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Strategic Behavior in the Renewable Energy Industry: A Behavioral Macrosystemic Case Study of Vestas

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Abstract

This study explores whether strategic decisions in the renewable energy sector follow predictable patterns shaped by external environmental forces. Drawing on a mixed-methods design, it combines qualitative STEEPLE analysis—covering social, technological, economic, environmental, political, legal, and ethical factors—with behavioral economics concepts such as bounded rationality, loss aversion, and status quo bias. A comparative radar chart and benchmarking of key industry players add a quantitative lens to the analysis. Focusing on Vestas Wind Systems A/S, the study tracks strategic responses across decades, revealing patterns of behavior that repeat in response to specific macro shifts like policy changes or technological advances. By doing so, the research offers a clearer view into how companies make decisions under pressure—not only in structured ways, but often shaped by behavioral tendencies. The findings suggest that strategic behavior can be anticipated to a meaningful extent, especially when viewed through the combined lens of behavioral and environmental analysis. This work contributes to strategic management and sustainability studies by offering a framework that helps both academics and practitioners make sense of corporate decision-making in uncertain contexts.

Keywords: *behavioral economics, strategic behavior, bounded rationality, STEEPLE analysis, Vestas;*

1. Introduction

1.1. Rationale and Background

The global transition to renewable energy has brought about profound structural shifts in the energy sector. Companies now face mounting pressure to evolve in response to fast-changing technological landscapes, economic volatility, regulatory developments, and growing socio-political demands. Adapting effectively to these macro-environmental forces has become essential for ensuring long-term competitiveness and resilience.

Vestas Wind Systems A/S—a Danish multinational with a legacy dating back to 1945—offers a compelling case for examining strategic adaptation. Originally a manufacturer of agricultural equipment, Vestas shifted focus to wind turbine production in the wake of the 1970s energy crises. Since then, it has grown into a global leader in wind energy solutions, navigating multiple industry transformations while responding to both market and regulatory stimuli.

This transformation raises a central question: Can a company's strategic behavior be systematically understood—and even anticipated—through the combined lenses of behavioral economics and macro-environmental analysis? Exploring this question provides valuable insights not only into Vestas's trajectory but also into the broader dynamics that shape strategic decision-making in sustainability-focused industries.

1.2. Theoretical Framework and Research Gap

Conventional strategic frameworks—such as Porter's competitive forces model (1985) and the resource-based view (Barney, 1991)—have long shaped how scholars and practitioners assess corporate strategy. These models emphasize competitive positioning, innovation leadership, and market dominance. However, they often overlook the behavioral complexity behind strategic decision-making, particularly under uncertainty.

In contrast, behavioral economics offers valuable tools for examining how cognitive biases, heuristics, and organizational behavior influence corporate choices. Foundational work by Tversky and Kahneman (1974) and more recent contributions by Akerlof and Shiller (2009) have illuminated the ways in which decisions deviate from strict rationality—yet these insights have not been fully integrated into mainstream strategic analysis.

Although scholars such as Gavetti (2012) and Powell et al. (2011) have begun bridging this gap, few empirical studies have applied behavioral economics in detailed, case-based examinations of corporate behavior—especially within the sustainability-driven renewable energy sector. Similarly, while environmental scanning models like STEEPLE or PESTEL are widely used, they tend to remain descriptive and rarely connect external pressures with specific behavioral responses from firms.

To address this shortfall, the present study proposes an integrated framework that combines the STEEPLE model with behavioral economics. This approach offers a more nuanced understanding of how companies like Vestas adapt strategically, not only to environmental forces but also through recurring behavioral patterns rooted in cognitive and organizational tendencies.

1.3. Research Objectives, Research Question, and Hypotheses

This study aims to determine whether Vestas's strategic decisions follow consistent

behavioral patterns shaped by identifiable macro-environmental factors. By examining these patterns through the combined lenses of behavioral economics and the STEEPLE framework, the research seeks to uncover whether such behaviors can help anticipate the company's future strategic direction.

