

THE NORDIC MODEL OF SUSTAINABLE VALUE CREATION: ESG, PUBLIC-PRIVATE COLLABORATION, AND MARKET PERFORMANCE ON THE PATH TO CARBON NEUTRALITY

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Abstract. Although Nordic economies rank among the global leaders in sustainability and climate policy, the extent to which corporate environmental, social and governance (ESG) performance and carbon efficiency translate into market value is not well understood. This paper analyses how large listed firms in Denmark, Finland, Norway, Sweden and Iceland create sustainable value under well-established disclosure frameworks and close public-private collaboration. It investigates the relationship between ESG scores, carbon efficiency indicators and financial characteristics for 82 firms between 2021 and 2024. Cross-sectional and pooled Pearson correlations, complemented by two-sample t-tests, demonstrate the link between revenues per tonne of CO₂, enterprise value including cash (EVIC) per tonne of CO₂, greenhouse gas (GHG) emissions intensity and the presence of carbon-reduction targets, and market capitalisation, assets, leverage, profitability and capital expenditure. The results show that there is no meaningful association between conventional ESG scores and firm value or profitability. In contrast, carbon-efficiency indicators exhibit strong and consistent financial linkages. EVIC per tonne of CO₂ is highly correlated with market capitalisation, assets and, in particular, total debt ($r \approx 0.90$), suggesting that the firms that are the most carbon-efficient are also the largest and most capital-intensive. Revenue per tonne of CO₂ shows a moderate but significant correlation with size variables ($r \approx 0.54-0.55$). Firms with carbon-reduction targets have a market capitalisation that is almost four times higher, as well as substantially greater EBITDA and CAPEX. This confirms that climate commitments are concentrated among companies that are stronger financially. Cluster analysis reinforces these patterns: seven independent NbClust criteria identify two clusters, with almost all firms falling into a dominant cluster, which is evidence of a highly homogeneous regional sustainability-financial structure. Only a few outliers diverge significantly from this Nordic profile. Sectoral asymmetries persist, with financial, technology, and consumer-oriented firms demonstrating a capacity to translate sustainability performance into valuation gains more effectively than industrial and resource-intensive sectors. The latter face limitations in the immediate improvement of their performance due to technological and operational constraints. The findings indicate that sustainable value creation in the Nordic region is driven primarily by carbon efficiency, firm scale, and institutional capacity, underscoring the importance of targeted industrial policies and innovation programmes in helping heavy industries close the carbon-efficiency gap.

Keywords: carbon efficiency, sustainable value creation, ESG performance, public-private collaboration, market valuation, corporate decarbonisation, sustainability reporting, Nordic economies.

JEL Classification: Q56, Q58, G32, M14

1. Introduction

Achieving carbon neutrality has become a central objective of both national and international climate strategies, necessitating profound structural transformations in energy systems, industrial processes, and governance arrangements. In this context, the public sector plays a critical role in setting regulatory frameworks, long-term climate targets, and financial incentives, while the private sector contributes

innovation capacity, investment capital, and scalable technological solutions. It is therefore evident that effective public-private collaboration is a pivotal mechanism through which economies can expand low-carbon infrastructure, reduce emissions intensity, and accelerate progress towards net-zero objectives.

The Nordic countries – Denmark, Finland, Norway, Sweden and Iceland – offer a unique setting in which to analyse the relationship between sustainability

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performance and corporate market valuation. These countries are consistently ranked among the global leaders in environmental governance and corporate responsibility. According to the International Sustainable and ESG Standards Group (2024), Denmark, Finland, Norway and Sweden are the top four countries in the world for ESG, with Iceland close behind in 13th place. Their overall ESG scores range from 88.1 to 98.8 (grade A) and substantially exceed global averages. This reflects their mature institutional frameworks, strong stakeholder engagement and long-standing corporate sustainability practices.

Finland's position as a leader in sustainable development is further confirmed by its ranking at the top of the Sustainable Development Goal Index, followed by Sweden in second place, Denmark in third place, Norway in seventh place, and Iceland in fifteenth place. These countries have SDG scores ranging from 80.79 to 87.02 (SDG Index Report, 2025). These results suggest significant progress in climate action, clean energy deployment, social inclusion, and governance quality. This pattern is reinforced by environmental indicators: the Nordic economies exhibit exceptionally low carbon intensity of GDP (0.06 kg CO₂/USD in Sweden and 0.07 kg CO₂/USD in Denmark, compared with a global average of 0.40), and maintain very high shares of renewable energy in final consumption (led by Iceland (82.4%) and Norway (61.4%)), far exceeding the global average of 19.74% (World Bank, World Development Indicators, 2024).

Together, these attributes demonstrate a balanced and consistent approach to sustainability, where robust climate policies, effective public-private collaboration, and sophisticated ESG practices work together to promote economic competitiveness and accelerate the transition to a low-carbon economy. This article aims to assess whether corporate ESG performance in the Nordic countries translates into measurable market valuation outcomes. To this end, it examines ESG performance and carbon efficiency indicators, analyses their relationship with market valuation metrics and considers how public-private collaboration and institutional context facilitate these effects.

Hypothesis: Nordic companies that demonstrate stronger ESG performance, as evidenced by higher carbon efficiency, lower emissions intensity and the adoption of carbon-reduction targets, are more likely to exhibit favourable valuation dynamics. However, this relationship is moderated by sectoral characteristics: financial, technology and consumer-oriented firms are better placed to convert sustainability improvements into economic value than industrial and resource-intensive companies. Furthermore, it has been demonstrated that firms with greater scale and resource availability tend to adopt more ambitious climate commitments. Moreover, mature public-private

collaboration frameworks and advanced reporting systems have been shown to further strengthen the capacity of ESG-leading companies to convert sustainability performance into measurable financial outcomes.

2. Literature Review

An expanding body of research suggests that strong ESG performance is becoming more closely associated with favourable corporate valuation outcomes. Not only do firms with higher ESG scores demonstrate better environmental and social responsibility, they also tend to experience enhanced financial performance. This reflects investors' recognition of sustainability as a strategic value driver (Clark, Feiner & Viehs, 2015; Krüger, Sautner & Starks, 2020). Carbon efficiency, which is often measured in terms of revenue or enterprise value per tonne of CO₂, has emerged as a critical metric for assessing how firms convert sustainability initiatives into tangible market value (Agliardi & Agliardi, 2021).

The characteristics of a given sector play a decisive role in shaping the relationship between ESG performance and valuation. While ESG performance can improve financial outcomes, the extent to which it does so varies across industries: firms in the finance, technology and consumer sectors tend to benefit more than those in the industrial and resource-intensive sectors. These patterns are consistent with findings that ESG practices alleviate capital constraints (Cheng, Ioannou & Serafeim, 2014) and that financial gains are most significant when firms address sustainability issues that are relevant to their sector (Khan, Serafeim & Yoon, 2016). In the Nordic context, financial institutions and technology firms have used ESG performance to attract sustainable capital. They have benefited from coherent regulatory frameworks and strong stakeholder engagement (OECD, 2022).

