Adhering to Brooks's rule (2019), the correlation coefficients do not indicate any issues of collinearity, as their absolute values remain consistently below 0.8. Furthermore, the variant inflation factor (VIF) shows no evidence of multicollinearity.

3.4.2. Baseline Model: Results and Discussion

The results of the truncated regression, presented in Table 20, allow us to examine the relationship between D&I practices and ECO as measured by the DEA model. First,

our results indicate a positive relationship between the index that collectively measures diversity, inclusion, people development, and the absence of labor incidents, and ECO. This may be due to the fact that, as pointed out in the conclusions of previous literature in this field (Özbilgin and Tatli, 2011; Rohwerder, 2017), diversity, inclusion, and equality measures in the workplace encourage employee commitment to the organization, improve job satisfaction and absenteeism, promote talent retention, and reduce litigation, with the consequent impact on financial and environmental performance. Our results are consistent with the findings of Suciu et al. (2020) regarding profitability, thus supporting our first formulated hypothesis (H1). Particularly noteworthy is the significant positive correlation between ECO and policies that promote diversity in the workforce, as well as their effective implementation, especially concerning cultural and gender diversity, thereby supporting Hypothesis 2. These results align with studies that associate gender balance and greater cultural diversity with higher financial performance, such as those by de Klerk and Singh (2023) in the healthcare sector or Harjoto et al. (2019) in their analysis of US companies. Furthermore, our findings regarding gender diversity are consistent with empirical studies by Kemp et al. (2015), Li and Nagar (2013), and Williams (2003), all suggesting that women exhibit higher commitment to environmentally friendly behavior (Davidson and Freudenburg, 1996) and are less likely to face lawsuits for breaching environmental requirements (Liu, 2018). However, existing studies primarily focus on gender diversity within the board of directors rather than across the entire company. The only study examining gender diversity globally throughout the entire company, along with cultural diversity on board, alongside the adoption of diversity policies using an aggregate measure similar to ours, is that of Suciu et al. (2020). Their study reached a similar conclusion to ours but only examined the effect on financial performance.

Similarly, we found a positive and significant relationship between people's development, that is investments in training and employee development opportunities, and ECO, thereby supporting Hypothesis 3. While the most obvious direct effects are related to both cost savings and reduced employee turnover, absenteeism, and labor conflicts that can boost productivity, these aspects can also have indirect effects on environmental commitment (Ajgaonkar et al., 2022) and direct effects on productivity and profitability (Aziri, 2011; Katou, 2011).

In relation to inclusion policies, although several studies have positively linked inclusion policies and practices with financial performance (Sears and Mallory, 2011; Li and Nagar, 2013; Pichler et al., 2018) or environmental performance (Habib & Khalid, 2019), our results do not find a statistically significant relationship with the ECO. This aligns with the only study that used the same composite metric as a measure: the human resource management policies. In the study by Suciu et al. (2020), the results were inconclusive since the effect of workforce inclusion policies depended on the measure used for financial performance. Therefore, we cannot confirm Hypothesis 4.

Regarding controversies, our results do not show a relationship with ECO, consistent with the findings of Suciu et al. (2020), who also analyzed labor controversies. Our findings also support and extend previous research examining controversies, not only of labor origin but related to any aspect of sustainability, which

found mixed results concerning financial performance (Rodríguez-Fernández et al., 2018; Nirino et al., 2021). Therefore, we cannot confirm the Hypothesis 5 formulated.

As for the control variables and corporate governance structure, the results indicate that ECO in the energy sector is positively and significantly influenced by factors such as board size, adoption of a CSR strategy, implementation of quality management systems, and alignment with the United Nations' environmental SDGs. These findings are consistent with previous studies such as those of McGuinness et al. (2017), Shaukat et al. (2016), Kumar et al. (2018), and Taglialatela et al. (2023). Conversely, we did not find significant effects regarding CEO-chairman duality, the integration of ESG aspects into executive compensation, and the presence of a CSR committee. As for the presence of independent directors, the effects on ECO are not conclusive.

Regarding other control variables, it is evident that firms with higher profitability have higher ECO. More profitable firms tend to reduce production costs, thereby improving financial efficiency (Guo et al., 2020) and acquiring resources that can be applied to enhance their CSR efforts (Ruggiero and Cupertino, 2018; Ramecesse, 2021; López-Penabad et al., 2022).

Similar to the findings in Haque's work (2017), we find a positive relationship between leverage and ECO. It could mean that companies with higher indebtedness may try to divert shareholder attention by disclosing more information about their environmentally responsible behavior. The relationship between Capex and ECO is negative, contrary to studies such as those by Amorelli and García-Sánchez (2023) and Moussa and Elmarzouky (2023), which found a positive effect on environmental commitment. It may be that the effects of increased capital investments will not translate into immediate operational and environmental efficiency improvements, but rather manifest in later years, especially considering our composite measure assessing environmental aspects.

The association between Beta and ECO was found to be non-significant, consistent with De Villiers et al. (2011). One possibility for this non-significant relationship could be market fluctuations having less impact on environmental practices in the energy sector, regulated by external policies and driven by long-term strategic goals rather than direct pressures. Our results also show that, in line with previous research (Waddock and Graves, 1997; Ruggiero and Cupertino, 2018), larger companies are more environmentally friendly due to increased resource availability and heightened sustainability expectations from stakeholders. Finally, contrary to the study of De Villiers et al. (2011), the association between firm age and ECO was not significant.

Table 20. Truncated regressions result for the D&I-ECO relationship.

	ECO	ECO	ECO	ECO	ECO
D&I Global	0.005*** (0.001)				
D&I Div		0.003*** (0.001)			
D&I PD			0.002*** (0.000)		
D&I Incl				0.000 (0.000)	
D&I Contr					-0.002 (0.002)
B_Size	0.010*** (0.003)	0.010*** (0.003)	0.010*** (0.003)	0.010*** (0.003)	0.010*** (0.003)
CEO_Duality	0.015 (0.014)	0.019 (0.014)	0.008 (0.014)	0.010 (0.015)	0.011 (0.015)
IndpBMemb	-0.001* (0.000)	-0.001** (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Sus_Comp	0.014 (0.014)	0.009 (0.014)	0.013 (0.015)	0.015 (0.015)	0.013 (0.015)
QMS	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
CSR_Stra	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
CSR_Com	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Env_SDGs	0.078*** (0.020)	0.079*** (0.020)	0.094*** (0.020)	0.100*** (0.021)	0.102*** (0.021)
ROA	0.366*** (0.068)	0.379*** (0.072)	0.356*** (0.066)	0.370*** (0.071)	0.370*** (0.070)
Capex	-0.028*** (0.007)	-0.026*** (0.007)	-0.028*** (0.007)	-0.030*** (0.007)	-0.029*** (0.008)
Beta	-0.007 (0.007)	-0.011 (0.007)	-0.006 (0.007)	-0.008 (0.007)	-0.008 (0.007)
Lev	0.043** (0.018)	0.044** (0.018)	0.045*** (0.017)	0.049*** (0.018)	0.049*** (0.017)
Size	0.054*** (0.009)	0.054*** (0.009)	0.056*** (0.009)	0.059*** (0.009)	0.058*** (0.010)
Age	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Constant	-0.445*** (0.113)	-0.334*** (0.109)	-0.334*** (0.110)	-0.331*** (0.118)	-0.157 (0.218)
Sigma	0.167*** (0.005)	0.168*** (0.005)	0.166*** (0.005)	0.172*** (0.005)	0.172*** (0.005)
Year FE	YES	YES	YES	YES	YES
N	918	918	918	918	918
Wald chi2	669.67	670.21	703.51	598.85	587.88
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Source: own elaboration.

Note: The dependent variable is the ECO score, computed using 2000 bootstrap replications to correct bias in DEA. Data enclosed in () are the standard error. Dummy variables for time have been used. Asterisks indicate significance at the 10 percent (*), 5 percent (**), and 1 percent (***) levels.

3.4.3. Complementary Analysis

As a complementary analysis, we ran the models independently for environmental performance, using the environmental score as a proxy, and for financial performance, using ROA as a proxy[4].

As for the results observed when using only the environmental variable as the dependent variable (see Table 21), both diversity, inclusion, and people training and development affect it positively and significantly. In this way, we can verify the interconnection between human capital and environmental factors. Our findings indicate

that a stronger D&I is a significant driver of environmental commitment. However, higher diversity and inclusion policies do not guarantee higher financial performance; only training and development opportunities for employees show positive and significant results with ROA (see Table 22). Our findings are in line with those found in the Pakistani manufacturing sector by Syed et al. (2020), who measured recruitment and staff training policies through surveys.

Regarding inclusion policies, our results show that they positively affect environmental performance (Table 21), in line with Habib and Khalid (2019), and do not affect financial performance (Table 22), coinciding with the conclusions of the work by Suciu et al. (2020), which found different results depending on the financial performance measure used. It might be advisable for companies in the energy sector to redesign the jobs held by employees with family reconciliation needs, disabilities, or AIDS/HIV to adapt them to their characteristics and thus improve financial performance.

Regarding labor controversies, although our results align with those of Suciu et al. (2020) and Rodríguez-Fernández et al. (2028), we find it surprising that they do not influence performance, either environmental or financial (see Table 21 and Table 22), especially in a sector with such high reputational risk as the energy sector. In our study, this could be due to the almost absence of labor disputes in the sample under study, with an average score of nearly 99 out of a maximum of 100, and very low variability, of just 5 points.

In conclusion, our findings support the idea that human resources management policies promote workforce diversity, along with practices fostering job satisfaction through promotion and training, result in companies that are more environmentally committed, but only in the last case are more economically profitable.

Table 21. Truncated regressions result for the D&I-environmental score relationship.

	ENV	ENV	ENV	ENV	ENV
D&I Global	0.528*** (0.060)				
D&I Div		0.117*** (0.038)			
D&I PD			0.271*** (0.026)		
D&I Incl				0.063** (0.025)	
D&I Contr					0.032 (0.065)
Control	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
N	1061	1061	1061	1061	1061
Wald chi2	763.13	633.06	811.51	625.98	612.88
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Source: own elaboration.

Note: Data enclosed in () are the standard error. Dummy variables for time have been used. Asterisks indicate significance at the 10 percent (*), 5 percent (**), and 1 percent (***) levels.

Table 22. Truncated regressions result for the D&I-financial performance relationship.

	ROA	ROA	ROA	ROA	ROA
D&I Global	0.001 (0.001)				
D&I Div		-0.000 (0.000)			
D&I PD			0.000* (0.000)		
D&I Incl				-0.000 (0.000)	
D&I Contr					0.001(0.001)
Control	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
N	1062	1062	1062	1062	1062
R2	0.2645	0.2639	0.2669	0.2636	0.2644

Source: own elaboration.

Note: Data enclosed in () are the standard error. Dummy variables for time have been used. Asterisks indicate significance at the 10 percent (*), 5 percent (**), and 1 percent (***) levels. Ordinary least squares estimation has a year fixed effect. Standard errors are clustered at firm level.

3.4.4. Robustness

Finally, we carry out various analyses to ensure that the results are unbiased and free from endogeneity issues. So, given that the sample is biased due to the high number of observations from the US (32.24% of the sample), we assess the robustness of our initial findings from the baseline model by employing an alternative estimation approach and excluding observations from US companies[3]. We adopt another widely used model in efficiency literature, the Tobit model, as ECO values are bounded between 0 and 1 (Sánchez-Robles et al., 2022). Overall, the results of the Tobit random effects model closely align with those of the baseline model (see Table 23), with most coefficient estimates remaining stable across both models.

Table 23. Tobit regressions result for the D&I-ECO relationship, non-US firms.

	ECO	ECO	ECO	ECO	ECO
D&I Global	0.006*** (0.001)				
D&I Div		0.003*** (0.001)			
D&I PD			0.003*** (0.000)		
D&I Incl				-0.000 (0.000)	
D&I Contr					0.001 (0.002)
Control	YES	YES	YES	YES	YES
Constant	-0.227* (0.132)	-0.080 (0.132)	-0.087 (0.124)	-0.109 (0.134)	-0.251 (0.232)
Sigma	0.158*** (0.006)	0.160*** (0.007)	0.154*** (0.006)	0.164*** (0.007)	0.163*** (0.007)
Year FE	YES	YES	YES	YES	YES
N	622	622	622	622	622
Wald chi2	471.00	445.42	509.76	424.37	422.92
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Source: own elaboration.

Note: Data enclosed in () are the standard error. Dummy variables for time have been used. Asterisks indicate significance at the 10 percent (*), 5 percent (**), and 1 percent (***) levels.

[3] We used the same control variables as in the baseline analysis.

Additionally, to address potential endogeneity concerns, we employed two alternative models. We first re-estimated Equation 1, introducing a lag of one year in various independent and control variables as regressors and using the ordinary least squares (OLS) method. Subsequently, we conducted a two-stage least squares regression (2SLS), utilizing the variables with a one-year lag as instruments, consistent with prior studies (e.g., Amorelli and García-Sánchez, 2023; Khatri, 2023). This paper uses different tests, suggesting that the instruments are valid and that the models are correctly specified.

As we can see in Tables (C.5) and (C.6) in Appendix C, the results of the robustness analysis confirm the positive and significative correlation between the diversity, inclusion, and people development policies of firms and ECO, and specifically with the implementation of human resources management policies that promote gender and cultural diversity in the organization, as well as training and promotion practices for the workforce, suggesting that the main results are robust to endogeneity.

3.5. CONCLUSIONS

Corporate social responsibility activities have a positive effect on business performance in companies (Jo and Harjoto, 2011; Gherghina et al., 2015; Adeneye and Ahmed, 2015). However, in the energy sector, this effect is more pronounced compared to other sectors (Iazzolino et al., 2023b), due to the high public scrutiny it faces, both because of the nature of its activities and the size of its companies (Beck et al., 2018). Improving the efficiency and sustainability of companies is paramount, and the study of the factors influencing these in such a crucial sector as energy has not received sufficient attention in previous research. Among these factors, the role of human capital management stands out, as attracting and retaining talent in today's companies is linked not only to salary but also to values such as diversity, equality, and inclusion in the workplace. This article aims to assess the impact of diversity and inclusion initiatives in workplaces on ECO of 373 listed energy companies from a total of 53 countries for the period 2016–2022.

In the descriptive analysis conducted, we observed a wide scope for improvement in human resource management policies by introducing measures that foster professional development, diversity, and especially inclusion in the workplace.

In the multivariate analysis, this research verifies the relationship between human capital management and ECO in the energy sector, concluding that effective workforce management translates into achievements in both economic and environmental realms. Specifically, policies focused on training and career advancement, as well as those aimed at gender and cultural diversity for employees, have become drivers of improved ECO. Our results also indicate that while companies in the energy sector have made progress in certain CSR-related areas, such as appointing independent directors and women executives, a notable proportion of companies have yet to define CSR strategies or establish sustainability committees. Furthermore, there remains a low percentage of companies incorporating ESG metrics into senior management incentive plans or actively supporting environmental SDGs.