Research Question:

Can corporate behavior, when analyzed through macro-environmental and behavioral-economic perspectives, reveal consistent decision-making patterns that enable predictions of future strategic actions?

To explore this question, the study tests the following hypotheses:

- **Null Hypothesis (H_0):**
  Vestas's strategic decisions do not exhibit recurring behavioral patterns that can be reliably linked to specific macro-environmental (STEEPLE) factors.

- **Alternative Hypothesis (H_1):**
  Vestas's strategic decisions do exhibit recurring behavioral patterns that are consistently associated with specific macro-environmental (STEEPLE) factors, thereby supporting predictions about future corporate actions.

1.4 Methodology Overview

This study adopts a mixed-method research design, combining qualitative and quantitative components to examine the behavioral dimensions of Vestas's strategic responses to macro-environmental pressures. This approach allows for an in-depth analysis of behavioral patterns while providing quantitative validation through comparative benchmarking.

Qualitative Component: Behavioral Economics and STEEPLE Integration

The qualitative phase is built around the STEEPLE framework, which categorizes external forces into Social, Technological, Economic, Environmental, Political, Legal, and Ethical dimensions (Johnson et al., 2008). Within each dimension, Vestas's historical and current strategic actions are examined using thematic content analysis, supported by publicly available reports, academic literature, and corporate disclosures.

To interpret how Vestas responds to these external stimuli, behavioral economic concepts are embedded within each STEEPLE domain. Key constructs include:

- **Bounded Rationality** (Simon, 1957; Cristofaro, 2023): to assess decision-making under uncertainty.

- **Loss Aversion and Status Quo Bias** (Kahneman & Tversky, 1979; Thaler, 2024): to explain inertia in risk-sensitive environments.

- **Anchoring Effects** (Tversky & Kahneman, 1974): to evaluate how early regulatory cues shape strategic commitments.

Each STEEPLE factor is thus explored not only descriptively but also interpretively,

identifying recurring behavioral traits in response to distinct macro-environmental stimuli.

Quantitative Component: Benchmarking and Radar Chart Analysis

To complement and validate the qualitative insights, the study uses benchmarking and radar chart analysis. Benchmarking allows for direct comparison between Vestas and two industry peers—Siemens Gamesa and GE Renewable Energy—across strategic performance dimensions.

The radar chart provides a visual representation of behavioral consistency across the STEEPLE dimensions. Each axis of the chart corresponds to a domain and is scored on a 1–10 scale based on publicly available metrics and expert evaluation.

Key Variables and Justification

The radar chart is constructed using the following variables, selected for their strategic relevance and alignment with behavioral predictability:

Variable	STEELPE Domain	Justification
ESG Scores (Sustainalytics, MSCI)	Social / Ethical	Reflect stakeholder alignment and ethical consistency
Technological Innovation Indices	Technological	Capture sustained investment in R&D and digitalization
Market Share and Revenue Growth	Economic	Indicate adaptive performance under economic volatility
Regulatory Compliance Metrics	Political / Legal	Reflect responsiveness to national and international legal standards
Supply Chain Risk Assessments	Political / Legal	Measure strategic resilience and proactive risk mitigation
Corporate Governance Transparency	Ethical / Legal	Serve as a proxy for institutionalized ethical behavior and decision consistency

These variables allow for structured, comparable measurement of firm behavior across the STEEPLE domains, supporting the predictive dimension of the analysis.

Integration of Methods

The qualitative and quantitative components are integrated at two key levels:

1. **Thematic-empirical convergence**: The STEEPLE-behavioral themes identified qualitatively are compared with quantitative scores to assess alignment. For example, where behavioral consistency is observed in ESG reporting, corresponding ESG ratings provide external validation.

2. **Cross-case benchmarking**: Radar chart outputs allow Vestas's behavior to be evaluated against its peers, highlighting areas of strategic distinction or convergence. This enhances the study's generalizability and strengthens the claim of behavioral regularity.