The mechanism linking ESG and firm valuation is often explained by stakeholder, legitimacy and signalling theories. Firms adopt ESG practices to maintain their legitimacy with investors, regulators and customers. ESG disclosures also signal long-term strategic resilience, thereby improving market perceptions and lowering the cost of capital (Hahn & Kühnen, 2013; Grewal et al., 2018). Access to green finance, in the form of loans, bonds and investment funds, further amplifies these benefits by enabling firms to invest in low-carbon technologies and improvements to operational efficiency that enhance both sustainability and financial performance (Wang, Li & Sun, 2023; Liu & Zhang, 2022).

Public-private collaboration is crucial in translating ESG performance into tangible financial results. Evidence from the Nordic countries suggests that coordinated government policies, transparent ESG

reporting standards and supportive institutional frameworks can improve the effectiveness of corporate sustainability initiatives (OECD, 2022; UNEP FI, 2020). Effective public-private partnerships and blended finance mechanisms are crucial for directing sustainable capital towards green projects and reducing financing barriers. This enables firms to convert environmental, social and governance (ESG) improvements into financial gains (Tsapko-Piddubna, 2022). In the Nordic region, these mechanisms are reinforced by shared institutional values, such as high levels of trust, coordinated governance and a common, sustainability-oriented business model, which strengthen firms' capacity to operationalise ESG commitments (Hurnyak et al., 2025). Illustrative examples include Sweden's Climate Act and Denmark's mission-oriented industrial strategies. These demonstrate how policy-driven incentives, when combined with corporate innovation, can improve carbon efficiency and increase a company's value (Mazzucato, 2021).

Empirical evidence from international studies supports the synergistic effect of ESG and public policy. Firms in sectors with strong ESG performance within countries with robust climate governance tend to experience improved environmental performance and higher market valuation. In contrast, firms operating in less supportive institutional contexts often find it challenging to convert their sustainability efforts into financial gains (Clark et al., 2015; Krüger et al., 2020; Agliardi & Agliardi, 2021). This dynamic is particularly evident among Nordic companies, which generally have transparent governance structures and advanced ESG reporting, particularly in the technology, finance and consumer-oriented sectors.

The extant literature suggests that ESG performance and carbon efficiency function not only as sustainability instruments but also as strategic drivers of firm value creation. Sectoral characteristics, institutional support, and robust ESG reporting practices act as moderating factors that influence the extent to which sustainability performance translates into market valuation growth. In the Nordic context, the interaction between advanced ESG practices, high carbon efficiency, and supportive public-private ecosystems strengthens the proposition that sustainability-oriented strategies are associated with positive financial outcomes.

3. Aims and Objectives

This study examines how ESG performance, particularly in terms of carbon efficiency, emissions intensity and the adoption of climate targets, affects market valuation among Nordic companies. The study also evaluates how sectoral characteristics influence firms' ability to convert sustainability performance into financial outcomes, and examines the impact of public-private collaboration and advanced reporting

frameworks on this relationship. The findings aim to inform strategies and policies that better align environmental commitments with long-term value creation.

4. Data and Methodology

Data Sources and Sample: The empirical analysis draws on a panel dataset comprising 82 publicly listed firms from Denmark, Finland, Norway, Sweden and Iceland, observed between 2021 and 2024. The sample comprises the largest companies by market capitalisation for which harmonised financial, environmental and ESG indicators were available throughout this period. Data were compiled from Nordic ESG databases, Sustainalytics, Yahoo Finance, corporate sustainability reports and annual financial statements.

The environmental dimension focuses on reported Scope 1–2 greenhouse gas emissions and derived carbon efficiency indicators. Meanwhile, financial data capture firm scale, profitability, capital structure and investment activity. The ESG dimension incorporates the Sustainalytics ESG risk score, which is available from 2024 onwards, as well as a categorical variable that indicates whether or not a firm has disclosed carbon-reduction targets.

The observation period coincided with a significant change in European sustainability reporting. While all Nordic EU Member States transitioned to the Corporate Sustainability Reporting Directive (CSRD) in 2024, Iceland implemented parallel requirements through its European Economic Area obligations. As Nordic firms were already operating within a well-established ESG disclosure environment, supported by long-standing national legislation such as Denmark's 2008 CSR reporting mandate, Sweden's regulations for state-owned enterprises, Finland's state ownership guidelines and Norway's 2022 Transparency Act, the period from 2021 to 2024 provides an appropriate context in which to evaluate the relationship between sustainability and valuation under relatively stable and consistent reporting regimes.

Variables: Three carbon-efficiency indicators were constructed to evaluate how effectively firms translate emissions into economic value. Revenue per tonne of CO₂ and EVIC per tonne of CO₂, both expressed in euros per tonne of emissions, measure operational and market-based carbon productivity, respectively. GHG intensity, defined as emissions relative to operating scale, captures the underlying emissions burden. A binary carbon-reduction target variable identifies firms that have publicly disclosed decarbonisation commitments. The financial variables that are taken into consideration in this study include market capitalisation, total assets, total debt and leverage ratios, EBIT, EBITDA, net income, and capital expenditures

(CAPEX). These measures are designed to capture firm scale, profitability, and investment capacity. The ESG dimension is represented by the 2024 Sustainalytics ESG risk rating, where lower scores indicate stronger ESG performance.

Empirical Strategy: The empirical strategy combines multiple complementary approaches to assess the relationship between sustainability performance and financial outcomes. Firstly, a cross-sectional analysis for 2024 employs Pearson's correlation coefficient to examine the associations between Environmental, Social and Governance (ESG) scores, carbon-efficiency indicators (Revenue/CO₂ and EVIC/CO₂), profitability metrics, and firm size variables. This analysis assesses whether ESG performance and carbon productivity help explain differences in valuation and earnings in the most recent reporting year. Secondly, two-sample t-tests are utilised to compare market capitalisation, EBITDA, and CAPEX between firms that disclose carbon-reduction targets and those that do not. This enables the evaluation of whether climate commitments correspond to distinctive financial characteristics, such as larger scale, higher profitability, or greater investment intensity. Thirdly, in order to capture structural and time-persistent relationships, Pearson correlations are computed for the pooled panel (2021–2024) between carbon-efficiency indicators, GHG intensity, ESG commitment, and core financial variables. Interpretation is restricted to statistically significant results ($p < 0.05$), thereby reducing noise inherent in single-year observations.

Furthermore, the application of k-means clustering, supported by NbClust criteria, is employed to identify structural patterns across firms based on market capitalisation, ESG performance, and carbon-efficiency indicators. This enables an assessment of whether Nordic companies form clearly differentiated sustainability-financial patterns or operate within a relatively homogeneous regional framework.

All computations and the reading of financial statement data were conducted in Python (pandas, numpy, seaborn, matplotlib, and other packages), R (stats, dplyr, ggplot2, ggrepel, NbClust) and cross-validated in Excel.