This study has practical implications for various stakeholders in the energy sector. First, it provides a tool that can be useful for stakeholders seeking to comprehensively analyze business performance management called ECO, by incorporating not only financial aspects but also an indicator that includes 286 environmental measures. Second, our results strongly support the need for energy company managers to place diversity, equality, and inclusion policies as the central axis of human resources management since these aspects are crucial for company executives as they enable them to optimize human resources management while enhancing ECO. Third, although there are both social justice (Dahanayake et al., 2018) and ethical and moral (Gotsis and Kortezi, 2013) reasons for the public sector to define policies that promote diversity, equality, and inclusion in the workplace, our findings have clear implications for guiding regulators and policymakers in ensuring the sustainable development of the sector. Sustainable development involves putting people at the center of management, developing actions based on environmental responsibility, and not focusing solely on financial objectives (Camilleri, 2017). This is today referred to as the triple bottom line toward which the management of energy companies should be focused.

From a theoretical standpoint, our findings allow for the integration of stakeholder theory and resource-based theory as a framework to frame human resources management in the energy sector. Thus, organizations that demonstrate commitment to diversity, equity, inclusion, and climate transition enhance their corporate reputation and create long-term value for all stakeholders, as advocated by stakeholder theory. Simultaneously, these practices create scarcely imitable competitive advantages that represent highly valuable intangibles, as supported by resource-based theory. Therefore, these theories are compatible in explaining the CSR behavior of energy companies.

Based on our findings, policymakers could enact and refine regulations to promote human resources management policies that emphasize diversity and human resource development within the sector. This strategic approach aims to foster the development of more sustainable companies, benefiting both environmentally and economically. Additionally, investors are increasingly interested in social aspects such as diversity and training, as our research has demonstrated their close relationship with financial and environmental outcomes. As a result, our study offers valuable insights and recommendations for industry managers seeking to implement sustainable business practices, particularly through effective talent management strategies. Furthermore, it provides guidance for investors interested in constructing environmentally conscious portfolios. Moreover, stakeholders within the energy sector should consider incorporating environmental, social, and governance (ESG) criteria into their decision-making processes to ensure long-term sustainability and resilience amidst evolving global challenges.

While this study significantly broadens existing literature and deepens our understanding of the link between diverse and inclusive workplaces and their financial performance and environmental impact, the results should be considered considering several limitations. First, the sample is restricted to a specific timeframe and includes only listed energy sector companies. Consequently, these findings may not be applicable to other sectors or to privately held energy firms, indicating a need for future research on other environmentally sensitive industries. Second, our study concentrates on firm-level factors and does not account for institutional or macro-level influences that might

also impact financial and environmental performance. For instance, aspects such as public governance quality—including enforcement mechanisms, rulemaking and regulatory frameworks, the overall environmental and social development of countries, and a free press—could compel energy companies to implement certain CSR practices. Future research should explore the relationship between these institutional factors and company ECO. Finally, the sample is predominantly skewed toward developed countries, as illustrated in Table C.1 of Appendix C, which could affect the study's results.

4

Commitment to Social SDGs and Its Influence on Energy Sector Performance: Symbolism or Reality?

4. COMMITMENT TO SOCIAL SDGS AND ITS INFLUENCE ON ENERGY SECTOR PERFORMANCE: SYMBOLISM OR REALITY?

ABSTRACT

This study investigates the relationship between corporate commitment to social Sustainable Development Goals (SDGs) and social performance, based on a global sample of 353 energy companies between 2016 and 2022. Specifically, the analysis focuses on SDGs related to Diversity and Inclusion (D&I). The findings suggest that companies generally align their public SDG commitments with their social and D&I practices, though inconsistencies are observed in D&I scores. While commitments to "Gender Equality" (SDG 5) and "Decent Work and Economic Growth" (SDG 8) are associated with stronger performance in these areas, evidence of symbolic actions related to "Reduced Inequalities" (SDG 10) indicates a lack of tangible efforts, such as promoting a healthy work-life balance, raising concerns about potential "social washing." Furthermore, the results indicate that institutional factors influence opportunistic practices supporting social SDGs. Firms headquartered in developed countries or those with a stronger environmental focus are less likely to exhibit a disconnect between discourse and action on social SDGs. These findings provide valuable insights for industry managers and policymakers on effectively integrating SDGs into business practices and offer guidance for stakeholders to make informed decisions.

Keywords: Diverse workplace; Inclusive workplace; Social performance; SDG; Greenwashing; Energy sector.

4.1. INTRODUCTION

The growing awareness of the environmental and social consequences of human activities during the late 20th century led to the adoption of the Triple Bottom Line framework. This approach emphasizes balancing environmental stewardship, social responsibility, and economic performance (Tomislav, 2018). A significant milestone in the global commitment to a more just and sustainable world was the Millennium Declaration in 2000, signed by 189 United Nation member states, and later the adoption of the 2030 Agenda for Sustainable Development in 2015. This agenda outlined 17 SDGs, 169 targets, and over 200 indicators, serving as a roadmap for global sustainable development (Rosati & Faria, 2019).

Achieving these ambitious goals requires collaboration between public administrations, civil society, NGOs and the private sector. Among the private sector, large corporations, particularly in the energy industry, hold a pivotal role. Their core activities are fundamental to achieving several SDGs (Wynn & Jones, 2022). For energy companies, with high public exposure due to its environmental impact, financial and environmental performance are not enough for business sustainability, which is intrinsically linked to social SDGs such as respect for human rights, gender and cultural diversity within the company, an inclusive work environment, and the improvement of employee skills (Saha et al., 2024).

Despite the critical role of energy companies, limited research has focused on their commitment to social SDGs. While studies such as Arena et al. (2023) provide a global analysis, most research (e.g., Izzo et al., 2020; Manes-Rossi and Nicolo', 2022; and Gerged & Almontase, 2021) is regional and focuses on Italian, European, and Libyan samples, respectively, analyzing the disclosure of SDGs rather than actual support. Additionally, socially responsible practices related to diversity, equality, and inclusion are increasingly prioritized by executives (Heidrick & Struggles, 2020). However, the extent to which energy companies prioritize support for social SDGs, particularly those related to diversity, inclusion, and professional development, remains underexplored. Addressing this gap constitutes the first objective of our study.

Building on legitimacy theory, we investigate whether energy companies' commitments to SDGs are substantial or symbolic. Symbolic actions, or "SDG-washing", occur when companies use SDG commitments to enhance their public image without substantive follow-through (Díaz-Sarachaga, 2020; Silva, 2021). This practice undermines stakeholders' ability to make informed decisions (Assoune, 2022). Our second objective is to examine whether commitments to social SDGs, particularly those related to diversity and inclusion, are used as tools for public image management.

From an institutional theory perspective, the adoption of the SDGs is strongly influenced by the specific context in which companies operate (Galeazzo et al., 2024; Bellostas et al., 2023). Companies often replicate the practices of other companies in their environment as a reaction to institutional pressures (Van Zanten & Van Tulder, 2018). Bellostas et al .(2023) analyze the individual impact of each SDG on overall ESG performance and the moderating effect of cultural factors, but little is known about the effect of institutional pressures on the practice of social SDG-washing. This leads us to investigate whether institutional factors, such as the level of economic development

and environmental awareness of the energy companies' home country, could affect the interaction between support for social SDGs and levels of social performance, the third objective of our study.

Utilizing a panel dataset of 353 global energy companies from 2016 to 2022, our findings reveal significant commitment to the Social SDGs, particularly “Decent Work and Economic Growth” (SDG8) and “Gender Equality” (SDG5). While there is a positive relationship between corporate social responsibility and social SDG commitments, evidence of "SDG-washing" persists, especially in inclusion policies. Additionally, institutional factors, such as economic development and environmental awareness, moderate this relationship between social SDGs commitment and effective policy implementation. In developed countries and those more aware of environmental issues, the gap between words and action on social SDGs is less common.

This study offers several significant contributions to the field of sustainability information quality. First, to the best of our knowledge, it is the first to analyze the existence of social washing through the relationship between support for social SDGs and social performance, focusing on diversity, inclusion, and professional development. Second, it identifies the moderating role of economic development and environmental consciousness in SDG-washing practices, which have been overlooked in previous literature (Pizzi et al., 2022; Bellostas et al., 2023). Finally, it extends prior research on the energy sector (e.g., Manes-Rosi & Nicolo', 2022) by conducting multivariate analysis with a large and diverse sample, offering deeper insights into global practices.

The remainder of the article is structured as follows: Section 2 reviews the most relevant literature on the subject and formulates the hypotheses to be tested; Section 3 describes the methodology employed; Section 4 presents the empirical results; and Section 5 concludes with the main findings.

4.2. THEORETICAL BACKGROUND AND HYPOTHESES

From the perspective of Agency Theory, ESG commitments can also be interpreted through the window dressing phenomenon (Palazzo & Richter, 2005). This refers to cases in which firms undertake superficial or symbolic sustainability actions with the aim of enhancing their image rather than generating substantive impact. Such a misalignment between rhetoric and practice can undermine trust and damage credibility among stakeholders. However, support for the SDGs can improve corporate performance by reducing information asymmetry, in line with Agency Theory (Buallay, 2019).

In addition, Stakeholder Theory (Freeman, 1984) provides another important perspective. It emphasizes that firms adopt sustainability practices, including commitments to the SDGs, with the aim of meeting the expectations of diverse stakeholder groups such as investors, employees, regulators, and communities. Addressing these expectations is essential for maintaining legitimacy and ensuring sustainable long-term performance. In this regard, support for the SDGs fosters competitive advantages and corporate reputation, according to the substantive approach of Legitimacy Theory (García-Meca & Martínez-Ferrero, 2021). Companies often

commit to the SDGs to legitimize their activities in the eyes of stakeholders. Legitimacy is not obtained solely through financial success but also by addressing the needs and expectations of a wide range of actors beyond shareholders (Curtó-Pagès et al., 2021). This includes obtaining social and environmental legitimacy to carry out their activities.

Nevertheless, support for the social SDGs may primarily seek to positively influence stakeholders' perceptions of a firm's social performance, to reduce its social and political exposure, and to respond to threats to its legitimacy (Cho & Patten, 2007; Clarkson et al., 2008). While this approach contributes to securing a "social license to operate," it often lacks substantive social impact, particularly in sectors such as energy. Such behavior aligns with the symbolic approach to Legitimacy Theory (Brammer & Pavelin, 2006) and can manifest as social washing.

Institutional theory offers additional insights into the phenomenon of social SDG-washing. Corporate sustainability practices, specifically commitments to the SDGs, are influenced by the institutional context of the countries in which companies operate (Jensen & Berg, 2012). Cultural values shape these institutional contexts, conditioning corporate behavior and responses to sustainability pressures (Bellostas et al., 2023). Van Zanten and Van Tulder (2018) point out that similar contexts, such as the country of origin, foster similar responses in companies, therefore, companies may commit to the SDGs in response to institutional pressures.

4.2.1. Walking the Talk on Social SDGs Vs. Social SDG Washing

In recent decades, companies have faced increasing pressure to adopt environmentally and socially responsible practices. While corporate awareness of sustainability issues has grown significantly in recent decades (Rendtorff, 2020), some companies employ manipulate strategies to align superficially with stakeholders' expectations. One manipulative tool involves a dissociated behavior: committing to sustainability goals but without taking substantial action to achieve them, making the commitment symbolic. This behavior is known as "corporate hypocrisy" (Wagner et al., 2009),"CSR washing" (Pope & Waeraas, 2015) or "CSR masking" (Crotty & Holt, 2021).

CSR washing has often been linked to environmental practices, known as greenwashing (Walker & Wan, 2012; Heras-Saizarbitoria et al., 2020; Treepongkaruna et al., 2024). Due to strong institutional pressures, starting in the 1980s, claims about sustainability commitment expanded from environmental to social issues, termed social washing, which refers to statements making a company appear more socially responsible than it actually is. For example, this can relate to the LGBTQ+ community (Özbilgin & Erbil, 2024) or gender equality (Baker et al., 2024).

The 2030 Agenda for Sustainable Development has also led to the emergence of "SDG-washing", referring to superficial commitments to SDGs without substantial follow-through (Bebbington & Unerman 2018; Moratis & Melissen, 2022; Beyne, 2020). Heras-Saizarbitoria et al. (2022) analyzed SDG commitment in sustainability reports of 1,370 global companies, finding superficial commitment indicative of SDG-

washing and suggesting another manipulative technique: prioritizing easier-to-achieve SDGs or "cherry-picking."

Research on SDG-washing yields mixed results, potentially due to varying methodologies and sample characteristics. Ferrón Vilchez et al. (2022), in a study of FTSE 100 companies in the UK, found evidence of SDG-washing by comparing environmental and social SDG commitments with performance. Similarly, Del Río et al. (2023), focusing on S&P Sustainability Yearbook companies in a global sample, observed symbolic commitments. Qualitative research has also examined SDG-washing. Díaz-Sarachaga (2020), in Spain, found limited, non-comparable SDG information in annual reports of the country's top four sustainable companies. Van der Waal and Thijssens (2020), in their study of European companies, concluded that SDG commitment was largely symbolic, confirming narrative manipulation. Lodhia et al. (2023), examining Australian companies, found that SDG commitments were not linked to internal processes for change, lacked specific targets, and were often superficial. Silva (2021), based on an analysis of FTSE 100 companies in the UK, documented that these companies chose strategies that did not significantly change their legitimacy through SDG contributions. Conversely, Beretta et al. (2024), in a study of Italian companies, and Nicolo' et al. (2024), analyzing a global sample, found a positive correlation between sustainability performance and SDG disclosure, ruling out SDG-washing. Bellostas et al. (2023), using a global sample, also found that SDG support positively impacts sustainability performance. Finally, Perevoznic and Dragomir (2024), in their study of publicly listed European Union companies, found a significant positive correlation between support for the SDGs and the implementation of corresponding policies.

Previous research has revealed sectoral differences in the adoption of SDGs. Clarkson et al. (2008), in a sample of US companies, documented that companies in more environmentally sensitive sectors have a greater inclination towards sustainability disclosures, thus legitimizing their activities. This is because companies in sectors subject to greater public scrutiny, such as controversial or environmentally sensitive sectors, have a greater motivation to legitimize their activities through commitment to the SDGs (Curtó-Pagès et al., 2021). In this regard, Manes-Rosi and Nicolò (2022), in a descriptive study of 15 European energy companies, indicated that these companies make a symbolic declaration of adherence to the SDGs but without experiencing any real change in their activities. They also pointed out that this practice can be harmful in the medium and long term for the corporate reputation of these companies when their performance is examined. García-Meca and Martínez-Ferrero (2021), in a multivariate analysis of a large sample of European companies, concluded that SDG disclosure plays a symbolic role for their activities. However, for the energy sector, the role is substantial.

After recognizing that conclusions on SDG-washing remain unclear, and noting the lack of studies on social SDG-washing in the energy sector, we propose the following hypothesis, grounded in legitimacy theory, as well as stakeholder theory:

***Hypothesis 1*:** There is a positive relationship between support for social SDGs and social performance in energy companies.