As Creswell and Creswell (2023) suggest, mixed-methods research enables richer interpre-

tation by linking interpretive depth with empirical breadth. This approach provides a more holistic view of strategic behavior, allowing the study to go beyond description toward grounded, evidence-based prediction.

1.5 Literature Review

This study builds on three intersecting bodies of literature: behavioral economics, strategic management, and renewable energy strategy. Each field contributes essential insights into how organizations respond to uncertainty, competitive pressures, and macro-environmental change. Yet, despite these rich traditions, a critical integration remains underdeveloped: the empirical linkage between behavioral patterns and structured environmental scanning within corporate strategic behavior.

Behavioral Economics and Strategic Decision-Making

Behavioral economics provides a foundational lens for analyzing how organizations make decisions under uncertainty. Seminal work by Tversky and Kahneman (1974) introduced key cognitive biases—such as loss aversion, anchoring, and bounded rationality—that challenge the rational actor model. These biases have been further contextualized within corporate settings by scholars such as Thaler (2024) and Cristofaro (2023), who examine how decision-making deviates from optimal logic due to cognitive and organizational constraints.

More recently, Gavetti (2012) and Powell & Lovallo (2024) have explored behavioral regularities in strategic choices, linking cognitive shortcuts and risk sensitivity to long-term corporate behavior. However, much of this research remains theoretical or applied at the individual or organizational culture level, without systematically connecting behavior to structured environmental triggers like regulation, technology shifts, or political risk.

Strategy in the Renewable Energy Sector

The renewable energy sector has been the subject of increasing strategic interest, with scholars examining innovation pathways (IRENA, 2024), policy responsiveness (Bloomberg NEF, 2024), and stakeholder alignment (GWEC, 2024). Traditional strategic frameworks—such as Porter's Five Forces (1985) and the Resource-Based View (Barney, 1991)—remain influential in explaining competitive positioning. Yet, these models often assume stable rationality and underrepresent the behavioral nuance involved in corporate adaptation.

While industry reports and ESG studies focus on performance outcomes, few provide insight into *why* firms behave in certain ways across different external domains. Vestas, in particular, has been analyzed through the lens of ESG metrics and innovation investment, but the deeper behavioral patterns behind these actions remain underexplored.

Research Gap: Behavioral Predictability and Strategic Patterning

There is currently **no established framework** that combines behavioral economic theory with structured macro-environmental models (e.g., STEEPLE) to assess **predictable patterns of strategic behavior**. Most existing research either:

- Focuses on environmental scanning models (PESTEL, STEEPLE) as descriptive tools, without behavioral interpretation; or
- Applies behavioral theory in isolation, often without empirical grounding in strategic outcomes or macro-environmental contexts.

This gap is particularly evident in **sustainability-focused industries**, where external pressures are both volatile and value-driven. The absence of empirical, behaviorally informed case studies limits our ability to anticipate strategic responses and weakens theoretical progress in behavioral strategy.

Contribution of This Study

To address this void, the present research introduces a novel analytical model that blends behavioral economics with the STEEPLE framework. It applies this model to Vestas—an industry leader in renewable energy—through both qualitative pattern analysis and quantitative benchmarking. In doing so, the study contributes to a small but growing body of work that seeks to move beyond description toward **behavioral prediction** in strategic management.

This hybrid approach adds value in three key ways:

1. It operationalizes behavioral theory within real-world strategic environments.
2. It empirically connects macro-environmental triggers to specific behavioral responses.
3. It enables a structured forecast of firm behavior across distinct external domains.

These contributions lay the groundwork for further empirical testing across sectors and advance a more behaviorally realistic understanding of corporate strategy in high-stakes, sustainability-oriented industries.

1.6 Structure of the Paper

The paper is organized to progressively build a comprehensive understanding of Vestas's strategic behavior in response to macro-environmental factors. The structure is as follows:

- **Sections 2–8** apply the STEEPLE framework, analyzing how Vestas has historically responded to each macro-environmental factor. These sections evaluate the consistency and predictability of the firm's strategic decisions in each domain.
- **Section 9** introduces a behavioral benchmarking model, comparing Vestas's strategic profile against industry competitors, specifically Siemens Gamesa and GE Renewable Energy.