4. Results

Cross-sectional relationships in 2024: ESG scores and market valuation: The ESG score demonstrates only very weak and statistically insignificant correlations with market capitalisation and profitability measures (EBIT, EBITDA, net income) (see Appendix A – Table A1). This finding suggests that, within the Nordic sample, an aggregate ESG score alone does not provide a significant explanation for cross-sectional differences in firm value or earnings in 2024.

By contrast, the carbon-efficiency indicators, which reflect only the environmental pillar of ESG, display much stronger links to firms' capital structure than to short-term profitability or equity valuation. In the 2024 cross-section, revenues per tonne of CO₂ and the EVIC-to-emissions ratio both exhibit strong positive correlations with total debt. This indicates that companies that generate higher value per unit of emissions tend to be more highly leveraged. In contrast, their correlations with market capitalisation are weak, suggesting that equity markets do not fully reflect differences in carbon efficiency across a single year. The modest relationships with current profit measures indicate that carbon efficiency indicators are more strongly associated with long-term structural financial characteristics, such as assets, debt and capitalisation, than with short-term earnings, such as EBIT or EBITDA. This suggests that carbon efficiency reflects underlying balance sheet fundamentals rather than immediate operational performance.

Carbon reduction targets and firm characteristics: To assess whether explicit decarbonisation commitments are associated with distinct financial profiles, Table 1 provides mean comparisons and t-tests for firms with and without carbon reduction targets for 2024. The results indicate statistically significant differences across all examined metrics. On average, firms with carbon reduction targets have a market capitalisation that is almost four times larger than firms without targets, with a t-statistic corresponding to a p-value below 1%. Companies with targets also display significantly higher EBITDA, indicating stronger earnings capacity. Additionally, these firms report notably larger capital expenditures (CAPEX), which is consistent with more intensive investment activity, including investments that support the energy transition and decarbonisation.

Overall, these findings suggest that, in the Nordic context, explicit carbon-reduction commitments are predominantly adopted by larger, more profitable and more investment-intensive firms—namely, those with the financial capacity to implement climate-related strategies. This pattern supports the hypothesis that a firm's ability to commit to decarbonisation is shaped by its size and the availability of its resources.

Pooled Correlations: Relationships Between Carbon Efficiency, ESG Commitment, and Firm Size (2021–2024): The pooled correlation analysis (see Table 2) examines the statistically significant ($p < 0.05$) associations between carbon efficiency indicators, environmental, social and governance (ESG) commitments and core financial variables. It reveals a clear and economically meaningful pattern: firms with higher carbon efficiency and stronger ESG engagement tend to be larger, more capital-intensive and better positioned to convert sustainability performance into market value.

Table 1

T-tests: Market Cap, EBITDA, CAPEX vs carbon target (2024)

Variable	Mean_Target = 1	Mean_Target=0	t-stat	p-value
Market Capital	22.701	5.69	2.852	0.00588
EBITDA	1.32E+10	2.35E+09	3.212	0.00219
CAPEX	-3.6E+09	-5E+08	-3.1	0.0027

Source: author's calculations in Python

– Carbon efficiency and firm size

The EVIC-to-emissions ratio shows the strongest correlation with firm size, displaying a very high association with total capitalisation ($r \approx 0.88$), total assets and, in particular, total debt ($r \approx 0.90$). This suggests that the firms with the lowest carbon emissions are also the largest and most heavily indebted. These patterns suggest that carbon efficiency is closely tied to scale advantages; large firms have diversified operations, stronger resource bases and better access to capital, enabling greater investment in decarbonisation and efficiency. Consequently, carbon-efficient companies tend to be greener, financially stronger, and more advanced in terms of organisation.

– Revenue-based carbon productivity and financial structure

A similar pattern is evident in the data concerning revenues per ton of CO₂, which exhibit a moderate to significant correlation with total capitalization ($r \approx 0.54$), total assets ($r \approx 0.54$), and total debt ($r \approx 0.55$), all at $p < 0.001$. These results underscore the notion that firms with higher revenue per unit of emissions tend to be more substantial in their structure and more capital-intensive. The relationship between the two mechanisms may be explained in two

ways. Firstly, low-emission business models (finance, telecommunications, technology) inherently generate high revenue per tonne of CO₂. Secondly, larger firms with advanced digitalisation and process optimisation are better able to decouple growth from emissions. In both cases, carbon efficiency functions as a proxy for organisational competence and competitive strength.

– ESG commitment and profitability

The findings of this study demonstrate that firms which have formally declared carbon reduction targets exhibit slightly higher EBITDA ($p < 0.05$). This suggests that companies which adopt climate targets tend to be more profitable and better resourced. The modest yet noteworthy positive correlation between target-setting and market capitalisation lends further credence to this interpretation. Consequently, ESG commitments appear to be more prevalent among large, mature firms with sufficient financial and managerial capacity to engage in long-term climate planning.

– Emissions intensity and firm size

The findings of the present study demonstrate a weak but statistically significant negative correlation between the intensity of greenhouse gas emissions and total capitalisation ($p < 0.05$). This suggests that firms with higher emission intensity tend to be smaller in

Table 2

Significant correlations between carbon-efficiency indicators and financial characteristics of Nordic companies, pooled data 2021–2024¹

Carbon/ESG variable	Financial variable	r (Pearson)	p-value	N
EVIC per ton CO ₂	Total Debt	0.898	< 0.01	79
	Total Capitalisation	0.886	< 0.01	79
	Total Assets	0.88	< 0.01	79
	Leverage	0.316	0.0045	79
Revenues per ton CO ₂	Total Debt	0.55	< 0.01	84
	Total Capitalisation	0.545	< 0.01	84
	Total Assets	0.536	< 0.01	84
Presence of carbon target	EBITDA	0.232	0.0002	252
GHG intensity	ROIC	-0.264	< 0.001	213
	EBITDA	-0.273	< 0.001	151
	EBIT	-0.285	< 0.001	161

Source: author's calculations in Python

Notes: Profitability can be affected by accounting practices, so its correlations are low. But external financing shows a strong link: more socially responsible companies tend to receive more funding.

¹ The table reports only statistically significant Pearson correlation coefficients ($p < 0.05$) with absolute values $|r| \geq 0.20$. Variables include revenues per ton of CO₂, EVIC-to-emissions, GHG intensity, a dummy for the presence of carbon reduction targets, and core financial metrics such as total capitalisation, total assets, total debt, and profitability indicators.

size. Despite its modest nature, this finding aligns with a broader pattern: firms with lower emissions intensity tend to be larger and more diversified, while those with high emissions intensity often operate in structurally constrained industrial sectors.

Cluster Analysis Results

The k-means clustering results demonstrate a high degree of structural similarity among Nordic firms across market capitalisation, ESG scores, carbon-efficiency indicators, and global sustainability rankings (see Figure 1). Across a total of seven NbClust criteria, two clusters are consistently identified, with one containing almost all of the firms under consideration. This dominant cluster, which is closely grouped along the first two principal components, reflects the sustainability practices and financial characteristics of the Nordic corporate environment, which are broadly aligned. The much smaller second cluster comprises only a few firms that differ significantly from the common profile. Overall, the clustering confirms that Nordic firms operate within a largely homogeneous sustainability framework. This reinforces the idea that the pooled correlations reflect broad regional patterns rather than isolated effects at the level of individual firms.