Intellectual capital is fundamental to understanding how companies create value (Melloni, 2015). A 2020 global survey by Heidrick & Struggles revealed that business leaders consider diversity, inclusion, equity, and human capital well-being as critical aspects of their operations, with 93% of leaders deeming it more important than three years ago. In the energy sector, socially responsible practices associated with human resources have been particularly emphasized (Suárez-Fernández et al., 2024).

Companies often leverage support for job inclusion and efforts to reduce inequalities to enhance their corporate image, even without implementing effective measures. This is because the cost of such opportunistic practices is relatively low, and most lawsuits filed for non-compliance with diversity and inclusion commitments are dismissed (La Croix, 2021). For instance, Baker et al. (2024) found that US companies often use voluntary disclosures about employee diversity opportunistically, with notable discrepancies between stated commitments to gender and racial diversity and actual hiring practices. Similarly, Garlin (2022) documented opportunistic support for the LGBTQ+ community, often limited to symbolic actions like incorporating rainbows into advertising or merchandise.

Other studies highlight symbolic commitments to diversity issues. Buchter (2021) observed symbolic adherence to civil rights commitments, while Sterbenk et al. (2022) coined the term "femvertizing" to describe advertising campaigns around gender equity goals that lack substantive action. Their study of 61 US companies found no significant difference in gender equity actions between those winning awards for their commitments and those without such recognition. Melloni (2015) also documented the use of an impression management strategy in intellectual capital disclosures, using an overly optimistic tone regarding financial performance achieved. Finally, Walters (2022) documented various types of gender washing in sustainability reports of multinational companies.

While previous research documents the use of human resources information as a reputation management tool, no prior studies have focused specifically on diversity, inclusion, and professional development SDGs. We argue that the practice of social SDG-washing in human capital matters can impose significant reputational costs on energy companies due to the high level of public scrutiny they face, hindering their relationship with stakeholders (Goldman & Zhang, 2024). Therefore, we propose the following hypotheses:

Hypothesis 2: There is a positive relationship between support for D&I SDGs and the implementation of diversity, equality, and inclusion policies in energy companies.

We can divide this hypothesis into different sub-hypotheses based on the various elements that make up the index.

Hypothesis 2a: There is a positive relationship between commitment to SDG 5 and diversity performance in energy companies.

Hypothesis 2b: There is a positive relationship between commitment to SDG 8 and professional development performance in energy companies.

Hypothesis 2c: There is a positive relationship between commitment to SDG 10 and inclusion performance in energy companies.

4.2.2. The Moderating Role of a Country's Development Level and Environmental Performance

The search for legitimacy and environmental pressures leads companies to standardize their behavior with peers operating in the same context, a phenomenon known as isomorphism (Van Zanten & Van Tulder, 2018). Institutional isomorphism leads companies to preserve or enhance their legitimacy through imitation due to normative, mimetic, and coercive pressures (Bellostas et al., 2023).

For example, Amoako et al. (2021), using interviews as their research methodology, confirmed the existence of both normative and mimetic pressures on the environmentally responsible practices of environmentally sensitive companies (mining, energy, transportation, and construction) in Ghana. Similarly, Tetteh et al. (2024), focusing on Ghana's oil industry, demonstrated the sensitivity of domestic companies to institutional pressures when implementing measures to comply with the SDGs. Furthermore, Hyatt and Berente (2017) found that normative pressures encourage companies to make symbolic commitments to environmental practices, aimed at improving their public image rather than achieving real environmental impact.

As Vormedal and Ruud (2009) pointed out, a country's specific institutional context, by defining the "rules of the game," influences corporate behavior and, more specifically, the adoption of sustainability practices. Firms operating in countries with stricter environmental standards often face heightened stakeholder pressure, leading to improved social performance, particularly in terms of D&I. Supporting this, Long et al. (2024) revealed that stricter environmental regulations significantly reduce companies' likelihood of engaging in greenwashing, primarily due to increased risks of legal consequences and reputational damage.

Additionally, disparities in levels of economic development help explain variations in corporate social performance. Countries at different stages of development face unique social environments, legal frameworks, public opinion, and technological innovation contexts (Cai et al., 2016). Institutional factors also shape corporate contributions to the SDGs, as evidenced by Pizzi et al. (2022), while Bellostas et al. (2023) found that certain cultural characteristics of a country can moderate the positive relationship between corporate SDG commitments and ESG performance.

In light of the previous literature, we propose the following hypotheses:

Hypothesis 3: The level of environmental awareness of the country of origin has a positive effect on the relationship between support for the social SDGs and social performance.

Hypothesis 4: The level of development of the country of origin has a positive effect on the relationship between support for the social SDGs and social performance.

4.3. METHODOLOGY

4.3.1. Sample and Data

Our sample includes firms operating in coal, oil and gas, renewables, and uranium sub-sectors, covering the period from 2016 to 2022. The starting point, 2016, was selected as it marks the implementation of the United Nations Sustainable Development Goals (SDGs) in 2015.

The analysis focuses on publicly listed firms that reported their financial performance, as well as social and Diversity & Inclusion (D&I) scores on the London Stock Exchange Group (LSEG) platform[6]. After excluding firms with incomplete data, the final dataset comprises 353 firms, resulting in 1,118 firm-year observations.

The sample spans 51 countries, with the largest proportions coming from the United States (29.60%), Canada (12.08%), China (7.78%), the United Kingdom (5.90%), Australia (5.28%), India (3.76%), and Norway (2.86%). Notably, the sample is dominated by firms based in developed countries, which account for 72.00% of the total.

4.3.2. Measurement of Variables

4.3.2.1. Dependent Variables

We used ESG scores obtained from the LSEG database, which previous studies (e.g. Bellostas et al., 2023; Khaled et al., 2021; Morán-Muñoz et al., 2024 and Thammaraksa et al., 2024) have demonstrated to be reliable indicators of SDG implementation.

The social performance measure (Social_Perf) is evaluated using four criteria: workforce, community, human rights, and product responsibility. The Diversity and Inclusion score (D&I_Perf) is calculated based on four components: diversity, inclusion, people development, and broader News and Controversies about Human Capital component, which includes 24 indices. The Diversity (Div_Perf)[7], Inclusion (Inc_Perf)[8], and People Development (PDev_Perf)[9] scores are composed of 8, 5, and 7 metrics, respectively. Performance was evaluated using a percentage scale from 0 to 100, with higher percentages indicating enhanced performance.

4.3.2.2. Independent Variables

To test our hypothesis, the main explanatory variables in this research are the levels of support for social SDGs, analyzed in varying degrees of detail. With 17 dichotomous variables -one for each SDG- the LSEG database evaluates companies' contributions to the 17 United Nations-defined SDGs. A company's commitment to a specific SDG is identified by explicit mentions of support for that SDG in any company document, following methodologies established in prior studies (Kiefner et al., 2022; Taglialatela et al., 2023; Bellostas et al., 2023).

To explore the potential relationship between the SDGs and ESG performance indicators, we constructed a dataset linking each SDG to its corresponding ESG indicator, following the framework proposed by Perevoznic and Dragonir (2024).

Building upon previous research (e.g. Saha et al., 2024 and Galeazzo et al., 2024), our initial step was to identify the social SDGs, which were: SDG1 (No Poverty), SDG2 (Zero Hunger), SDG3 (Good Health and Well-being), SDG4 (Quality Education), SDG5 (Gender Equality), SDG8 (Decent Work and Economic Growth), SDG10 (Reduced Inequality), and SDG16 (Peace, Justice, and Strong Institutions).

The second step was calculating the Social SDG Index (SDG_SOC) by dividing the number of social SDGs a firm supports to the total number of social SDGs assessed. This index ranges from 0 to 1, reflecting the extent of a firm's contribution to these goals. To assess the consistency of the Social SDG Index, we calculated Cronbach's alpha coefficient, 0.9252, confirming high internal consistency.

To analyze potential social washing in relation to diversity and inclusion SDGs, we focused on SDGs 5 (gender equality), 8 (decent work and economic growth), and 10 (reduced inequalities). We developed the Global D&I SDG Index (SDG_D&I) by dividing the number of these D&I-related SDGs a company adopts to the total number of D&I SDGs considered. The Cronbach's alpha coefficient for the D&I SDG Index was 0.8468, indicating a strong level of internal consistency, confirming that the items effectively capture the same underlying constructs.

Finally, we operationalized three additional independent variables as dichotomous indicators. These variables take a value of one if the company explicitly mentioned its support for diversity (SDG_Div), SDG 10 for inclusion (SDG_Incl), and SDG 8 for professional development (SDG_PD) in any of its public disclosures.

4.3.2.3. Moderator |Variables

Most studies primarily examine internal determinants of ESG performance due to their ease of measurement and control. However, external factors, despite being more complex, are often overlooked. This oversight can lead to an incomplete understanding of the drivers of long-term sustainability. To address this gap, we analyze how the formal institutional environment of each country influences corporate behavior and sustainability practices, drawing on previous research by Bellostas et al. (2023) and Tetteh et al. (2024).

Specifically, we use the country's development level (Developing) to test Hypothesis 3 and the Environmental Performance Index (EPI) to test Hypothesis 4. The variable Developing is represented as a dummy variable, which equals 1 if the firm's headquarters is in a developing country and 0 if based in developed countries. We used the criteria established by the United Nations[10] to classify countries as either developed or developing. EPI is a composite metric of countries' environmental performance, from the Yale Center for Environmental Law & Policy[11]. This index, which measures environmental performance, ranges from zero (indicating poor environmental performance) to 100 (indicating excellent environmental performance). It is based on assessments of environmental health and ecosystem vitality. To properly disentangle the

impact of the different degrees of countries' environmental performance, we transformed the EPI variable into a dummy variable that takes the value 1 when the index is above the median, and zero otherwise.

4.3.2.4. Control Variables

Many studies have already demonstrated that other variables apart from SDGs and moderator variables can have a significant impact on ESG performance. The inclusion of control variables is essential to mitigate alternative explanations for the research findings and to ensure the robustness of statistical testing. This study incorporates control variables across three main categories: (1) governance characteristics[12], including shareholder value (Shareholders) (Komath et al., 2023), CSR strategy (CSR_Stra) (Rajesh et al., 2022) and analyst coverage (Analyst) (García-Sánchez et al., 2024a); (2) company characteristics, in line with previous studies (Martiny et al., 2024; García-Sánchez et al., 2024a; López-Penabad et al., 2022) such as leverage (Lev), profitability (ROA), capital expenditure (Capex), size, and age; and (3) external determinant, public debt-to-GDP ratio (Public Debt) as a proxy for financial constraints (Li et al., 2024).

4.4. EMPIRICAL METHODOLOGY

To examine the relationship between firm's support for different SDGs on social and D&I performance, and how this interaction is influenced by institutional factors we estimate the following regression model:

$$Social/D\&I\_Perf_{it} = \alpha_1 + \gamma_1 SDG_{it} + \delta_1 Control_{it} + \eta_1 D_t + \varepsilon_{it} (1)$$

In Eq. (1) SOC_Perf_{it} represents the Social and Diversity & Inclusion scores of a firm i in year t. SDG_{it} are vectors that reflects the company's commitment to different SDGs of a firm i in year t. $Control_{it}$ demonstrates the set of corporate control variables. Dt represents a vector of year dummies from 2016 to 2022. The parameters to be estimated are denoted by α, γ, δ and η, while εit denotes the error term.

To analyze the influence of country-specific factors -environmental performance and the economic development level- on the relationship between SDGs and corporate performance, we use the following equations:

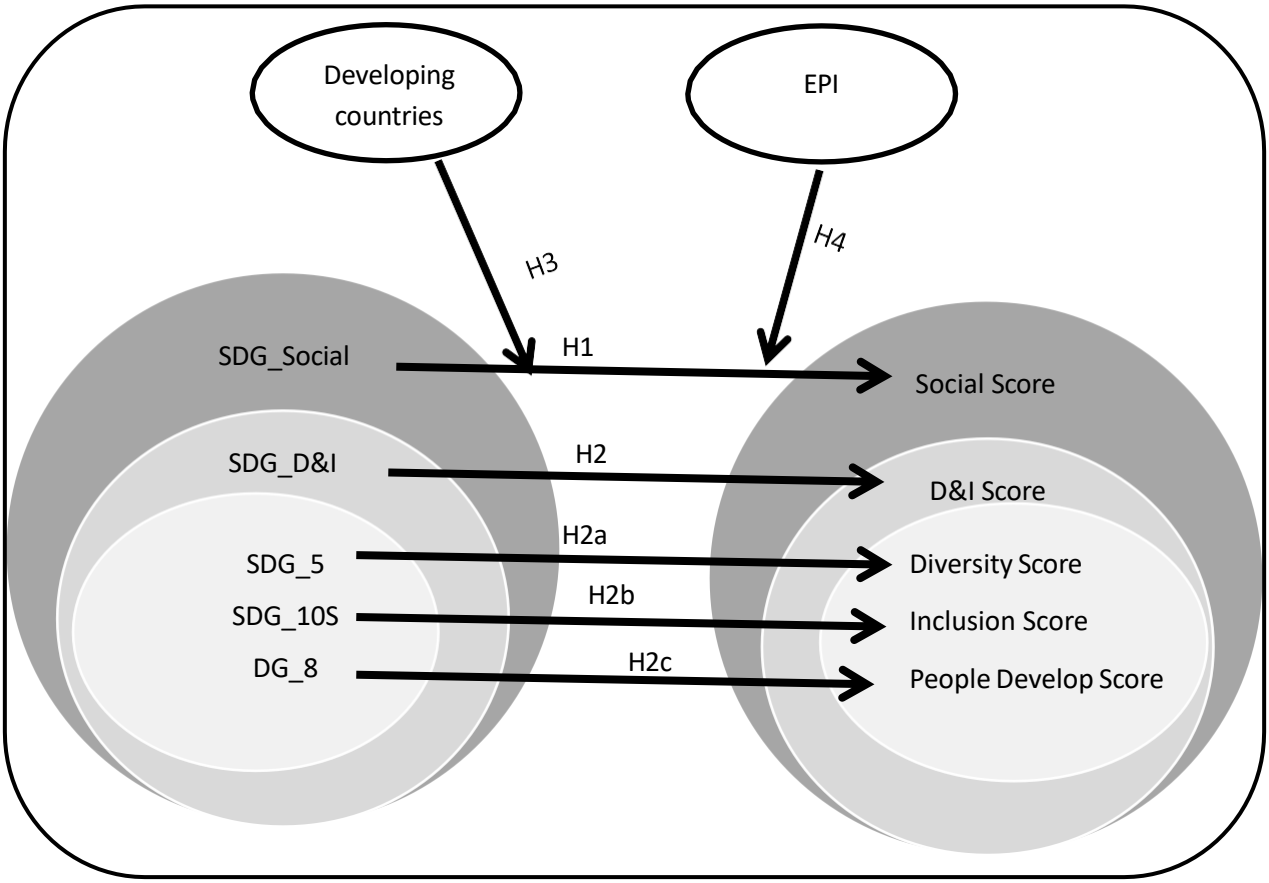
$$Social/D\&I\_Perf_{it} = \alpha_2 + \gamma_1 SDG_{it} + \delta_2 Developing_t + \omega_2 (SDG_{it} \times Developing_t) + \delta\ Control_{it} + \eta_2 D_t + \varepsilon_{it}\ (2)$$

$$Social/D\&I\_Perf_{it} = \alpha_2 + \gamma_1 SDG_{it} + \delta_2 EPI_t + \omega_2 (SDG_{it} \times EPI_t) + \delta\ Control_{it} + \eta_2 D_t + \varepsilon_{it}\ (3)$$

In Eq. (2) Developing equals 1 for developing countries and 0 for developed countries and Eq. (3) EPIt represents country-level environmental performance. The coefficients of the interaction between the variables $SDG\_{it} \times Developing_t$ and $SDG_{it} \times EPI_t$ show whether there is an additional change in the effect of SDG support on the different Social and D&I scores when EPI, and

Developing moderate this effect, respectively. The study framework can be seen graphically in Figure 6 below.