- **Section 10** synthesizes the study's findings, evaluates the hypotheses, and outlines practical implications for strategic management, along with directions for future research.

This structured approach enables a systematic examination of corporate behavior, offering insights into how strategy can be understood—and potentially forecast—within industries shaped by rapid change and high uncertainty.

2. Social Factors: Formative Experiences Shaping Vestas' Identity and Strategic Decisions

2.1 Societal Context: Public Perception and Social Acceptance

Public perception plays a pivotal role in determining the pace and success of renewable energy deployment. Social acceptance can shape not only the location and scale of energy projects but also a company's long-term operational viability (Devine-Wright, 2023). In Denmark, early societal support for wind energy created a favorable environment for Vestas to evolve. Today, the company continues to build on that foundation by emphasizing transparency, community involvement, and environmental education as essential components of its strategy.

"Public acceptance remains crucial to renewable energy expansion; engaging local communities early in the planning process significantly enhances project feasibility and longevity."

Devine-Wright (2023)

2.2 Community Engagement and Local Impact

Resistance at the local level can threaten the viability of renewable energy projects, particularly when communities feel excluded from planning processes or when local benefits are unclear. In response, Vestas has developed comprehensive community engagement initiatives, often integrating job creation, infrastructure investment, and regional partnerships into its project strategies (Wüstenhagen et al., 2024). This approach strengthens the firm's social license to operate and reduces implementation risk.

"Renewable energy firms increasingly view local communities not merely as stakeholders but as strategic partners whose interests must be proactively integrated into project planning."

Wüstenhagen et al. (2024)

Examples from recent Vestas projects across Latin America and Asia-Pacific highlight this localized, partnership-oriented strategy.

2.3 Social Movements and Public Advocacy

The rise of environmental and climate advocacy movements—such as Fridays for Future and Extinction Rebellion—has raised societal expectations around corporate responsibil-

ity. These movements exert growing influence on corporate behavior, prompting companies to align their messaging and operations with broader social sustainability narratives. Vestas has responded by embedding sustainability commitments into its public discourse and brand positioning.

"Global social movements are increasingly shaping public policy and corporate behaviors, compelling companies to transparently align strategic decisions with broader societal sustainability goals."

Fisher & Nasrin (2023)

2.4 Corporate Social Responsibility (CSR) and ESG Integration

Corporate Social Responsibility and Environmental, Social, and Governance (ESG) performance are no longer optional—they are integral to investor relations, customer engagement, and regulatory compliance. Vestas has institutionalized these values, tracking and reporting on social metrics such as employment equity, community impact, and human rights across its global footprint.

"Companies demonstrating strong ESG performance consistently outperform peers in market resilience, financial performance, and stakeholder trust, especially within sustainability-sensitive industries."

McKinsey & Company (2024)

2.5 Behavioral Patterns and Predictive Capabilities in the Social Domain

The patterns observed in Vestas's approach to social factors reflect key behavioral economic principles—particularly bounded rationality and status quo bias (Cristofaro, 2023; Kahneman, 2023). These patterns suggest that the company has developed a structured and anticipatory approach to social engagement. Three recurring behavioral traits emerge:

- **Proactive social alignment:** A consistent focus on maintaining and strengthening public support.
- **Community-centric strategy:** Emphasis on local partnerships and impact-oriented programs.
- **Alignment with advocacy movements:** Strategic responsiveness to evolving societal expectations.

These traits are illustrated in the table below:

Table 1. Behavioral Traits in Social Context: Historical and Recent Evidence

Behavioral Trait	Historical Example	Recent Example (2024)	Source
Proactive public acceptance	Danish wind projects (1980s–90s)	Community-focused projects in Latin America/ Asia	Devine-Wright (2023); Vestas Annual Report
Community-centric strategy	Cooperative wind models in Denmark (1990s–2000s)	Job creation and regional partnerships	Wüstenhagen et al. (2024); Vestas Sustainability Report
Advocacy alignment	Early environmental engagement (2000s)	Transparent ESG communication and reporting	Fisher & Nasrin (2023); McKinsey (2024)

These recurring patterns reinforce the study's alternative hypothesis (H_1), demonstrating that Vestas's strategic decisions are consistently shaped by identifiable social dynamics. The company's stable, structured responses to public perception, community interests, and social activism suggest a high degree of behavioral predictability in the social domain.