The extant evidence demonstrates that carbon efficiency is the strongest and most consistent predictor of financial scale in Nordic firms. Carbon-efficient companies are typically larger, more capital-intensive, and better positioned to leverage sustainability for valuation gains. While firms with carbon-reduction

targets tend to demonstrate higher profitability and greater resources, carbon efficiency itself remains the more robust indicator of financial performance. These findings serve to corroborate the hypothesis that sustainability advantages in the Nordic region are most effectively realised by firms with the scale, capital, and technological capability to implement decarbonisation strategies.

Country Case Studies:

Denmark

Denmark is a prime example of the broader Nordic tradition of strong ESG performance. The country shows how a mature regulatory framework and a long-standing culture of corporate sustainability can generate measurable outcomes for firms of all sizes (see Table 3). While Denmark's largest companies, such as Novo Nordisk and Vestas Wind Systems, combine strong ESG scores with superior carbon efficiency and financial scale, ESG rankings also reveal that several smaller firms, including Zealand Pharma and ALK-Abelló, achieve high global positions comparatively. This pattern reflects the wide diffusion of sustainability norms in Denmark.

While nearly all Danish firms have set carbon reduction targets, the extent to which these commitments are translated into measurable outcomes varies across sectors. Notable improvements in GHG intensity, carbon efficiency, and market valuation per unit of emissions have been seen among financial institutions, such as SPAR Nord Bank, and high-value industrial or consumer goods companies,

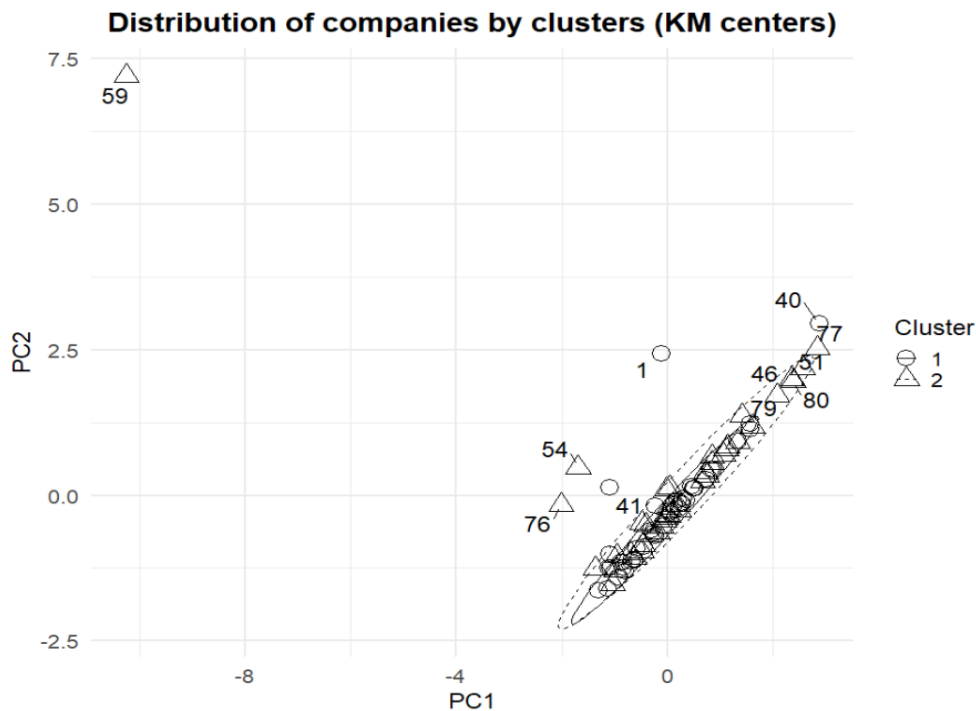


Figure 1. Distribution of Nordic companies by clusters (K-means, 2-cluster solution)

Source: author's processing data in R

Table 3

Corporate sustainability, market valuation, and carbon efficiency of Danish companies

Company	Market Capital (billion USD)	ESG 2024	Global Universe (out of 14377)	Revenues per ton CO ₂ (2023–2024 growth)	EVIC / Emissions (2023–2024 growth)
NOVO NORDISK	364	23,2	5653	393768.077 (-55.3)	4117614.119 (-14.9)
DSV	49.36	12,4	651	60959.439 (-33.9)	174801.799 (-12.1)
NOVONESIS	26.26	17,6	2603	8841.969 (-48.6)	153878.374 (38.5)
COLOPLAST	25.06	14,1	1165	207871.524 (233.5)	1575485.496 (206.1)
DANSKE BANK	22.83	19,1	3411	6265808.736 (-8.8)	218392030.404 (-14.2)
ORSTED	19.51	19,7	3712	14542.339 (87.5)	62363.092 (104.3)
PANDORA	14.08	15,9	1842	3422186.491 (521.4)	13960137.098 (656.3)
VESTAS WIND SYSTEMS	13.3	22,1	5044	166296.478 (16.7)	329980.757 (-26.3)
CARLSBERG	13.27	17,8	2684	27681.115 (-14.4)	64868.253 (-28.7)
GENMAB	12.97	21	4480	2051535.451 (-53.9)	8525548.509 (-75.5)
TRYG	12.84	22,1	5052	3908123.781 (-3.0)	14628360.103 (-5.3)
DEMANT	8.01	24,1	6160	102673.361 (12.3)	360368.369 (2.1)
ROCKWOOL	7.5	21,2	4542	2285.784 (-9.7)	4689.043 (5.3)
ZEALAND PHARMA	7.18	28,2	8600	250538.086 (-24.4)	42576070 (126.6)
H. LUNDBECK	5.38	20,4	4153	110568.673 (12.7)	347930.111 (50.4)
ALK-ABELLÓ	4.98	27,9	8481	132199.572 (16.2)	897901.817 (54.9)
JYSKE BANK	4.2	20,8	4351	3888028.504 (-0.5)	94609168.23 (-8.1)
RINGKJØBING LANDBOBANK	4.2	19,7	3768	3282835.825 (4.9)	65545819.466 (3.2)
AMBU	3.95	17,8	2714	37966.733 (19.1)	198186.341 (18.0)
SPAR NORD BANK	3.28	20,8	4330	2389772.529 (127.1)	34444168.777 (18.0)

Source: Sustainalytics, 2024; CEOWORLD Magazine, 2024; Nordic ESG Data Platform, 2024

including Pandora. In contrast, production-intensive industrial firms such as Carlsberg face operational and energy-intensity challenges that can result in increased emissions despite having formal targets. Tryg, Denmark's largest insurance company, has a different approach: its sustainability strategy involves reducing operational emissions, sourcing 100% renewable electricity by 2030 and encouraging climate-resilient practices among its customers and suppliers. This aligns with Denmark's broader climate policies. The variation observed in revenue per tonne of CO₂ and EVIC-to-

emissions growth highlights the heterogeneous nature of corporate performance. Taken together, these findings suggest that strong ESG performance – driven by targeted carbon reduction, operational efficiency and market recognition – can act as a catalyst for achieving climate goals, whilst sector-specific strategies remain essential for delivering meaningful results.