Figure 6. Research Model



Source: own production.

4.5. EMPIRICAL RESULTS

4.5.1. Descriptive Statistics

Within the energy sector, performance levels are moderate across both social and overall D&I scores, as well as their individual dimensions (all ranging from 0 to 100). The average social score is 55.88%, while the D&I Global score stands at 47.23%. The specific dimensions of diversity (Div), inclusion (Incl) and people development (PD), have average scores of 31.49%, 19.63%, and 38.96%, respectively. These results highlight significant opportunities to enhance social policies, particularly in human resource management, by implementing measures that promote diversity, support employee development, and, most importantly, foster workplace inclusion.

Regarding the independent variables, energy companies' support for various SDGs (ranging from 0 to 1) is generally moderate to low. The average scores are 0.35 for the

SDG_SOC, 0.40 for the SDG_D&I. Specifically, 0.38 for SDG 5 (gender equality), 0.52 for SDG 8 (decent work and economic growth), and 0.30 for SDG 10 (reducing inequalities).

In terms of corporate governance, 60.30% of energy companies have established CSR strategies, with an average Shareholder score of 54.99%. The average number of analysts following these firms is 7.85. Most companies in the sample maintain a positive ROA, averaging 2%, and average leverage stands at 59%. The firms are generally large in terms of natural logarithms of total assets, with an average value of 22.33, which is equivalent to total assets of approximately 2.36e+10e, and an average value of natural logarithm of capital expenditures (Capex) of 19.18, equivalent to capital expenditures 1.38e+09e. The average natural logarithm of company age is 2.95, equivalent to 27.62 years.

In summary, while companies in the energy sector have made progress in social and D&I areas, a significant proportion still do not actively support SDGs related to these aspects, nor have they developed comprehensive CSR strategies or established clear relationships with shareholders.

These companies operate within diverse institutional environments. Country-level data indicate an average EPI of 62.46%, reflecting relatively high environmental performance, with significantly higher values in developed countries compared to developing ones (EPI: 70.67 vs. 41.36). Our sample is predominantly composed of firms based in developed countries, representing 72% of the observations. During the study period, average public debt to GDP ratio was 82.31%.

Table 24. Descriptive statistics of dependent, independent and moderating variables

	Mean	Std.Dev.	Max	Min	Obs.
Social_Perf	55.88	22.31	98.26	1.00	1,118
D&I_Perf	47.23	9.57	72.75	25.00	1,118
Div_Perf	31.49	13.55	70.00	0.00	1,118
Incl_Perf	19.63	20.02	95.00	0.00	1,118
PD_Perf	38.96	19.56	87.00	0.00	1,118
SDG_Soc	0.35	0.38	1.00	0.00	1,118
SDG_D&I	0.40	0.42	1.00	0.00	1,118
SDG_5	0.38	0.49	1.00	0.00	1,118
SDG_8	0.52	0.50	1.00	0.00	1,118
SDG_10	0.30	0.46	1.00	0.00	1,118
Developing	0.28	0.45	1.00	0.00	1,118
EPI	62.46	16.82	87.42	0.00	1,118
EPIdummy	0.45	0.50	1.00	0.00	1,118

Source: LSEG. Yale Center for Environmental Law & Policy, World Bank. own production.

Table 25. Descriptive statistics of control variables

	Mean	Std.Dev.	Max	Min	Obs.
CSR_Stra (%)	60.30	29.03	99.68	0.00	1,118
Shareholders (%)	54.99	27.18	99.85	1.03	1,118
Analyst (%)	7.85	7.67	34.00	0.00	1,036
Size (Ln)	22.33	1.76	27.08	16.96	1,118
Age (Ln)	2.95	0.96	4.93	0.00	1,087
Lev	0.59	0.39	8.82	0.01	1,118
RoA	0.02	0.16	1.72	-0.92	1,118
Capex (Ln)	19.18	2.10	24.57	11.34	1,114
Public debt (%)	82.31	39.85	239.2	0.00	1,118

Source: LSEG. own production.

We computed the correlation matrix coefficients between the SDGs and the control variables. The absolute values of the correlation coefficients were all below 0.8, suggesting that multicollinearity is not a significant issue in our study (Brooks, 2008). Additionally, to further assess multicollinearity among the explanatory variables, we performed a Variance Inflation Factor (VIF) test. All VIF values were under 5, indicating that multicollinearity does not pose a significant issue in this model (Hair et al., 2010).

The correlation matrix, presented in Table 26, also shows a positive relationship between SDG engagement and both social and D&I scores (p-value < 0.05), indicating that commitment to the SDGs is associated with higher levels of sustainable performance.

Table 26. Spearman correlations among dependent, independent and moderating variables (p star(.05))

	1	2	3	4	5	6	7	8	9	10	11	12
Social_Perf	1											
D&I_Perf	0.6017*	1										
Div_Perf	0.4231*	0.6001*	1									
Incl_Perf	0.4184*	0.7595*	0.2447*	1								
PD_Perf	0.4987*	0.7230*	0.2977*	0.3118*	1							
SDG_Soc	0.4515*	0.4375*	0.2792*	0.3390*	0.3342*	1						
SDG_D&I	0.4405*	0.4326*	0.3050*	0.3311*	0.3092*	0.9625*	1					
SDG5	0.3288*	0.3418*	0.2349*	0.2709*	0.2472*	0.8323*	0.8784*	1				
SDG8	0.4520*	0.4591*	0.3264*	0.3462*	0.3262*	0.8941*	0.9137*	0.7145*	1			
SDG10	0.3253*	0.2880*	0.2030*	0.2222*	0.2044*	0.7779*	0.8213*	0.6592*	0.5845*	1		
EPI	-0.1054*	-0.0701*	0.2423*	-0.1033*	-0.2064*	-0.1901*	-0.1475*	-0.1244*	-0.1326*	-0.1249*	1	
Developing	0.1586*	0.1840*	-0.1575*	0.1524*	0.2991*	0.2700*	0.2228*	0.1749*	0.2337*	0.1605*	-0.7342*	1

Source: own production.

4.5.2. Multivariate Analysis

As the values of the social and Diversity and Inclusion scores are truncated between 0 and 100, we estimate the regression using a truncated regression model with year fixed effects, obtaining robust standard errors to address potential heteroscedasticity issues. Table 27 shows a summary of the regressions results, highlighting the main determinants of social and D&I scores as a function of companies' engagement with the SDGs.

Our analysis reveals a positive relationship between commitment to the SDG_Soc and the Social performance (10.676, p-value < 0.010), supporting Hypothesis 1. These findings indicate that a stronger commitment to social SDGs is associated with higher levels of social performance. Similarly, there is a positive interaction between the SDG_D&I and the D&I score (3.252, p-value < 0.010), confirming Hypothesis 2. These results align with the substantive perspective of legitimacy theory: companies use their social commitment, particularly regarding D&I, to legitimize their activities while also enacting real change.

Nevertheless, upon delving into the specifics of different D&I practices, the findings are heterogeneous. Specifically, there is the positive and significant relationship between commitment to gender equality (SDG 5) and the diversity performance (4.922, p-value < 0.010), as well as between decent work and economic growth (SDG 8) and people development performance (3.200, p-value < 0.010). Consequently, hypotheses 2a and 2b are supported by our data. However, no significant relationship was found between commitment to reducing inequalities (SDG 10) and inclusion performance, leading us to reject hypothesis 2c.

Table 27. Truncated regression for SDG-Social and D&I performance

	Social_Perf	D&I_Perf	Div_Perf	Incl_Perf	PD_Perf
SDG_Soc	10.676*** (1.833)				
SDG_D&I		3.252*** (0.616)			
SDG_Div			4.922*** (0.855)		
SDG_Incl				0.848 (1.410)	
SDG_PD					3.200*** (1.210)
CSR_Stra	0.316*** (0.026)	0.116*** (0.009)	0.073*** (0.016)	0.173*** (0.022)	0.221*** (0.023)
Shareholders	0.034 (0.022)	0.039*** (0.009)	0.045*** (0.014)	0.073*** (0.020)	0.040** (0.020)
Analyst	0.448*** (0.104)	0.107*** (0.040)	-0.064 (0.065)	0.405*** (0.094)	0.121 (0.085)
Size	5.411*** (0.760)	1.528*** (0.292)	3.211*** (0.484)	1.851*** (0.656)	2.489*** (0.670)
Age	3.393*** (0.637)	1.227*** (0.234)	0.632* (0.365)	2.685*** (0.561)	2.180*** (0.532)
Lev	8.164*** (2.604)	0.947 (0.862)	2.216* (1.335)	2.327 (2.265)	0.319 (2.344)
Capex	-4.078*** (0.626)	-0.632** (0.246)	-1.673*** (0.406)	0.247 (0.514)	-1.610*** (0.553)
ROA	3.681 (5.280)	1.628 (1.471)	-0.973 (2.803)	2.566 (3.640)	4.479 (3.585)
EPI	0.243*** (0.071)	0.161*** (0.029)	0.406*** (0.071)	0.242*** (0.058)	0.069 (0.057)**
Developing	5.266** (2.579)	4.184*** (1.064)	1.599 (2.630)	7.866*** (2.302)	7.611*** (2.053)

	Social_Perf	D&I_Perf	Div_Perf	Incl_Perf	PD_Perf
Public debt	-0.040** (0.018)	-0.022*** (0.007)	-0.052*** (0.012)	0.007 (0.019)	-0.049*** (0.015)
Year fixed effect	YES	YES	YES	YES	YES
Constant	-35.966*** (10.249)	4.081 (3.781)	-32.239*** (6.980)	-65.136*** (9.742)	-10.465 (8.000)
Sigma	17.434*** (0.390)	7.107*** (0.178)	11.427*** (0.282)	16.785*** (0.408)	16.033*** (0.375)
Wald chi2	893.55	953.26	472.71	690.39	463.19
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000
N	999	999	999	999	999

Source: own elaboration. Note: Standard errors are in parenthesis.
***p < .01, **p < .05, *p < .1

The findings of the moderation analysis are presented in Table 28. Regarding the moderating effect of $SDG_{it} \times Developing_i$ on Social and D&I performance (refer to Panel A in Table 28) was negative and significant (-9.962***and -6.108***, respectively). The interaction term *SDG_Soc* × *Developing* yields a combined coefficient of 4.293, which is significantly lower than the coefficient of 14.255 observed for developed countries. The interaction term *SDG_D&I* × *Developing* results in a negative combined coefficient of -1.109 compared to 4.999 for developed countries. This suggests that for energy firms operating in developing countries, the impact of SDG commitment on social and D&I performance is less pronounced[4].

Lastly, the interaction effect of the $SDG_{it} \times EPI_i$, (Panel B in Table 28), it was found to be significant and positive for social and D&I performance (10.151*** and 4.099***, respectively). The interaction terms $SDG\_Soc \times EPI$ and $SDG\_D\&I \times EPI$ yield combined coefficients of 17.48 and 5.575, respectively, for firms above the average environmental performance index (EPI = 1). In contrast, the coefficients for firms below the average (EPI = 0) are 7.329 and 1.476, respectively.

The results suggest that the impact of SDG commitment on social and D&I performance is higher for companies operating in countries with higher Environmental Performance Index (EPI) scores, compared to those based in countries with lower environmental performance. Our findings suggest that EPI serves a complementary role in enhancing the influence of SDG commitment on social and D&I outcomes.

[4] Although not reported in Table 28, the same result is obtained for the interaction between SDG 5, SDG 10, and SDG 8 × Developing variable in relation to diversity, inclusion, and people development performance.

Table 28. The moderating effect of development level and EPI

	Social_Perf	D&I_Perf
	Panel A	
SDG_Soc × Developing	-9.962***(3.850)	
SDG_D&I × Developing		-6.108***(1.236)
SDG_Soc	14.255***(2.223)	
SDG_D&I		4.999***(0.692)
Developing	9.480*** (3.073)	7.207***(1.207)
Control	YES	YES
Year fixed effect	YES	YES
Constant	-39.536***(10.826)	5.156(3.784)
Sigma	17.867***(0.454)	7.022***(0.175)
Wald chi2	692.40	1027.84
Prob > chi2	0.0000	0.0000
N	999	999
	Panel B	
SDG_Soc × EPI	10.151***(3.570)	
SDG_D&I × EPI		4.099*** (1.124)
SDG_Soc	7.329*** (2.464)	
SDG_D&I		1.476* (0.827)
EPI	-1.712 (2.044)	1.051 (0.779)
Control	YES	YES
Year fixed effect	YES	YES
Constant	-23.735** (10.009)	13.854***(3.585)
Sigma	17.970*** (0.455)	7.125***(0.172)
Wald chi2	672.09	911.35
Prob > chi2	0.0000	0.0000
N	999	999

Source: own elaboration. Note: Standard errors are in parenthesis.
***p < .01, **p < .05, *p < .1

As a result, we can conclude that these institutional factors, operating in countries with higher EPI scores and developed countries, are essential for translating SDG initiatives into ESG improvements, as they influence stakeholder support for such initiatives (Husted & De Sousa, 2017). Therefore, our results confirm the proposed hypotheses H3 and H4.

4.5.3. Robustness Analysis

To ensure the robustness of our initial findings, we employed alternative estimation methods. First, to address potential endogeneity, we recalculated Equation 1 by incorporating a one-year lag of the firm-level variables as regressors. This approach allows us to examine the long-term impact of commitment to social SDGs, particularly those related to Diversity and Inclusion (D&I), as engagement in period t-1 may influence performance in year t. We then conducted a Two-Stage Least Squares (2SLS) regression, using lagged values of the variables of interest (SDGs and corporate governance scores) as instruments, consistent with prior research (e.g., Maside-Sanfiz et al., 2024b).

Next, considering the nature of our data, which is structured as a panel with both time and cross-sectional dimensions, and the fact that ESG scores are censored between 0 and 100, we used a Tobit model with random effects (Sánchez-Robles et al., 2022; García-Sanchez et al., 2024b). The estimates were calculated using robust standard errors, adjusted with the observed information matrix (OIM), to address potential heteroskedasticity, which is a common issue in panel data analysis.