3. Technological Factors: Innovation as Behavioral Driver in Vestas' Strategic Evolution

3.1 Technological Change and Strategic Agility

In the renewable energy industry, technological innovation is a primary driver of strategic behavior. Because innovation follows recognizable patterns—such as development, scaling, optimization, and repowering—companies often respond in predictable ways (Gavetti, Greve, & Levinthal, 2023).

Several structural forces reinforce this predictability:

- **Technology life cycles** guide investment and product planning.
- **High switching costs and asset specificity** discourage abrupt technological pivots (Williamson, 2023).
- **Regulatory standards and investor expectations** reinforce adoption of specific technologies (IEA Technology Outlook, 2024).

Together, these elements create a landscape where firms like Vestas tend to evolve their technology strategies incrementally.

3.2 Scaling Technologies and Competitive Advantage

Vestas's development of larger turbines illustrates this strategic predictability. The V236-15.0 MW offshore turbine aligns with broader industry efforts to improve energy output and reduce the levelized cost of electricity (LCOE).

"Industry competition increasingly revolves around scaling offshore wind technologies, as larger turbines significantly reduce levelized costs of electricity (LCOE) and enhance

project viability."

IRENA Offshore Wind Report, 2024

By focusing on larger turbine models, Vestas strengthens its competitive position in key markets like Europe, North America, and Asia-Pacific.

3.3 Digital Transformation: Strategic Continuity through Innovation

The firm's consistent investment in digital infrastructure—ranging from early SCADA systems to AI-powered maintenance analytics—demonstrates its strategic commitment to operational efficiency. Digital innovation becomes self-reinforcing due to sunk costs and system integration challenges, making long-term continuity a rational choice (Bloomberg NEF Digital Energy, 2024).

"Consistent investments in digital analytics, driven by significant sunk costs and operational complexity, reinforce predictability of corporate strategic commitments."

Bloomberg NEF Digital Energy Outlook, 2024

3.4 Intellectual Property and Innovation Pathways

Vestas's long-standing intellectual property strategy further reinforces this path-dependent approach. Since the 1980s, the company has actively secured patents to protect innovation and shape its technological trajectory.

"Renewable energy companies predictably use intellectual property rights not only defensively, to protect innovations, but also strategically, to shape technological trajectories and influence market competition."

WIPO, 2024

3.5 Behavioral Patterns and Predictive Insights

Behavioral economics provides insight into why Vestas maintains this structured technological path. Status quo bias and bounded rationality lead to incremental innovation strategies, especially in high-stakes industries.

Key behavioral traits include:

- A preference for **progressive scaling**, avoiding radical departures from proven technologies.
- **Incremental digital transformation**, building on existing systems rather than adopting

entirely new models.

- A **long-term IP strategy** to consolidate innovation and reduce uncertainty.

These traits are summarized in Table 2.

Table 2. Behavioral Traits in Technological Context: Historical and Recent Evidence

Behavioral Trait	Historical Example	Recent Example (2024)	Source
Predictable technology scaling	Early focus on larger turbines in late 1990s	Launch of V236-15.0 MW offshore model	IRENA (2024); Vestas Annual Report (2024)
Consistent digital transformation	Introduction of SCADA systems (2000s)	Use of AI for predictive maintenance	Bloomberg NEF (2024); Vestas Sustainability Report (2024)
Strategic IP management	Early wind tech patents (1980s–90s)	Ongoing IP coverage for offshore/digital solutions	WIPO (2024); Vestas IP disclosures (2024)

This structured approach to innovation supports the study's alternative hypothesis (H_1). Vestas's technological decisions reflect consistent behavioral patterns that are shaped by external expectations and internal cognitive heuristics—making its strategic behavior in this domain highly predictable.