Both Pandora and Ørsted exemplify complementary approaches to advancing ESG and climate performance within Denmark's corporate sector. By reducing GHG intensity while improving revenue per tonne of CO₂

and EVIC-to-emissions ratios, Pandora has set a benchmark, demonstrating that environmental efficiency can align with financial performance. Its initiatives, such as transitioning to the use of 100% recycled silver and gold by 2025, encouraging suppliers to source renewable energy, and adopting circular economy principles, align with Denmark's broader climate objectives. These initiatives demonstrate how private sector leadership can supplement national policies and generate operational and market value (Buck, 2025; Nordea, 2024; Pandora A/S, 2025).

Ørsted's *Green Fuels for Denmark* initiative – supported by the Danish Business Authority under the EU's Important Projects of Common European Interest – illustrates the effectiveness of structured state–corporate collaboration. The project unites leading Danish and international partners in the production of renewable hydrogen and green fuels for challenging sectors such as shipping and aviation, which are difficult to decarbonise. Together with state-funded carbon capture investments at the Avedøre and Asnæs plants, these initiatives demonstrate how public policy and corporate capital can reinforce each other to support high-risk, capital-intensive innovation (Ørsted, 2023). Ørsted's performance further reflects this synergy: revenues per ton of CO₂ increased nearly fivefold and EVIC-to-emissions ratios more than sixfold between 2018 and 2024. In collaboration, Pandora and Ørsted demonstrate that strategic congruence between private initiative and public support can expedite decarbonisation, fortify market valuation, and establish Danish enterprises as frontrunners in the ESG and climate transition domains.

Finland

Finland reflects the broader Nordic pattern of strong ESG performance, shaped by its industrial structure and innovation-oriented economy. It has been demonstrated that smaller and mid-sized firms frequently demonstrate strong ESG integration and comparatively low risk scores. This suggests that sustainability leadership is influenced more by sectoral characteristics and technological specialisation than by firm size alone. As demonstrated in Table 4, an analysis of ESG data reveals a notable correlation between high performance and sectors characterised by low operational emissions and advanced technological capabilities. This phenomenon is exemplified by prominent Finnish companies such as Nokia, Amer Sports, and Konecranes, which illustrate that sectoral positioning exerts a pivotal influence in determining sustainability outcomes.

Sectoral variation remains pronounced. Telecommunications and pharmaceuticals, represented by Elisa and Orion, demonstrate high carbon efficiency and steady improvements in emissions productivity, reflecting structurally low-emission business models. Conversely, energy and industrial enterprises such as

Neste, Valmet, and Kemira exhibit elevated ESG risk and, in numerous instances, deteriorating efficiency, underscoring the enduring challenges in decarbonising carbon-intensive operations.

Trends in GHG intensity from 2018 to 2024 reinforce these patterns. While most Finnish firms achieved gradual reductions in emissions intensity, UPM-Kymmene, Stora Enso and Kone demonstrated consistent downward trajectories. However, volatility persists among energy and heavy industrial firms, such as Fortum, Neste and Valmet, whose performance reflects exposure to energy price cycles and production dynamics. Meanwhile, service-oriented companies such as Nordea and Elisa maintain low and stable emission levels, highlighting the asymmetries in carbon exposure across different sectors.

Growth indicators further highlight these differences. For example, firms such as Elisa and Amer Sports have recorded strong revenue growth and improvements in EVIC-to-emissions efficiency, demonstrating the link between innovation and financial performance. In contrast, carbon-intensive incumbents continue to struggle to translate their sustainability commitments into outcomes that align with EU climate objectives and the CSRD framework.

Overall, the disparity between ESG scores, market valuation and carbon efficiency highlights the varied nature of corporate sustainability in Finland. The finance and telecoms sectors are low-carbon leaders, while industrial and energy firms face structural challenges in balancing competitiveness with decarbonisation. Much like Denmark, Finland's experience exemplifies how ESG excellence can drive climate ambition, though differentiated, sector-specific transitions remain essential to achieving net-zero alignment.

In Finland, Nokia is a prime example of a company that sets the standard for ESG and climate performance within the corporate sector. Since 2018, the company has maintained continuous carbon reduction targets, achieving measurable improvements in environmental and financial metrics. For example, revenues per tonne of CO₂ increased by 25.7%, and EVIC-to-emissions ratios grew by 56% between 2023 and 2024. Although Nokia benefits from inherently low-emission operations in the telecommunications sector, it continues to improve emissions productivity and integrate ESG principles across its business. Its initiatives, which include the deployment of energy-efficient network infrastructure and sustainable 5G base stations in collaboration with Elisa, align with Finland's national climate objectives. This demonstrates how corporate leadership can generate operational and market value.

In parallel, Finland has leveraged strategic public-private partnerships to accelerate decarbonisation. For instance, Fortum and Microsoft utilise waste heat from data centres to provide district heating in Espoo, thereby reducing urban carbon emissions. Meanwhile,

Table 4

Corporate sustainability, market valuation, and carbon efficiency of Finnish companies

Company	Market Capital (billion USD)	ESG 2024	Global Universe (out of 14377)	Revenues per ton CO ₂ (2023–2024 growth)	EVIC / Emissions (2023–2024 growth)
NORDEA BANK ABP	37.26	13.6	989	6362136.88 (11.41)	154528960.02 (10.94)
KONE	25.42	20.1	3999	101333.64 (7.46)	279228.18 (10.47)
NOKIA	23.78	10.2	283	221629.21 (25.67)	456864.77 (55.97)
SAMPO	21.87	14	1131	3525460.46 (15.63)	20474653.90 (-2.28)
UPM-KYMMENE	14.26	13.9	1101	3097.34 (7.81)	6429.59 (-4.76)
FORTUM	12.27	24	6118	4421.63 (7.55)	14743.61 (12.85)
WÄRTSILÄ	10.46	22.2	5109	131789.63 (20.14)	303171.80 (37.58)
NESTE	8.98	26.7	7760	7532.15 (-9.91)	6354.89 (-45.76)
METSO OUTOTEC	7.72	20.8	4344	119210.31 (-11.5)	289135.63 (-3.13)
STORA ENSO	7.68	14.9	1470	7780.33 (19.85)	14320.80 (10.33)
KESKO	7.49	18.7	3191	152908.63 (-6.73)	153191.21 (-1.66)
ELISA	6.95	16.5	2133	936359.78 (141.85)	3745785.15 (148.69)
ORION	6.27	20.4	4153	141241.44 (65.05)	605093.57 (39.22)
KONECRANES	5.12	13.1	846	114136.36 (15.61)	207973.02 (36.53)
AMER SPORTS	5.09	11.5	488	194371.88 (82.49)	704076.43 (246.37)
VALMET	4.4	23.3	5721	81546.49 (-6.26)	128390.14 (-11.08)
HUHTAMÄKI	3.66	15.3	1575	9065.80 (19.56)	13759.24 (17.76)
KEMIRA	3.13	15.3	1575	5066.18 (-12.47)	7822.41 (4.98)
KOJAMO	2.38	14	1127	18149.66 (31.43)	272894.18 (21.6)

Source: Sustainalytics, 2024; CEOWORLD Magazine, 2024; Nordic ESG Data Platform, 2024

Fortum's collaboration with Norsk e-Fuel and the Port of Rauma aims to produce sustainable synthetic aviation fuel, thereby decarbonising emissions-intensive transport sectors (Fortum, 2024).