As shown in Table 30, Table 31 and Table 32, the robust analysis results confirm a significant correlation between SDG engagement and social and D&I performance, indicating that the main results are robust to endogeneity concern. As in the previous regressions, the relationship between SDG_10 (reducing inequalities) and Inclusion performance indicator is not significant.

Table 29. Truncated regression lag

	Social_Perf	D&I_Perf	Div_Perf	Incl_Perf	PD_Perf
SDG_Soc$_{t-1}$	11.250***(2.242)				
SDG_D&I $_{t-1}$		2.219***(0.725)			
SDG_Div. $_{t-1}$			3.204***(1.036)		
SDG_Incl. $_{t-1}$				-0.054(1.771)	
SDG_PD $_{t-1}$					2.494*(1.314)
Control	YES	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES	YES
Constant	-37.680***(13.213)	1.840 (4.790)	-42.002***(8.832)	-80.254***(12.332)	2.636 (9.503)
Sigma	17.303***(0.487)	6.760***(0.202)	11.422***(0.345)	16.852***(0.495)	14.625***(0.428)
Wald chi2	456.40	462.96	287.39	404.56	238.57
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000
N	653	653	653	653	653

Source: own elaboration.

Note: Standard errors are in parenthesis. ***p < .01, **p < .05, *p < .1

Table 30. Instrumental variables (2SLS) regression

	Social_Perf	D&I_Perf	Div_Perf	Incl_Perf	PD_Perf
SDG_Soc	9.650***(2.414)				
SDG_D&I		2.073**(0.949)			
SDG_Div.			3.864***(1.331)		
SDG_Incl.				-1.225(2.279)	
SDG_PD					4.180** (1.868)
Control	YES	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES	YES
Constant	-19.194(11.703)	4.258(4.833)	-38.637***(9.036)	-72.857***(13.304)	12.951 (9.616)
Sigma	17.303***(0.487)	6.760***(0.202)	11.422***(0.345)	16.852***(0.495)	14.625***(0.428)
Wald chi2	511.28	456.50	293.31	399.92	217.78
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Source: own elaboration. Note: Standard errors are in parenthesis. ***p < .01, **p < .05, *p < .1.

Table 31. Tobit regression

	Social_Perf	D&I_Perf	Div_Perf	Incl_Perf	PD_Perf
SDG_Soc	5.484***(1.382)				
SDG_D&I		2.961***(0.565)			
SDG_Div.			3.823***(0.734)		
SDG_Incl.				2.181(1.555)	
SDG_PD					2.054* (1.172)
Control	YES	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES	YES
Constant	-	4.422(5.450)	-17.458**(8.834)	-103.215***(18.471)	-32.096** (13.744)
Sigma_u	15.566***(0.678)	6.467***(0.286)	10.490***(0.469)	20.722***(1.126)	16.455***(0.767)
Sigma_e	7.685***(0.219)	3.649***(0.103)	5.873***(0.167)	10.990***(0.377)	8.667***(0.260)
Wald chi2	449.70	533.23	260.95	272.57	305.47
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000
Log likelihood	-3891.01	-3104.74	-3549.03	-3048.83	-3692.38
N	999	999	999	999	999

Source: own elaboration.

Note: Standard errors are in parenthesis. ***p < .01, **p < .05, *p < .1

4.6. DISCUSSION

Our research makes a significant contribution to the debate on how social information can be leveraged for reputation management in environmentally sensitive industries. It is pioneering in analyzing the veracity of explicit claims of support for the SDGs made by companies, comparing these claims to actual performance in the context of social SDGs within the energy sector.

While previous research findings are mixed, a majority conclude that corporate commitments to the SDGs are superficial rather than substantive (Van der Waal & Thijssens, 2020; Lodhia et al., 2023; Ferrón Vilchez et al., 2022). Nevertheless, research has shown that belonging to a sector with high public exposure is a critical factor, as the reputational cost of engaging in social SDG washing is significantly higher (Goldman & Zhang, 2024). In this regard, our results align with those of Arena et al. (2023), who document the relevance of SDG disclosures in the oil and gas sector, and with those of García-Meca and Martínez-Ferrero (2021) who found that support for social SDGs is positively associated with higher performance in social aspects, and specifically, with D&I practices. Similarly, our findings support the conclusions of Nicolo' et al. (2022), who demonstrated that environmental SDG disclosures reflect the environmental performance of firms in sensitive industries. This is linked to the greater availability of economic, human, and financial support that comes with SDG commitment. As noted by Nicolo' et al. (2022), such commitment helps legitimize companies, making them appear more dedicated and socially responsible, a point also emphasized by Kücükgül et al. (2022).

Our disaggregated analysis of D&I policies revealed that explicit declarations of support for "Gender Equality" and "Decent Work and Economic Growth" are genuinely reflected in practice. Similarly, Perevoznic and Dragomir (2024), in their study of a global sample of EU firms with a focus akin to ours, found a positive and significant relation between SDG support and its implementation. However, support for the goal of reducing inequalities is not matched by actions to facilitate a proper work-life balance for employees. This result is in line with that found by Garlin (2022) regarding the opportunistic use of LGBTQ+ symbolism. The survey conducted by Preston and Scott (2015) highlights that firms typically prioritize SDGs that align closely with their corporate objectives and promise the greatest potential benefits and SDGs such as "Reduced Inequalities" ranked outside the top five priorities for over 80% of respondents. Robustness checks confirm our findings, indicating that the effects persist not only in the short term but also over the long run, corroborating the findings of Bellostas et al. (2023) on the relationship between SDG commitment and ESG performance.

Given that sustainability practices and SDG adoption can be shaped by institutional factors (van den Heiligenberg et al., 2022), particularly the relationship between SDG commitment and ESG performance (Bellostas et al., 2023), our study addresses the potential impact of economic context and sustainability awareness on social washing practices related to the SDGs. The results confirm that the development level and environmental performance of the energy firm's headquarters country positively influence the relationship between support for social SDGs and social performance, both overall and specifically regarding D&I policies. These findings

corroborate those of Tetteh et al. (2024) regarding the positive impact of institutional pressures on the implementation of measures to achieve the SDGs in the oil industry.

Therefore, the economic context and heightened awareness of sustainable practices foster genuine commitments to social SDGs. This facilitates the establishment of trust and credibility with stakeholders. According to legitimacy theory, stakeholders in economically and environmentally developed contexts tend to be more informed about sustainable development issues and are more likely to scrutinize and demand commitments to socially responsible practices. In these countries, where regulations related to reporting and performance on diversity and inclusion are more stringent (Deloitte, 2022; World Economic Forum, 2023), companies have stronger incentives to provide accurate and transparent disclosures to mitigate reputational risks and avoid legal consequences (Long et al., 2024).

4.7. CONCLUSIONS

This research fills a critical gap in literature by examining the discrepancy between corporate commitments to social SDGs and the actions taken to achieve them. The study explores the relationship between corporate commitment to social SDGs and social performance, while analyzing how institutional factors shape this dynamic. As Rosati and Faria (2019) pointed out, adopting practices related to the social SDGs improves business planning, implementation, monitoring, and stakeholder communication, enhancing corporate reputation. Specifically, the adoption of D&I practices allows companies to address critical challenges such as fostering a more stable and productive workforce.

Our findings reveal that while there is a general alignment between companies' public commitments to the SDGs and their social and D&I practices, inconsistencies emerge upon closer examination of D&I scores. Commitments to SDGs 5 (Gender equality) and SDG 8 (Decent work and economic growth) were found to be substantive. However, the relationship between commitment to SDG 10 (Reduced inequalities) and actual inclusion practices was less clear, suggesting the potential for "social washing". These results imply that some companies engage in symbolic commitments to inclusion without implementing substantive changes. Moreover, institutional factors, such as high levels of environmental performance and the development level of the firm's headquarters country, play a crucial role in aligning corporate commitment with socially responsible practices.

From a theoretical standpoint, our results underscore the role of energy companies' support for social SDGs as a legitimizing strategy for their operations. However, this support appears to be grounded in a substantive perspective, where companies seek social license to operate by genuine commitment to social objectives, particularly in terms of D&I.

From a practical perspective, our analysis provides valuable implications for corporate practitioners. A detailed analysis of sustainability performance provides stakeholders with a clearer understanding of companies' ESG practices and enables managers to design more effective sustainability strategies. For energy companies, we

offer a framework linking support for D&I-related SDGs to improve performance in these areas, identifying strategic priorities and areas for improvement, such as SDG 10 "Reduced Inequalities", to maximize the impact of their initiatives and reinforce their commitment to sustainability goals.

The development of transparent information on the achievement of social SDGs enhances credibility among stakeholders and provides key information for continuous improvement and compliance with international sustainability standards. Tools such as the UN SDG Compass or guidance from specialized consultants can help companies identify the SDGs most relevant to their operations, integrate these goals into their strategies, and communicate progress effectively.

Policymakers should develop targeted strategies to integrate the SDGs into business practices. Regulators should implement incentive programs, such as tax breaks, funding for social initiatives, and public recognition for outstanding social contributions, to reduce barriers to socially sustainable practices. This would make it financially viable for companies to invest in initiatives related to the social SDGs, thus fostering social programs that amplify the positive impacts of SDG implementation. Regulation of the information contained in sustainability reports is essential for enhancing accountability and transparency. Indeed, new regulations on non-financial information in the United States and the European Union aim to increase corporate non-financial disclosures and combat misleading CSR reporting.

Ultimately, our findings highlight the influence of various institutional factors on the sincerity of commitments to social SDGs. Therefore, investors should recognize that the veracity of support for social SDGs depends not only on the organization's efforts but also on the institutional context. Context-specific social policies are needed, especially in developing countries where cultural and institutional factors may hinder the adoption of social SDGs.

The findings of our study should be interpreted considering certain limitations. Firstly, a key limitation of our study is its focus on publicly traded multinational corporations in the energy sector, which may have greater resources to engage with the SDGs and face increased pressure from regulators and financial markets to meet SDG targets and disclose ESG information. Consequently, our findings may not be generalizable to smaller, privately held firms. Secondly, it is crucial to acknowledge the limitations of the proxies employed for both dependent and independent variables. A universally accepted framework for assessing sustainable performance is lacking, and discrepancies among measures from different databases have been well-documented (Martiny et al., 2024). Moreover, the SDG commitment variables were constructed based on dichotomous values, which limited the study to broad goals rather than the more specific targets that subdivide these goals. Among the research avenues to be developed in the future, we highlight the possibility of studying the effect that Social SDG washing may have on corporate reputation. It would also be interesting to include other institutional factors such as culture or the political and legal system as moderating variables. Finally, a more granular analysis could be conducted by examining the specific targets within each goal, allowing for a deeper exploration into the existence of SDG washing.

5
Conclusion, Limitations and Future Research Studies

5. CONCLUSION, LIMITATIONS AND FUTURE RESEARCH STUDIES

Chapter five functions as the concluding part of this thesis through which principal findings emerge alongside recommended policies and practical uses from each empirical essay together with a discussion about study restrictions. This section provides research directions for future exploration in human capital management and environmental responsibility as well as information transparency and diversity and inclusion practices and corporate social commitments in the global energy sector.

During the recent period the global energy industry must address stakeholder requests for better financial results as well as environmental sustainability alongside social responsibility requirements. Specifically, the study first analyzes the influence of human capital, environmental capital, and the quality of financial and non-financial disclosures on financial performance. It then applies Data Envelopment Analysis (DEA) to assess environmentally adjusted efficiency (ECO), integrating economic and environmental outcomes. The research further evaluates the impact of the Environmental, Social, and Governance (ESG) Index and its components on ECO, with particular emphasis on the role of human resource practices. Special attention is given to diversity and inclusion (D&I) initiatives and their effects on financial and environmental outcomes. Finally, the study examines the authenticity of corporate commitments to the SDGs, questioning whether such commitments reflect genuine strategic integration or constitute superficial "SDG-washing."

The first essay of this thesis integrates Resource-Based, Stakeholder, and Institutional Theories to examine the combined effect of human capital, environmental capital, and information quality on the financial performance of 169 energy industry multinational firms (2016–2022), framed within the context of the global energy crisis and the shift toward a sustainable energy future. The Table 32 below displays the findings of the hypothesis testing for Chapter 1.

Table 32. Hypotheses of Chapter 1 and the findings

Hypotheses		Findings
H1:	Human capital efficiency has a positive effect on the financial performance of energy companies.	**Supported**
H2:	Human capital professional development has a positive effect on the financial performance of energy companies.	**Supported**
H3:	A high salary gap between CEOs and average employees negatively impacts the financial performance of companies.	**Supported**
H4:	CO_2 emissions have a negative effect on the financial performance of energy companies.	**Supported**
H5:	ESG controversies have a negative effect on the financial performance of energy companies.	**Supported**
H6:	The quality of accounting information has a positive effect on the financial performance of energy companies.	**Supported**

Source: own production

The analysis reveals a positive and significant relation between HCE and GPMargin. These results validate Hypothesis 1; human capital effectiveness positively impacts financial performance. Similarly, there is a positive relation between professional training and GPMargin, confirming Hypothesis 2. Regarding differentials in wages, there is the negative and significant relationship between CEO-employee wage gaps and GPMargin. Hypotheses 3 and the Relative Deprivation Theory are therefore supported by our findings. Our findings indicate that human capital is a key driver of the financial performance of an enterprise, efficient human capital management and strategic investment in the professional development of employees are positively associated with improved financial performance. But extreme pay gaps, particularly between median employees and CEOs, discourage employees and undermine organizational cohesion, hurting financial performance.

The empirical results of the research provide a strong and negative relationship between profitability and CO_2 emissions, confirm Hypothesis 4. Moreover, our findings reveal a strong positive correlation between ESG controversy scores and financial performance, supporting Hypothesis 5. Higher CO_2 emissions are linked to lower profits, highlighting the hidden costs and economic risks of neglecting environmental responsibilities. Companies that fail to manage their carbon footprint effectively face increased operational risks, potential fines, stricter regulations, and diminished investor and consumer support. Moreover, negative ESG controversies further contribute to financial and reputational losses, emphasizing the critical need for robust governance mechanisms.

Finally, the analysis reveals a positive and significant relationship between earnings quality (EQ) and GPMargin, confirming that high-quality financial reporting enhances financial performance and supporting Hypothesis 6. The quality of accounting information emerges as a pivotal factor in corporate performance. High-quality financial disclosures enhance transparency and reliability, thereby boosting investor and stakeholder confidence and providing a competitive edge.

Together, these results firmly validate the combined theoretical model and suggest that a general strategy—combining strategic human capital management, proactive environmental stewardship, and rigorous financial transparency—is necessary to achieve sustainable growth and long-term competitiveness in the energy sector. Companies that achieve a balance between profitability and sustainability goals are better placed to manage regulatory pressures, meet stakeholders' expectations, and achieve competitive advantage.

Although the energy sector is increasingly global, institutional differences between developed and developing countries persist. Despite financial globalization, the home country's factors continue to shape the impact of Corporate Social Performance (CSP) on financial performance.