The collaboration between Nokia and Finland's public-private partnerships emphasises the country's dependence on technologically advanced firms and coordinated policy support to facilitate its transition to sustainability.

Norway

Norwegian companies present a diverse range of ESG practices (see Table 5), with sustainability leadership extending beyond the traditional energy sector. Between

2018 and 2024, firms demonstrated a steady yet differentiated trajectory in terms of both sustainability performance and carbon efficiency. Although large energy producers such as Equinor and Aker BP still dominate market capitalisation, financial, technology and engineering firms have achieved the most notable gains in revenue per tonne of CO₂ and EVIC-to-emissions ratios. This evolution suggests that Norway's corporate sustainability leadership is increasingly driven by innovation and structural transformation, rather than by the size and history of its energy industry.

Financial institutions, including DNB Bank, SpareBank 1 Østlandet and Storebrand, demonstrate

exceptional carbon productivity and consistent improvements in emissions efficiency. In 2024, DNB's revenue efficiency was close to 40 million euros per tonne of CO₂, while Storebrand's EVIC-to-emissions ratio exceeded 1.6 trillion EUR (the highest of all the firms analysed). These results reflect the low emissions intensity of financial services and the increasing

alignment of Norwegian finance with sustainable investment principles.

Firms specialising in engineering and technology, such as Kongsberg Gruppen, Aker Solutions and Tomra Systems, also demonstrate continuous improvement. For example, Aker Solutions has almost tripled its carbon efficiency between 2022 and 2024, thanks to

Table 5

Corporate sustainability, market valuation, and carbon efficiency of Norwegian companies

Company	Market Capital (billion USD)	ESG 2024	Global Universe (out of 14377)	Revenues per ton CO ₂ (2023–2024 growth)	EVIC / Emissions (2023–2024 growth)
EQUINOR	61.15	37.2	12489	12 098,19 (41.5 %)	17 461,14 (18.9 %)
DNB BANK	29.22	17.6	2604	39 902 848,83 (-4.5 %)	689 806 199,96 (-16.2 %)
SPARBANK 1 ØSTLANDET	25.57	12.9	788	4 112 644,37 (168.6 %)	69 092 490,18 (170.0 %)
KONGSBERG GRUPPEN	19.62	25.8	7227	436 342,73 (4 %)	2 438 369,91 (99.7 %)
TELENOR	15.07	19	3329	19 672,10 (27.5 %)	77 484,39 (30.7 %)
AKER SOLUTIONS	14,89	19.4	3566	321 822,16 (75.3 %)	239 802,25 (12.0 %)
AKER BP	11.85	32.8	10852	14 602,05 (5.5 %)	47 222,17 (6.9 %)
NORSK HYDRO	10.89	15.3	1587	1 985,14 (3.9 %)	2 129,58 (-6.9 %)
MOWI	8.88	23.5	5796	25 244,62 (-5.6 %)	58 954,43 (-5.6 %)
GJENSIDIGE FORSIKRING	8.83	17.5	2554	4 285 675,39 (-21.1 %)	25 237 184,55 (24.8 %)
ORKLA	8.61	18	2821	52 522,09 (5.9 %)	100 778,55 (16.6 %)
VAR ENERGI	7.46	34.1	11432	21 593,13 (174.0 %)	63 237,61 (116.2 %)
YARA INTERNATIONAL	6.71	26.7	7749	843,54 (-9.1 %)	892,59 (-14.3 %)
SALMAR	6.25	23.1	5537	69 653,74 (-14.2 %)	277 387,89 (-8.3 %)
STOREBRAND	4.58	17.3	2468	34 281 724,51 (17.9 %)	1 693 958 538,24 (13.7 %)
TOMRA SYSTEMS	3.92	28.2	8602	42 886,64 (-7.7 %)	149 353,79 (1.1 %)
AKER	3.5	12.3	620	3 567,09 (-40.4 %)	15 764,14 (-19.1 %)
WALLENIUS WILHELMSEN	3.36	20.3	4085	1 220,89 (8.3 %)	1 964,74 (0.3 %)
AUTOSTORE HOLDINGS LTD.	3.25	16.2	1966	210 593,62 (-12.1 %)	1 408 444,51 (-49.2 %)
STATCRAFT	state owned	14.7	1363	6 631,11 (-38.8 %)	24 933,88 (-21.7 %)

Source: Sustainalytics, 2024; CEOWORLD Magazine, 2024; Nordic ESG Data Platform, 2024

its expansion into offshore renewables and low-carbon engineering. Meanwhile, Kongsberg Gruppen's EVIC-to-emissions ratio has increased by over five times since 2019, highlighting the sector's strong capacity for innovation and its contribution to reducing emissions.

In contrast, energy-intensive and resource-based firms, including Statkraft, Yara International and SalMar, demonstrate greater volatility and, in some instances, deteriorating performance. Although Equinor and Aker BP have made moderate improvements to their emissions productivity since 2022, they are both still limited by the difficulties involved in decarbonising fossil fuel operations. Yara International's deteriorating carbon efficiency further highlights the technological and financial obstacles faced by heavy industry and agriculture.

GHG intensity data from 2018 to 2024 reinforce these contrasts. Although Equinor and Aker BP have reduced emissions from their 2020 peaks, progress is still gradual overall. Yara International has followed a similar downward trend, yet remains highly emission-intensive. Meanwhile, low-emission sectors such as finance, telecommunications and services maintain stable performance, whereas industrial firms such as Kongsberg Gruppen and Norsk Hydro record incremental gains. The persistent fluctuations of Var Energi and Aker ASA highlight Norway's ongoing reliance on resource-based activities, which limits its progress towards a low-carbon future.

It is evident that Norway's corporate sustainability profile demonstrates an increasing concentration of ESG leadership within the finance, technology, and engineering sectors. In contrast, fossil fuel-based sectors continue to be hindered by structural decarbonisation challenges. This trajectory reflects a gradual shift from resource-dependent competitiveness towards innovation- and finance-driven decarbonisation.