This study highlights the critical importance of integrating sustainable and strategic practices within the energy sector. For managers, investing in workforce development, adopting environmental measures, and ensuring transparent financial reporting are essential for long-term profitability. Policymakers should implement regulations that incentivize emission reductions and pay equity, while investors should

place greater value on companies with robust ESG commitments, given their positive impact on financial performance. The findings further demonstrate that ESG scandals and high CO_2 emissions damage reputation and economic outcomes, whereas high-quality accounting information strengthens stakeholder trust and financial stability.

Companies should prioritize employee training, address wage gaps, and adopt clean technologies to enhance competitiveness and resilience. Additionally, they must strengthen governance frameworks and non-financial reporting to mitigate reputational and regulatory risks. Policymakers, in turn, should enforce stricter environmental regulations, mandate enhanced ESG disclosure transparency, and promote green innovation through fiscal incentives. Investors can play an active role by directing capital toward firms that align their operations with sustainability and equity principles.

This research has several constraints, including its exclusive focus on publicly traded energy firms, which limits the generalizability of findings to SMEs or other sectors. The analyzed period (2016–2022) may not fully capture post-pandemic trends or recent regulatory advancements. Furthermore, the study does not explore regional variations, overlooking how local factors—such as disparate regulatory frameworks or specific economic conditions—might influence the identified relationships.

Future studies could expand the scope by including private firms and diverse sectors to assess the generalizability of the findings. Investigating the impact of contextual variables—such as national decarbonization policies or geopolitical crises—on the sustainability-financial performance dynamic would be valuable. Additionally, research could examine the role of disruptive technologies (e.g., AI, blockchain) in improving ESG reporting, as well as conduct longitudinal studies to capture long-term effects. A multidimensional approach integrating regulatory, technological, and social perspectives would enable the development of more robust strategies for the energy transition.

CSR has become an important source of corporate risk and may affect a company's value. Given the relevance of sustainability in today's business world, it is more important than ever to have an in-depth understanding of this relationship and what it means for a company. The second essay study analyzes the association between several CSR activities, which are measured by ESG performance, and an environmentally adjusted efficiency (EAE) index that combines economic factors and CO_2 emission and energy consumption reduction targets, in a worldwide sample of companies in the energy sector. The Table 33 below displays the findings of the hypothesis testing for Chapter 2.

Table 33. Hypotheses of Chapter 2 and the findings

Hypotheses		Findings
H1:	The relationship between CSP and EAE is non-linear with U-shape.	**Supported**
H2:	The environmental, social and corporate CRS pillars and their dimensions have a non-linear relationship with EAE with U-shape.	**Partially Supported**

Source: own production

Our unbalanced panel dataset comprises 239 publicly listed energy companies from 46 countries, covering the period 2016–2021, and applying truncated regression models, we obtained the following results.

Our results indicate that the coefficient of the ESG index variable is negatively significant whereas the coefficient of the squared ESG index variable is positively significant, allowing us to draw the conclusion that there is a U-shaped relationship, i.e. convex and upward oriented, between CSP and EAE, hence the statistical evidence supports Hypothesis 1. The test results obtained confirm that the CSP-EAE relationship depends on the level of ESG investment. ESG initiatives have a negative impact on EAE in their initial phase as marginal costs outweigh marginal benefits, up to the lowest point of the curve (42.95), after which the relationship reverses and becomes positive. This is because the ESG initiatives reinforce competitive advantages and build up reputation and legitimacy.

Moreover, our results allow us to reach the same conclusion regarding the social pillar, as the shape of the curve and the inflection point are similar, so we can state that from this turning point onwards higher performance in social activities have a positive effect on EAE. Our results find a convex relationship between the governance pillar and EAE. However, the economic-environmental implications are very different from the social pillar. Thus, the inflection point is much higher and the right slope of the curve smoother. Therefore, it is necessary to achieve high values in corporate governance practices to achieve slight increases in EAE. However, the curvilinear relationship for the environmental variable cannot be confirmed. Therefore, the evidence means that Hypothesis 2 cannot be fully confirmed. Nevertheless, the relationship between EAE and the environmental pillar is lineal and positive.

This study provides valuable insights for optimizing ESG strategies in the energy sector, demonstrating that CSR investments yield varying returns depending on their nature and implementation. The findings reveal a non-linear relationship between ESG activities and corporate performance, where certain initiatives become significantly more effective after reaching threshold investment levels. Importantly, the research highlights the superiority of proactive, long-term sustainability approaches over reactive compliance measures, as the latter often negatively impact profitability. These findings are particularly relevant given the energy sector's dual challenge of addressing climate change while managing price volatility, suggesting that strategic ESG investments can simultaneously enhance financial performance and contribute to broader sustainability goals.

For corporate leaders, the study recommends adopting dynamic ESG resource allocation models that account for performance thresholds and diminishing returns. Companies should transition from reactive compliance to proactive sustainability strategies, prioritizing initiatives that optimize both environmental and financial outcomes. Policymakers, meanwhile, should design industrial policies that accelerate the clean energy transition while phasing out protections for inefficient firms. The research also suggests that consolidation among environmentally efficient companies, coupled with innovation and improved financial management, could drive sector-wide efficiency gains. Investors may use these findings to refine their evaluation frameworks

for socially responsible investments, focusing on firms with proactive, well-balanced ESG strategies.

Several limitations qualify the study's findings. The exclusive focus on listed energy companies restricts the generalizability of results to private firms or other sectors. The post-2016 timeframe, while capturing the period following GRI G3 guideline implementation, may not reflect earlier CSR practices. Additionally, the chosen ESG indicators might introduce measurement bias, and the absence of institutional and regulatory contextual factors limits the analysis. These constraints suggest that the observed relationships between ESG factors and performance may vary under different conditions or measurement approaches.

Future studies should address these limitations by expanding the scope of analysis. Comparative research across energy sub-sectors and geographic regions could reveal important variations in ESG-performance dynamics. Incorporating institutional and regulatory factors would provide a more comprehensive understanding of contextual influences. Longitudinal studies examining pre- and post-GRI guideline periods could shed light on the evolution of CSR effectiveness. Researchers might also explore alternative environmental efficiency models incorporating additional sustainability metrics. Finally, investigating unlisted energy companies could validate whether the observed patterns hold beyond publicly traded firms, potentially offering new insights for private sector sustainability strategies.

In the third essay, this research explores the impact of diversity and inclusion (D&I) strategies—specifically those related to diversity, inclusion, people development and labor controversy on the eco-efficiency (ECO) of global energy companies. Eco-efficiency is measured using a composite indicator that integrates economic, financial, operational, and environmental performance dimensions.

It is important to examine specific human resource management policies in the energy sector—particularly those related to diversity and inclusion—at the organizational level, not just within the board of directors. These policies are closely linked to the sector’s reputational risk, especially given the growing public scrutiny of its activities (González-Ramos et al., 2018). Additionally, while previous research has explored the relationship between inclusion and human development policies and financial performance, their connection to environmental performance remains underexplored, highlighting the need for further analysis. The main findings of this research, corresponding to the specific hypotheses established, are presented below (Table 34).

Table 34. Hypotheses of Chapter 3 and the findings

Hypotheses	Findings
H1: D&I policies and practices positively influence the ECO of energy companies.	**Supported**
H2: Diversity policies and practices in the company positively influence the ECO of energy companies.	**Supported**
H3: People development policies and practices in the company positively influence the ECO of energy companies.	**Supported**
H4: Inclusion policies and practices in the company positively influence the ECO of energy companies.	**Rejected**
H5: Labor controversies negatively influence the ECO of energy companies.	**Rejected**

Source: own production

Using a sample of listed energy companies from 53 countries, operating across the coal, oil & gas, renewables, and uranium subsectors during the 2016–2022 period, and applying truncated regression models, we obtained the following results.

First, our findings reveal a positive and significant relationship between the composite index—measuring diversity, inclusion, people development, and the absence of labor incidents—and eco-efficiency (ECO), thus supporting Hypothesis 1. This result may be attributed to improved job satisfaction, reduced absenteeism, enhanced talent retention, and lower litigation risks, which collectively contribute to better financial and environmental performance.

A particularly noteworthy result is the significant positive association between ECO and policies that actively promote workforce diversity—especially in terms of cultural and gender diversity—and their effective implementation. These findings provide support for Hypothesis 2.

Likewise, we find a positive and statistically significant relationship between people development—defined as investments in training and career development opportunities—and ECO, thereby confirming Hypothesis 3. In contrast, the results do not show a statistically significant relationship between inclusion policies and ECO. In line with Suciu et al. (2020), the evidence remains inconclusive, and therefore, Hypothesis 4 cannot be confirmed. Finally, regarding labor controversies, our analysis does not reveal a significant association with ECO, consequently Hypothesis 5 is also not supported.

As for the control variables and corporate governance structure, the results indicate that ECO in the energy sector is positively and significantly influenced by factors such as board size, adoption of a CSR strategy, implementation of quality management systems, and alignment with the United Nations' environmental SDGs.

As a complementary analysis, we ran the models independently for environmental performance- using the environmental score as a proxy - and for financial performance - using ROA as a proxy. Practices related to diversity, inclusion, and people training and development impact the environmental performance. In this way, we can verify the interconnection between human capital and environmental factors. However, only training and development opportunities for employees show positive and significant

results with ROA. Regarding labor controversies, we find it surprising that they do not influence performance, either environmentally or financially.

Additionally, we assess the robustness of our initial findings from the baseline model by employing an alternative estimation approach (Tobit random effects model) and excluding observations from US companies. The results closely align with those of the baseline model, with most coefficient estimates remaining stable across both models.

Additionally, to address potential endogeneity concerns, we re-estimated the baseline model using Ordinary Least Squares (OLS) regressions with one-year lags and Two-Stage Least Squares (2SLS) estimations with lagged variables as instruments. The results from these models confirm the robustness of our main findings.

From a theoretical standpoint, our findings allow for the integration of Stakeholder Theory and Resource-Based Theory as a framework to frame human resources management in the energy sector. Thus, organizations that demonstrate commitment to diversity, equity and inclusion enhance their corporate reputation and create long-term value for all stakeholders, as advocated by Stakeholder Theory. Simultaneously, these practices create scarcely imitable competitive advantages that represent highly valuable intangibles, as supported by Resource-Based Theory. Therefore, these theories are compatible in explaining the CSR behavior of energy companies.

This study offers meaningful implications for a broad range of stakeholders in the energy sector, including corporate executives, policymakers, and investors. It highlights the strategic importance of diversity and inclusion (D&I) not only as ethical imperatives but as critical levers for enhancing environmental efficiency and advancing long-term sustainability.

At the managerial level, the research introduces the ECO indicator, a useful tool for evaluating business performance that goes beyond traditional financial indicators by incorporating environmental dimensions. Its application enables companies to better align business outcomes with sustainability objectives. Crucially, the findings reveal that D&I policies, when approached holistically, generate significant eco-efficiency gains. Conversely, fragmented or symbolic initiatives tend to yield minimal or no tangible benefits.

In this context, corporate managers are encouraged to embed D&I into their strategic and environmental planning frameworks. Aligning diversity objectives with broader ESG goals and the United Nations Sustainable Development Goals—especially SDG 5 on gender equality, SDG 8 on decent work, and SDG 13 on climate action—can reinforce organizational commitment to sustainable development. Executive compensation schemes should incorporate performance-based metrics that reflect progress in both environmental indicators, such as ECO, and workforce-wide advances in diversity, inclusion, and employee development. Furthermore, energy firms should prioritize inclusive talent pipelines, dedicating part of their green capital expenditures to training and reskilling diverse teams capable of operating and maintaining low-carbon technologies. Supplier relationships should also reflect this vision through contractual

clauses that establish diversity thresholds and require transparency in environmental performance. Regular DEI audits within ESG reporting processes can help monitor institutional progress and reveal critical gaps that may otherwise go unnoticed.

From a policy perspective, the evidence suggests that diversity and inclusion contribute meaningfully to the triple bottom line, encompassing economic, social, and environmental dimensions. Policymakers therefore have a vital role in shaping supportive regulatory frameworks that reward inclusive and sustainable practices. This includes mandating or incentivizing D&I disclosures in corporate sustainability reporting, particularly for large and publicly traded energy companies. Financial and fiscal instruments, such as tax incentives or grants, can be employed to support firms that adopt certified D&I strategies with measurable links to environmental and financial outcomes. Additionally, public-private partnerships aimed at promoting diversity in technical and STEM education pathways are essential to addressing the structural underrepresentation that persists in leadership and innovation roles within the sector. National and regional energy transition plans should incorporate D&I standards as preconditions for decarbonization, recognizing that inclusive human capital is indispensable for the effective implementation of environmental technologies. To support transparency and accountability, the development of national or sector-specific D&I scorecards that integrate environmental indicators such as ECO would allow for the evaluation of the real impact of inclusive strategies on sustainability performance.

For investors, this study underlines the growing relevance of social factors—particularly workforce diversity and employee development—as predictors of both financial profitability and environmental efficiency. Despite the increasing adoption of ESG principles in portfolio management, the social pillar often remains underutilized. Investors are encouraged to integrate D&I criteria into ESG screening and scoring models, recognizing the role of inclusive practices in reducing operational risk and enhancing long-term value. Active engagement with portfolio companies should promote transparency in D&I policies, set measurable diversity targets, and foster board-level accountability for inclusion efforts. Supporting investment vehicles and funds that apply a gender-lens or broader inclusivity lens is also recommended, as these financial products tend to prioritize companies with more sustainable and resilient business models.

In conclusion, this study positions diversity and inclusion as core elements of environmental and economic performance in the energy sector. Placing people at the center of corporate governance—through inclusive leadership, talent development, and social responsibility—can unleash a virtuous cycle of innovation, resilience, and sustainability. Stakeholders at all levels are thus urged to move beyond symbolic commitments and to systematically embed D&I frameworks into decision-making processes to ensure a just and effective transition toward sustainable energy systems.

Despite its contributions, this study has several limitations that open avenues for future research. First, the analysis focuses exclusively on publicly listed energy firms during a defined time window, which may limit the generalizability of the findings to privately held companies or firms in other industries. Given the sector-specific nature of eco-efficiency dynamics, future studies should extend the analysis to other

environmentally sensitive industries—such as manufacturing, transportation, or agriculture—to validate the robustness of the results in broader contexts.

The selected period (2016–2022) captures the impact of significant global events, including the COVID-19 pandemic and the Russia–Ukraine energy crisis. However, it omits the effects of emerging long-term structural shifts, such as the European Union's Carbon Border Adjustment Mechanism (CBAM), the Corporate Sustainability Reporting Directive (CSRD), or the U.S. Securities and Exchange Commission's initiatives on human capital disclosure. These policies are likely to reshape corporate environmental and social strategies, and their influence should be examined in subsequent research.

Another important limitation lies in the reliance on ESG data primarily sourced from the London Stock Exchange Group (LSEG) platform, which consists largely of self-reported disclosures by companies. In the absence of rigorous third-party verification or standardized frameworks, these datasets may be prone to greenwashing or social washing, introducing potential bias in the measurement of environmental and social performance. Future research should incorporate alternative data sources or apply triangulation methods to enhance the reliability of ESG indicators.

The present study also concentrates on firm-level variables, without accounting for institutional or macro-level factors that may influence corporate outcomes. Elements such as the quality of public governance, enforcement capacity, regulatory clarity, levels of environmental and social development, and media freedom may exert significant pressure on firms to adopt or enhance corporate sustainability practices. Comparative studies across different institutional environments could provide deeper insights into the interplay between external governance contexts and internal firm behavior.

Moreover, the sample is predominantly composed of firms from developed countries, which may introduce a geographic bias into the findings. Given that the drivers and constraints of sustainability performance can vary significantly between advanced and emerging economies, future work should aim for broader geographic representation, including under-researched regions.

From a methodological perspective, most traditional DEA models used in this study treat reference technologies as single-stage black boxes, overlooking the internal structure and multistage nature of energy production and distribution. Network DEA models could offer a more granular view by assessing the efficiency of interrelated subprocesses within firms—such as generation, transmission, and retail—providing a more accurate depiction of overall eco-efficiency. This refinement is particularly relevant in the energy sector, where technical complexity and interdependence play a critical role in shaping performance.

To address endogeneity concerns and strengthen causal inference, future studies should consider leveraging quasi-natural experiments, using policy shocks such as the phased implementation of the EU CBAM or CSRD as instrumental variables. These can help isolate the effect of sustainability investments and mitigate the possibility that only already-efficient firms allocate greater resources to ESG strategies.

Additionally, we recommend conducting longitudinal case studies of firms that transition across ESG performance thresholds to document the internal change mechanisms and actual payback periods of sustainability-driven transformations. Such qualitative insights would complement the quantitative results and offer a richer understanding of how ESG improvements materialize within organizations over time.

Finally, researchers should explore the existence of spillover effects, examining whether large-scale sustainability projects undertaken by energy firms influence eco-efficiency improvements in downstream resource-intensive industries such as steel, cement, or petrochemicals. Understanding these indirect benefits could help policymakers and investors better assess the broader systemic impact of corporate sustainability initiatives.

The fourth and final essay of this thesis examines the relationship between corporate commitment to social Sustainable Development Goals (SDGs) and the actual social performance of firms in the energy sector.

The 2030 Agenda for Sustainable Development outlines 17 goals, several of which are directly linked to business sustainability, especially those related to human rights, diversity, inclusion, and employee development. Despite the critical role of energy companies in the global economy, their commitment to social Sustainable Development Goals (SDGs)—particularly in areas such as diversity, inclusion, and professional development—remains insufficiently explored. While some studies suggest that corporate SDG commitments are often symbolic and lack measurable impact, others report genuine shifts in business practices. These mixed findings may stem from differences in methodologies and sample selection. Moreover, firms in highly visible sectors like energy are subject to greater reputational risks, which may deter superficial SDG engagement and encourage more substantive action. Table 35 below presents the results of the hypothesis test conducted in Chapter 4.

Table 35. Hypotheses of Chapter 4 and the findings

	Hypotheses	Findings
H1:	There is a positive relationship between support for social SDGs and social performance in energy companies.	**Supported**
H2:	There is a positive relationship between support for D&I SDGs and the implementation of diversity, equality, and inclusion policies in energy companies.	**Supported**
H2a:	There is a positive relationship between commitment to SDG 5 and diversity performance in energy companies.	**Supported**
H2b:	There is a positive relationship between commitment to SDG 8 and professional development performance in energy companies.	**Supported**
H2c:	There is a positive relationship between commitment to SDG 10 and inclusion performance in energy companies.	**Rejected**
H3:	The level of environmental awareness in a company's home country enhances the impact of social SDG commitments on social performance.	**Supported**
H4:	The level of economic development in a company's home country strengthens the relationship between social SDG commitments and social performance.	**Supported**

Source: own production

Using ESG data, we calculated social and diversity and inclusion (D&I) performance scores for 353 listed energy companies across the period 2016–2022. The independent variables include a composite index reflecting corporate commitment to social Sustainable Development Goals (SDGs), along with a specific indicator for D&I-related SDGs—namely SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), and SDG 10 (Reduced Inequalities)—which are directly linked to diversity, inclusion, and human capital practices. Moderator variables include the level of economic development in each company's home country and the Environmental Performance Index, which captures the quality of national environmental governance.

The results show that corporate support for social SDGs positively influences companies' overall social performance, confirming Hypothesis 1. More specifically, support for SDGs 5, 8, and 10 is significantly associated with improvements in D&I outcomes, supporting Hypothesis 2. The findings highlight that genuine engagement with sustainability goals enhances internal social practices.

Support for SDG 5 (Gender Equality) and SDG 8 (Decent Work and Economic Growth) was found to significantly improve diversity and employee development, confirming Hypotheses 2a and 2b. However, no statistically significant relationship was observed between corporate commitment to SDG 10 (Reduced Inequalities) and workplace inclusion performance, leading to the rejection of Hypothesis 2c. These varying effects suggest that while some SDG commitments translate into concrete organizational practices, others remain largely symbolic.

The analysis also confirms the moderating role of institutional factors. Companies headquartered in developed economies or countries with stronger environmental governance show greater effectiveness in translating SDG commitments into social and D&I outcomes, thus supporting Hypotheses 3 and 4. These results indicate that the impact of social SDG commitments varies depending on the institutional and socio-environmental context.

From a theoretical perspective, the findings contribute to both Legitimacy Theory and Institutional Theory, emphasizing that while some energy companies may adopt SDG language for reputational purposes, many demonstrate authentic engagement, particularly around diversity and inclusion. Moreover, institutional conditions—such as the level of economic development and environmental performance in a company's home country—play a crucial role in shaping the implementation and effectiveness of these commitments.

From a practical perspective, the proposed framework explicitly links corporate commitment to the Sustainable Development Goals (SDGs) related to social issues and diversity and inclusion (D&I) with tangible improvements in these areas. This approach facilitates the identification of strategic priorities and performance gaps, enabling companies to maximize the impact of their sustainability initiatives and strengthen their alignment with internationally recognized development goals. It also offers a structure for identifying key areas for improvement—such as SDG 10 on reducing inequalities—and underscores the importance of transparency, accountability, and corporate credibility.

The development and dissemination of clear, verifiable, and results-oriented information on progress toward social SDGs contributes to strengthening organizational credibility and fostering continuous improvement. Tools such as the United Nations SDG Compass, together with support from specialized ESG consulting firms, can play a key role in helping companies identify the most relevant SDGs, integrate them into strategic planning, and effectively communicate their progress to investors and other stakeholders.

As part of this transformation process, companies are advised to integrate a focused set of auditable and comparable social and D&I indicators into their core performance dashboards. Furthermore, a visible portion of executive variable compensation should be directly tied to annual progress on these indicators. Awareness campaigns alone are insufficient; structural approaches are needed, along with rigorous monitoring of participation in social and inclusion initiatives, applying the same level of scrutiny as that used for environmental or financial performance metrics. These actions not only reinforce internal accountability but also send strong external signals of a genuine corporate commitment to social sustainability.

This study also highlights the influence of institutional and cultural factors on the authenticity and effectiveness of corporate commitments to social SDGs. The credibility of these commitments depends not only on internal corporate efforts but also on the regulatory and socio-cultural context in which firms operate. In developing countries, for instance, structural challenges may hinder the effective adoption of social SDGs, reinforcing the need for public policies that are tailored to local realities. Therefore, investors should consider the institutional environment when assessing the quality and depth of corporate sustainability disclosures.

In this regard, policymakers and regulators play a crucial role. Targeted public policy measures—such as tax incentives, financial support for social programs, or formal recognition of companies with exemplary practices—can help reduce economic and institutional barriers to the implementation of socially sustainable business models. To ensure their effectiveness, these measures should be complemented by mandatory limited external assurance of reported social indicators, as well as incentive systems tied to verifiable improvements in social performance, diversity, equity, and inclusion.

Finally, given the increasing scrutiny from investors and civil society, it is essential to recalibrate ESG evaluation methodologies to prioritize the verifiable intensity and effectiveness of implemented programs. This requires the use of objective data sources and the development of discrepancy indices that can detect gaps between declared commitments and actual outcomes. Such tools can serve as early warning systems for reputational or regulatory risks, enhancing the reliability and relevance of ESG assessments in capital markets.

The findings of this study should be interpreted in light of several limitations. First, the analysis focuses on publicly traded multinational corporations in the energy sector, which typically possess greater financial and organizational resources to engage with the Sustainable Development Goals (SDGs). These firms also face stronger external pressure from regulators, investors, and capital markets to report on environmental, social, and governance (ESG) performance. Furthermore, companies

with more sophisticated communication strategies may appear more aligned with the SDGs in their public disclosures, even when their actual practices fall short. As a result, the generalizability of the findings to smaller or privately held firms—operating under different institutional conditions and stakeholder expectations—may be limited.

Second, the study is subject to the constraints of the proxies used for both dependent and independent variables. As noted in previous chapters, the lack of a universally accepted framework for measuring corporate sustainability performance leads to significant inconsistencies across ESG data providers (Martiny et al., 2024). In particular, the use of binary indicators to assess SDG commitment fails to capture the depth and quality of corporate engagement, reducing the explanatory power of the analysis. Additionally, relying on parent-level disclosures may mask important differences in labor practices and inclusion policies at the subsidiary level or across complex global supply chains. Lastly, the classification of highly heterogeneous firms—such as renewable energy developers and fossil fuel producers—under a single industry category may obscure key differences in stakeholder expectations, operational risks, and sustainability priorities.

To address these limitations, future research should adopt more granular and context-sensitive approaches. First, scholars should investigate the reputational risks associated with SDG-washing, particularly how discrepancies between corporate narratives and actual performance influence stakeholder trust and legitimacy. Second, future studies could integrate broader institutional variables—such as legal frameworks, governance quality, and cultural dimensions—as moderating factors that shape corporate sustainability outcomes. Third, examining firm progress at the level of specific SDG targets, rather than broad goal categories, would enable a more precise assessment of actual contributions and facilitate the detection of symbolic compliance.

Moreover, future research could validate corporate diversity and inclusion (D&I) claims by combining objective indicators with employee surveys to evaluate whether internal experiences align with reported metrics. Regulatory changes, such as the EU Corporate Sustainability Reporting Directive (CSRD) and the U.S. Securities and Exchange Commission (SEC) human-capital disclosure rules, present valuable natural experiments to assess whether enhanced disclosure requirements reduce instances of social-washing.

Additionally, text analytics and natural language processing (NLP) tools could be employed to detect rhetorical inflation in sustainability reports and earnings calls, and compare narrative strategies against measurable social performance indicators. Replicating this study in low-visibility sectors—such as logistics or basic chemicals—would help determine whether limited public scrutiny affects the level of engagement with the SDGs. Finally, future research could explore the financial implications of closing the gap between symbolic commitments and concrete action, particularly in relation to SDG 10 (Reduced Inequalities), by modeling the effects on firms weighted average cost of capital, project approval timelines, and insurance premiums.

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Appendices

APPENDICES

APPENDIX A

Table A. Definitions, source, expected sign and main references of the variables for chapter 1

Variable Name	Symbol	Definition	Source	Expected Sign	Main References
Dependent Variables					
Gross Profit Margin	GPMargin	Ratio of gross profit to operating revenue	LSEG Database		Zhang & Xie (2022)
Return on Assets	ROA	Net income divided by total assets	LSEG Database		Issa (2024); Tran & Vo (2020)
Independent Variables					
Human Capital Variables					
Human Capital Efficiency	HCE	Value added per unit of human capital expenditure (salary + training)	LSEG Database	+	Tran & Vo (2020); Bryl (2018)
Value-Added Intellectual Capital	VAIC	Sum of HCE, SCE, and CEE measuring total intellectual capital efficiency	LSEG Database	+	Tran & Vo (2020); Xu & Liu (2019)
Workforce Score	Workforce_Score	Composite index reflecting workforce practices (diversity, inclusion, training)	LSEG Database	+	Suciu et al. (2020)
Professional Development	PD	Investment in employee training (0–100%)	LSEG Database	+	Suciu et al. (2020); Bax (2023)
Diversity	Diversity	Score (0–100%) measuring gender, ethnic, cultural workforce diversity	LSEG Database	-	Baker et al. (2021); Beraki et al. (2022)
Inclusion	Inclusion	Score (0–100%) assessing inclusion and equity policies	LSEG Database	+/-	Suciu et al. (2020)
Salary Gap	Salary_Gap	Ratio of CEO-to-average employee compensation	LSEG Database	-	Przychodzen & Gómez-Bezares (2021); Xie et al. (2024)
Environmental Capital Variables					
CO_2 Emissions Variation	CO2_Var	Annual % change in Scope 1+2 CO_2 emissions	LSEG Database	-	Zhong et al. (2024); Wang (2023)
Environmental Score	Env_Score	ESG score for environmental performance (0–100%)	LSEG Database	+	Trumpp & Guenther (2017); Chen et al. (2023)

Variable Name	Symbol	Definition	Source	Expected Sign	Main References
ESG Controversies	ESG_Con	Inverse score of ESG controversies (higher = fewer scandals) (0–100%)	LSEG Database	+	Shakil (2021); Dorfleitner et al. (2020)
Accounting Quality Variables					
Earnings Quality	EQ	Score (0–100%) based on earnings persistence, accruals, cash flows, manipulation detection	LSEG Database	+	Behl et al. (2022); Rahman et al. (2024)
CSR Reporting	CSR_Report	Dummy variable: 1 if CSR/sustainability report is published, 0 otherwise	LSEG Database	+	Christensen et al. (2021); Etim et al. (2022)
Control Variables					
Leverage	Lev	Total debt divided by total assets	LSEG Database	-	Makridou et al. (2024); Okere & Igba (2023)
Capital Expenditure	LnCapex	Natural log of capital expenditure	LSEG Database	+/-	Moussa & Elmarzouky (2023)
Firm Size	Size	Natural log of total assets	LSEG Database	+/-	Okere & Igba (2023); Weqar et al. (2024)
Family Ownership	Family_Sh	Dummy variable: 1 if firm is family-controlled, 0 otherwise	LSEG Database	+	Bryl (2018); Watkins (2018)
GDP Growth Rate	GDP	Annual GDP growth of the firm's home country	World Bank	+	Klein & Weill (2022)
Inflation	Inflation	Annual inflation rate of the firm's home country	World Bank	-	Duong (2022)
Human Development Index	HDI	Composite index (0–1) reflecting life expectancy, education, and income	UNDP	+	Yilmaz (2021)
Legal System (Civil vs. Common Law)	Civil_Com	Dummy: 1 if firm is in civil law country; 0 if in common law country	La Porta et al. (1998)	+	Xu et al. (2023)