Kongsberg Gruppen serves as a prime example of a leading corporation in Norway's transition towards sustainable business practices. Although Kongsberg is mid-sized relative to major players such as Equinor or DNB, it has achieved pronounced growth in EVIC-to-emissions ratios, increasing from 4.3 million EUR in 2018 to over 2.4 billion EUR in 2024. This performance exceeds the proportional progress of most large emitters and reflects substantial improvements in carbon efficiency, innovation-driven value creation, and active participation in state-supported energy transition initiatives, including offshore wind and renewable energy storage projects. In addition, Kongsberg has established Kongsberg Renewables Technologies with the objective of achieving substantial revenue growth in the renewable energy sector by the year 2030. In collaboration with entities such as TGS, the company is developing integrated data and digital solutions for offshore wind field development, thereby contributing directly to the decarbonisation of the energy sector

(Kongsberg Gruppen, 2022). As a high-technology and engineering firm, Kongsberg illustrates Norway's broader shift from resource-based to knowledge-based sustainability, integrating competitive advantage with emissions reduction.

In addition, financial institutions such as Storebrand and SpareBank 1 Østlandet can also be used as benchmarks. These institutions have been demonstrated to exhibit strong CO₂ productivity and to maintain climate-aligned investment portfolios, thereby supporting the national energy transition through financial mechanisms rather than direct operational decarbonisation.

Statkraft, a state-owned Norwegian enterprise specialising in renewable energy, exhibits a commendable level of carbon efficiency, particularly during its most prolific operational years. However, due to fluctuations in its EVIC-to-emissions and revenue-per-ton CO₂ ratios, and its moderate performance compared with cross-industry leaders, Statkraft is best regarded as a sector-specific benchmark within renewable energy rather than a universal corporate sustainability benchmark.

Sweden

Swedish firms have exhibited consistent improvement in sustainability performance and carbon efficiency between 2018 and 2024, driven by robust ESG integration and alignment with national climate goals and EU decarbonisation frameworks (see Table 6). This trajectory is indicative of Sweden's gradual transition from a resource-based industrial growth model to an innovation- and finance-driven low-carbon economy.

Financial and investment institutions have been found to demonstrate the strongest carbon productivity and value efficiency, thereby confirming their structural advantage of low operational emissions and effective ESG-valuation linkages. Investor AB, Industrivärden, and EQT have demonstrated notable gains in 2023–2024, with Investor AB reporting a 65% increase in value efficiency (EVIC-to-emissions ratio) and over 540 million EUR in revenues per ton of CO₂. This indicates that active ownership and portfolio decarbonisation have directly contributed to market value growth. Similarly, Industrivärden and EQT have achieved double-digit increases in efficiency, while Svenska Handelsbanken and Swedbank have maintained stable carbon profiles, reflecting climate-aligned financial models with limited volatility.

A broad decline in greenhouse gas (GHG) intensity across listed companies signals tangible progress in decarbonisation and energy efficiency. Investor AB has achieved the steepest and most consistent reduction, cutting its GHG intensity by almost fivefold – from 68.6 in 2018 to 13.5 in 2024. Similar reductions at AB Volvo and Ericsson suggest effective emissions management in industrial and technological operations.

In contrast, the fluctuations observed in Atlas Copco, Assa Abloy and EQT are likely to reflect structural adjustments, acquisitions or changes in reporting boundaries.

Leading industrial and engineering companies, including AB Volvo, Atlas Copco, Assa Abloy and Alfa Laval, are demonstrating steady efficiency improvements through electrification, process

optimisation and low-carbon technologies. Volvo's 19% increase in revenue per tonne of CO₂ and Alfa Laval's 25% rise in value efficiency confirm measurable progress in industrial decarbonisation. However, the continued exposure of Sandvik, Epiroc and Investment Latour to resource-intensive operations and cyclical market dynamics that constrain long-term carbon gains is highlighted by their persistent volatility.

Table 6

Corporate sustainability, market valuation, and carbon efficiency of Swedish companies

Company	Market Capital (billion USD)	ESG 2024	Global Universe (out of 14377)	Revenues per ton CO ₂ (2023–2024 growth)	EVIC / Emissions (2023–2024 growth)
INVESTOR AB	80.69	11,9	543	535 541 428.462 (46.2%)	6 917 958 272.3 (65.4%)
ATLAS COPCO	2.38	20,2	4043	136 685.636 (3.9%)	685 110.761 (-0.3%)
VOLVO	49.45	27,7	8321	540 286.104 (19.3%)	426 248.766 (17.1%)
ASSA ABLOY	32.84	19,6	3686	61 117.854 (25.5%)	195 239.995 (32.2%)
EQT	32.68	17,4	2521	7 641 689.373 (52.2%)	95 208 852.044 (22.6%)
ENSKILDA BANKEN	27.49	17,6	2629	4 397 979.997 (-56.0%)	87 538 921.622 (-58.5%)
ERICSSON	26.94	15,1	1526	431 423.103 (24.5%)	847 931.887 (59%)
HEXAGON	25.71	13,1	838	130 374.974 (8.8%)	735 205.493 (-4.7%)
SANDVIK	22.65	24,2	6242	73 117.318 (-8.1%)	198 348.165 (-11.5%)
HENNES & MAURITZ	21.97	19,3	3488	493 098.361 (27.7%)	791 070.638 (19.0%)
SWEDBANK	21.77	24,5	6423	2 837 097.867 (7.5%)	62 057 193.323 (4.3%)
EPIROC	20.69	19	3368	112 927.83 (-44.8%)	464 783.354 (-47.6%)
SVENSKA HANDELSBANKEN	20.24	14,2	1203	6 861 065.886 (8.0%)	132 170 572.428 (1.2%)
ESSITY	18.55	23,5	5802	5 690.855 (-4.5%)	11 676.082 (1.3%)
ALFA LAVAL	17.46	25,6	7088	284 914.492 (17.1%)	994 644.426 (25.6%)
EVOLUTION	17.16	20,4	4133	480 122.777 (33.3%)	3 672 585.455 (-24.0%)
INVESTMENT LATOUR	15.9	16,4	2103	137 475.363 (-31.7%)	1 041 646.32 (-28.6%)
INDUSTRIVÄRDEN	13.6	13,9	1098	58 046 413.077 (39.3%)	1 067 632 285.3 (10.1%)
LIFCO	13.21	36,2	12178	170 940.173 (24.0%)	1 075 817.346 (45.8%)
L E LUNDBERGFÖRETAGEN	11.23	18,5	3098	44 166.963 (-1.6%)	228 502.212 (-2.4%)
SKANSKA	9.1	31	10128	100 171.439 (6.5%)	115 053.158 (19.1%)

Source: Sustainalytics, 2024; CEOWORLD Magazine, 2024; Nordic ESG Data Platform, 2024

Technology and consumer-oriented firms, including Ericsson, Evolution, and Hennes & Mauritz, demonstrate a combination of robust ESG performance and expanding emission productivity, with annual growth reaching up to 33%, thereby underscoring the pivotal role of innovation-led and digital business models in fostering low-emission value creation.