Source: own production

APPENDIX B

Table B.1. Distribution of sample observations by country for chapter 2

Country	Frequency	Percentage	Country	Frequency	Percentage
Argentina	6	0.62	Kazakhstan	5	0.51
Australia	41	4.21	South Korea	20	2.06
Austria	6	0.62	Luxembourg	6	0.62
Belgium	2	0.21	Malaysia	20	2.06
Bermuda	27	2.77	Monaco	4	0.41
Brazil	18	1.85	Netherlands	11	1.13
Canada	114	11.72	Norway	18	1.85
Chile	6	0.62	Papua New Guinea	4	0.41
China	47	4.83	Poland	18	1.85
Colombia	9	0.92	Portugal	6	0.62
Denmark	8	0.82	Romania	1	0.10
Finland	5	0.51	Russia	36	3.70
France	33	3.39	Singapore	10	1.03
Germany	13	1.34	South Africa	6	0.62
Greece	16	1.64	Spain	21	2.16
Hong Kong	24	2.47	Sweden	4	0.41
Hungary	6	0.62	Switzerland	6	0.62
India	22	2.26	Taiwan	5	0.51
Indonesia	14	1.44	Thailand	30	3.08
Israel	2	0.21	Turkey	4	0.41
Italy	41	4.21	United Arab Emirates	1	0.10
Japan	29	2.98	United Kingdom	61	6.27
Jersey	4	0.41	United States of America	183	18.81

Source: own production

Table B.2. Sample Selection for chapter 2

	Observations/companies
Firm-year observations/companies in Refinitiv EIKON database in energy industry from fiscal year 2016 to 2021	22.386/3.731
Less observations/companies with missing ESG data	(16.578)/(2.763)
Less observations/companies with missing operational data	(3.463)/(499)
Less observations/companies with missing accounting data	(1.372)/(230)
Final sample	
• Observations	973
• Unique companies	239

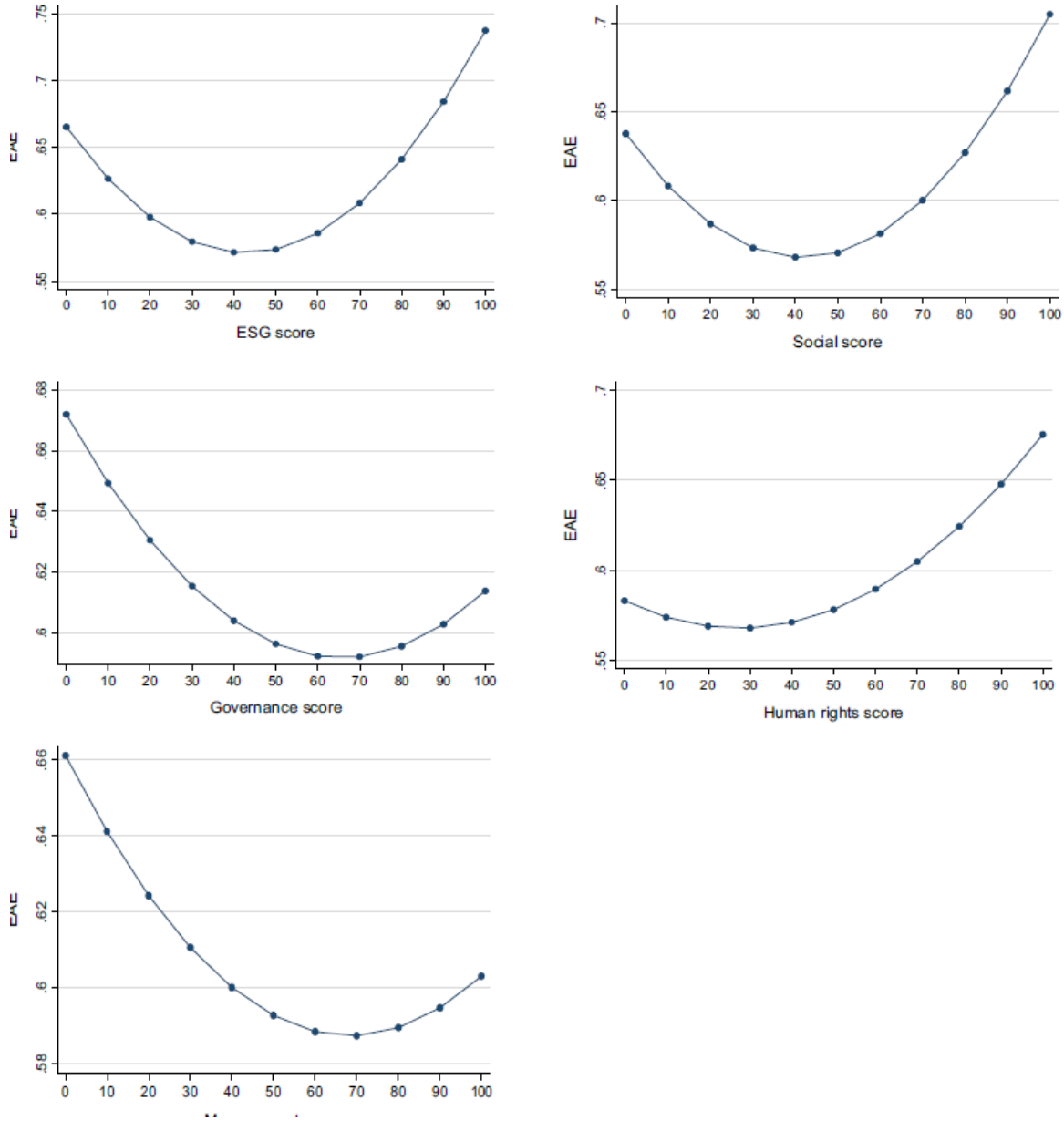
Source: own production

Table B.3. Variables Description

		Definition	Source
Inputs	Employees	Average of Employees at the beginning and at the end of the year	EIKON database
	Property, plant and equipment	Net book value of all property, plant and equipment.	EIKON database
	Operating cost	All expenses applied to the income statement before EBIT for the period	EIKON database
	Energy use	Total direct and indirect energy consumption in gigajoules	EIKON database
Outputs			
	Operating revenues	Revenue from all of a company's operating activities	EIKON database
	Market capitalization	Value of a company that is traded on the stock market, calculated by multiplying the total number of shares by the present share price.	EIKON database
	CO_2 (bad output)	Total carbon dioxide (CO_2) and equivalents emission in tonnes.	EIKON database

Source: own production

Figure B.1. U shaped relation. Predictive margins between EAE and ESG, social, governance, human rights, and management scores.



Source: own production

APPENDIX C.

Table C.1. Distribution of sample observations by country for chapter 3

Country	Percentage	Frequency
Argentina	0,48	5
Australia	3,86	41
Austria	0,48	5
Belgium	0,48	5
Brazil	1,93	21
Canada	12,32	131
Chile	0,24	3
China	8,70	92
Colombia	0,48	5
Cyprus	0,24	3
Denmark	0,24	3
Finland	0,24	3
France	1,93	21
Germany	0,72	8
Greece	0,48	5
Hong Kong	1,21	13
Hungary	0,24	3
India	4,11	44
Indonesia	1,93	21
Israel	0,24	3
Italy	0,97	10
Japan	1,93	21
Jersey	0,24	3
Kazakhstan	0,48	5
Korea; Republic (S. Korea)	0,97	10
Luxembourg	0,48	5
Malaysia	3,14	33
Mexico	0,24	3
Monaco	0,24	3
Mongolia	0,24	3
Netherlands	0,72	8
New Zealand	0,48	5
Nigeria	0,24	3
Norway	3,14	33
Philippines	0,24	3
Poland	0,72	8
Portugal	0,24	3
Romania	0,24	3
Russia	2,17	23
Saudi Arabia	0,24	3
Singapore	0,72	8
South Africa	0,48	5
Spain	0,72	8
Sweden	0,97	10
Switzerland	0,24	3
Taiwan	0,24	3
Thailand	2,42	26
Turkey	1,21	13
United Arab Emirates	0,97	10
United Kingdom	5,07	54
United States of America	28,99	308
Total	100	1,062

Source: own production

Table C.2. Sample selection for chapter 3

	Observations	Firms
Observations and number of firms of listed companies in the energy sector in the LSEG database from 2016 to 2022	2,898	414
Less observations/firms with missing data	1,836	41
Final sample	1,062	373

Source: own production

DEA model. Descriptive statistics and correlation coefficients

Table C.3. Descriptive statistics for the inputs and outputs used in the DEA model.

	Variable	Mean	Std. Dev.	Min	Max
Inputs	Employees	13,796.25	41,756.91	7	330,100
	Property, plant and equipment	1.06e+10	2.94e+10	5,417,844	2.10e+11
	Operating Cost	1.14e+10	3.12e+10	6,015,514	2.25e+11
Outputs	Operating Revenues	1.27e+10	3.54e+10	667,492.4	2.56e+11
	Market capitalization	1.07e+10	2.50e+10	2.11e+07	1.64e+11
	Env. Score	47.06597	24.71376	0.001	96.92313

Source: own production

Table C.4. Spearman rank correlation coefficients for the inputs and outputs used in the DEA model

	Inputs			Outputs		
	Employees	PP&E	Operating Cost	Operating Revenues	Market capitalization	Env. Score
Employees	1.0000					
Property, plant and equipment	0.5467	1.0000				
Operating Cost	0.7914	0.7455	1.0000			
Operating Revenues	0.7913	0.7643	0.9767	1.0000		
Market Capitalization	0.6569	0.7484	0.7677	0.8104	1.0000	
Env. Score	0.5622	0.4033	0.5422	0.5586	0.5007	1.0000

Note: The coefficients are significant at the 1% level.

Table C.5. Variable explanations

Dependent variables	Symbol	Definition	Expected sign	Main references
Ecoefficency	ECO	Technical Efficiency calculated using Data Envelopment Analysis.		
Independent variables				
D&I Global	D&I Global	Overall score of a company based on reported workforce information that define diverse and inclusive workplaces.	(+)	Suciu et al. (2020); Bax (2023)
Diversity.	D&I Div	Measures a company's commitment and effectiveness towards maintaining gender diverse workforce and board member cultural diversity.	(+)	

Dependent variables	Symbol	Definition	Expected sign	Main references
Inclusion	D&I Incl	Measures a company's commitment and effectiveness towards effective life-work balance, a family friendly environment and disability inclusion.	(+)	
People development	D&I PD	Measures a company's commitment and effectiveness towards providing training and development (education) for its workforce.	(+)	
Controversies	D&I Contr	Controversies category accounts for the negative impact workforce controversies have on the company. Higher values mean fewer controversies in a company.	(+)	
Control Variables: Corporate governance structure				
Board size	B_Size	Size of the board of directors	(+)	McGuinness et al. (2017)
CEO Duality	CEO_Duality	If the CEO simultaneously chairs the board or if the chairman of the board is simultaneously the CEO. 1 true, 0 false	(-)	Webb (2004)
Independent Board Members	IndpBMemb	The percentage of non-executive members on the board	(+)	Issa et al.(2022) ; Shahbaz et al. (2020)
Sustainability compensation	Sus_Comp	Senior executive's compensation linked to Sustainability targets	(+)	D'apolito (2019)
Quality management systems	QMS	Does the company claim to apply quality management systems, such as ISO 9000, Six Sigma, Lean Manufacturing, Lean Sigma, TQM or any other similar quality principles?	(+)	Kumar et al. (2018)
CSR strategy.	CSR_Stra	Company's practices to communicate that it integrates the economic (financial), social and environmental dimensions into its day-to-day decision-making processes	(+)	Shaukat et al. (2016)
CSR committee Score	CSR_Com	Assesses whether the company have a CSR committee	(+)	Hussain et al. (2018); Ben-Amar et al. (2017)
SDG environmental	Env_SDGs	The number of environmental SDGs a firm supports over the total number of environmental SDGs considered	(+)	Taglialatela et al. (2023)
Other control variables				
ROA	ROA	Income After Taxes for the fiscal period divided by the Average Total Assets	(+)	Guo et al. (2020)
CAPEX	Capex	Capital Expenditures represents the sum of purchase of Fixed Assets and Intangibles	(+)	Moussa and Elmarzouky (2023)
Market risk	Beta	How much the price of a stock changes in relation to the movement of the market.	(-)	Ramírez-Orellana et al, (2023)
Leverage	Lev	The ratio of total debt divided by Total Assets.	(+)	Haque (2017)
Firm size	Size	The logarithm of total assets.	(+)	Ruggiero and Cupertino (2018)
Firm age	Age	The logarithm of the number of years since incorporation.	(+)	De Villiers et al. (2011)

Note: The positive sign in the "expected sign" column indicates that the independent/control variables are expected to have a positive relationship with the dependent variables according to previous literature. The negative sign indicates the opposite.

Endogeneity analysis.

Table C.6. Lag OLS

	ECO	ECO	ECO	ECO	ECO
D&I Global	0.003*** (0.001)				
D&I Div		0.001** (0.001)			
D&I PD			0.002*** (0.000)		
D&I Incl				-0.000 (0.000)	
D&I Contr					0.001 (0.001)
Control	YES	YES	YES	YES	YES
Constant	-0.057	0.011	-0.015	-0.002	-0.066
	(0.119)	(0.118)	(0.117)	(0.119)	(0.209)
Year FE	YES	YES	YES	YES	YES
N	735	735	735	735	735
R^2	0.3471	0.3413	0.3549	0.3369	0.3370

Note: Data enclosed in () are standard error. Dummy variables for time have been used. Asterisks indicate significance at the 10 per cent (*), 5 per cent (**) and 1 per cent (***) levels.

Table C.7. Two-stage least squares regression

	ECO	ECO	ECO	ECO	ECO
D&I Global	0.005*** (0.001)				
D&I Div		0.003*** (0.001)			
D&I PD			0.003*** (0.001)		
D&I Incl				-0.000 (0.000)	
D&I Contr					0.000 (0.002)
Control	YES	YES	YES	YES	YES
Constant	-0.051 (0.107)	0.073 (0.106)	-0.024 (0.106)	0.037 (0.110)	0.047 (0.289)
Year FE	YES	YES	YES	YES	YES
N	612	612	612	612	612
Centered R2	0.4456	0.4359	0.4471	0.4317	0.4324
Anderson canon. corr. LM statistic	199.068	189.467	199.031	197.437	160.810
Chi-sq (8) P-value	0.0000	0.0000	0.0000	0.0000	0.0000
Sargan statistic	12.501	13.994	10.450	17.089	16.986
Chi-sq (7) P-value	0.2529	0.1733	0.4019	0.0724	0.0747

Note: Data enclosed in () are standard error. Dummy variables for time have been used. Asterisks indicate significance at the 10 per cent (*), 5 per cent (**) and 1 per cent (***) levels.

The energy sector, as one of the main contributors to global carbon emissions, is undergoing a profound transition toward more sustainable business models. This dissertation examines how publicly listed energy companies can balance profitability, environmental sustainability, and social responsibility in a demanding global context. Across four empirical chapters, the findings show that investment in human capital, high-quality financial reporting, and strong ESG practices are key drivers of financial and environmental performance. A non-linear relationship is identified between corporate social performance and environmental efficiency. Additionally, diversity and inclusion practices enhance eco-efficiency, while SDG commitments often align with actual social performance—though some gaps persist. The results underscore the relevance of institutional context and support Resource-Based, Stakeholder, and Institutional Theories in explaining sustainable corporate success.