The Swedish corporate landscape evinces an incremental yet quantifiable decarbonisation process, concomitant with an expansion in sectoral heterogeneity. The financial and technology sectors are becoming increasingly pivotal to sustainability leadership, while heavy industry is advancing more incrementally under the constraints of structure and cost.

Public-private collaboration continues to be a fundamental aspect of Sweden's green transition. Business Sweden-led Green Transition Alliances, including the Sweden-US and Sweden-Taiwan consortia, connect government agencies, export offices and major firms such as Atlas Copco, Assa Abloy, Ericsson, and Volvo to promote low-carbon technologies and international pilot projects. National partnerships also link Volvo with the state-owned Vattenfall on electrification and charging infrastructure, while Atlas Copco and Ericsson engage in publicly supported consortia and digital innovation programmes that enhance energy and resource efficiency. Collectively, these initiatives serve to illustrate Sweden's coordinated approach to climate governance, which combines public finance, regulatory support, and joint R&D to de-risk investment and accelerate measurable corporate decarbonisation.

Iceland

The paucity of available data constitutes a substantial limitation in the assessment of ESG performance in Iceland. Of the 25 firms on the list, only 16 disclose overall ESG scores, and of these, only four provide publicly accessible information on the Nordic ESG Data Platform. The narrow disclosure landscape of the domestic market, coupled with the absence of fully harmonised disclosure standards and comparatively less institutionalised reporting practices, is the primary factor contributing to this phenomenon. Consequently, the scope for

comprehensive benchmarking is restricted, and transparency for investors is affected.

The ESG landscape in Iceland demonstrates a moderate level of development, with considerable variation across sectors (see Table 7). In the period between 2018 and 2024, Icelandic companies have demonstrated a gradual enhancement in carbon efficiency and value creation relative to emissions. However, it should be noted that their overall performance remains inferior to that of other Nordic economies. Financial institutions have demonstrated the most consistent advancements, particularly in revenues generated per ton of CO₂ and in market valuation relative to emissions. In contrast, the single industrial company included in the analysis exhibits more volatile year-to-year results and comparatively limited gains in emission-related efficiency.

Cross-Country Comparison of Nordic Sustainability Outcomes

Across the Nordic region, corporate sustainability performance is broadly aligned, yet shaped by distinct national industrial structures and sectoral profiles. Denmark and Sweden have been demonstrated to demonstrate the most mature and consistently high sustainability outcomes, with firms across multiple sectors achieving strong ESG integration and notable improvements in carbon efficiency. Finland's performance is characterised by a pronounced sectoral focus, with technologically advanced and low-emission industries, most notably telecommunications and pharmaceuticals, demonstrating the most notable sustainability outcomes. It is evident that Norway exhibits a pronounced structural divide. The financial, technology and engineering firms lead in carbon productivity, whilst the fossil fuel-based and heavy industrial sectors continue to face persistent decarbonisation challenges. Iceland's progress is steady but constrained by limited disclosure and a smaller corporate base.

Overall, sectoral characteristics and firm size remain the strongest determinants of ESG effectiveness in the Nordic countries. Financial, technology and consumer-oriented companies are more effective at converting sustainability practices into carbon efficiency and

Table 7
Corporate sustainability, market valuation, and carbon efficiency of Icelandic companies

	Market Capital (billion USD)	ESG 2024	Global Universe (out of 14377)	Revenues per ton CO ₂ (2023–2024 growth)	EVIC / Emissions (2023–2024 growth)
MAREL HF.	3.18	32,9	10907	141 362.89 (-4.83 %)	128 128.079 (-11.33%)
ARION BANKI HF.	1.66	12,1	583	22 302 285.609 (17.97%)	211 168 708.303 (18.19%)
ÍSLANDBANKI HF.	1.66	20,8	4349	21 077 033.209 (82.44%)	210 068 662.873 (79.95%)
KVIKA BANKI HF.	0.672	25,4	6952	3 671 238.824 (89.77%)	36 852 302.941 (66.56%)

Source: *Sustainalytics, 2024; CEOWORLD Magazine, 2024; Nordic ESG Data Platform, 2024*

valuation gains than industrial and resource-intensive sectors, the latter of which require targeted policy support and long-term technological transitions. These patterns highlight the importance of innovation, high-quality reporting, and coordinated public-private action in linking ESG performance to financial and strategic outcomes.

6. Conclusions

The findings show that the creation of sustainable value in the Nordic economies is primarily driven by carbon efficiency and firm size, rather than by conventional ESG scores. Carbon efficiency indicators display strong and consistent links to market capitalisation, assets and leverage. This confirms that firms that generate higher economic value per unit of CO₂ are better positioned to benefit from sustainability-linked valuation effects. By contrast, aggregate ESG ratings offer little explanatory power with regard to differences in profitability or market value.

Although firms with carbon-reduction targets are significantly larger and more profitable, commitment

alone does not guarantee superior carbon performance due to sectoral constraints. Financial, technology and consumer-facing firms consistently demonstrate greater emissions productivity, whereas industrial and resource-intensive sectors encounter structural barriers to decarbonisation.

Clustering analysis shows that Nordic firms operate within a largely homogeneous sustainability framework, with only a few outliers. This suggests that the pooled correlations reflect broad regional patterns rather than isolated effects at the level of individual firms.

Overall, the results emphasise the strategic importance of carbon efficiency, scale and institutional capacity in converting sustainability performance into financial value. Targeted industrial policies and technological support are crucial in enabling carbon-intensive sectors to close the efficiency gap. Future research should examine the causal mechanisms involved and assess how CSRD-aligned reporting could strengthen the financial relevance of environmental performance.

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Appendix A. Additional empirical results

Table A1. Cross-sectional correlations between ESG, carbon efficiency, and financial indicators, 2024

	ESG	Market capital	EVIC per ton CO ₂	Revenues per ton CO ₂	EBIT	EBITDA	Net income	CAPEX	Total debt
ESG	1	0.05	-0.017	-0.12	0.197	0.193	-0.062	-0.167	-0.12
Market capital	0.05	1	-0.087	-0.117	0.893	0.828	0.706	-0.717	0.049
EVIC per ton CO ₂	-0.017	-0.087	1	0.808	-0.054	-0.064	0.099	0.111	0.925
Revenues per ton CO ₂	-0.12	-0.117	0.808	1	-0.023	-0.007	0.047	0.164	0.68
EBIT	0.197	0.893	-0.054	-0.023	1	0.984	0.985	-0.768	0.698
EBITDA	0.193	0.828	-0.064	-0.007	0.984	1	0.957	-0.786	0.784
Net income	-0.062	0.706	0.099	0.047	0.985	0.957	1	-0.478	0.384
CAPEX	-0.167	-0.717	0.111	0.164	-0.768	-0.786	-0.478	1	-0.007
Total debt	-0.12	0.049	0.925	0.68	0.698	0.784	0.384	-0.007	1

Notes: This table reports Pearson correlation coefficients for 2024.

Source: author’s calculations in Python

Received on: 10th of December, 2025
 Accepted on: 07th of February, 2026
 Published on: 10th of April, 2026