4. Economic Factors: Financial Dynamics Influencing Vestas's Strategic Decisions

4.1 Global Market Dynamics and Investment Trends

The global wind energy market is experiencing sustained growth, driven by declining costs, supportive policies, and rising investor interest. Forecasts indicate an expansion from USD 115.3 billion in 2024 to USD 361.2 billion by 2035, at a projected CAGR of 10.93% (Roots Analysis, 2024). This upward trend is mirrored in record-breaking investments across the broader renewable sector.

"Global renewable energy investments surpassed $2 trillion in 2024, with wind energy constituting a significant share. This trend signals long-term growth potential and sustained strategic opportunities."

Bloomberg NEF, 2024

Such market signals shape strategic decisions across the industry, and Vestas has consistently responded by positioning itself in high-growth regions and emerging markets.

4.2 Competitive Landscape and Market Positioning

Vestas competes in a concentrated market alongside Siemens Gamesa and GE Renewable Energy. The table below summarizes their relative positioning based on revenue, market share, and strategic priorities:

Table 3. Competitive Positioning of Leading Wind Energy Companies (2024)

Company	Revenue (EUR billion, 2024)	Market Share (%)	Key Strategic Focus (2024)
Vestas	17.3	19.8	Offshore growth, digital transformation
Siemens Gamesa	12.4	16.7	Offshore expansion, hydrogen integration
GE Renewable Energy	10.2	14.3	Repowering projects, digital innovation

(Source: GWEC, 2024; Company Annual Reports)

This positioning illustrates Vestas's leadership in offshore wind and digital capability—key areas for long-term competitiveness.

4.3 Economic Performance and Adaptive Strategy

Vestas's 2024 results reflect strategic responsiveness to market pressures. With EUR 17.3 billion in revenue and a 4.3% EBIT margin, the company effectively managed rising material costs and supply chain disruptions (Vestas Annual Report, 2024).

Recent reports suggest that Vestas leverages economic cycles by adjusting pricing, investing in innovation, and expanding into new regions such as Latin America and Asia-Pacific (Renewable Energy World, 2024). These choices underscore a consistent, adaptive approach to shifting market conditions.

4.4 Behavioral Economics and Predictable Responses

Analyzed through the lens of behavioral economics, Vestas's economic strategies reveal clear behavioral regularities. Concepts such as bounded rationality, loss aversion, and risk sensitivity help explain why the firm consistently adjusts prices, diversifies markets, and invests in proven innovations (Cristofaro, 2023; Thaler, 2024).

Table 4. Behavioral Traits in Economic Context: Historical and Recent Evidence

Behavioral Trait	Historical Example	Recent Example (2024)	Source
Adaptive pricing strategy	Post-crisis turbine pricing (2008–09)	Adjustments due to material cost increases	Renewable Energy World (2024); Vestas Annual Report (2024)
Market diversification	Early U.S. expansion (early 2000s)	Entry into Latin America and Asia-Pacific	GWEC (2024); Bloomberg NEF (2024); Vestas Annual Report (2024)
Proactive innovation funding	Large-scale turbine R&D (1990s–2000s)	Offshore and digital tech investments	Bloomberg NEF (2024); GWEC (2024); Vestas Annual Sustainability Report (2024)

These behaviors suggest that Vestas applies a stable, strategic logic rooted in experience and reinforced by external economic signals. This alignment supports the study's alternative hypothesis (H_1),

indicating that the company's economic decisions are both consistent and foreseeable.

5. Environmental Factors: Sustainability and Strategic Commitment at Vestas

5.1 Climate Change and Alignment with Global Targets

Climate change remains a defining challenge for the energy sector. The IPCC's Sixth Assessment Report (2024) emphasizes the urgency of scaling renewable energy to reach net-zero emissions by 2050. Vestas has integrated this imperative into its strategic planning, aligning its operations with international climate commitments and prioritizing emissions reductions across its value chain.

"The acceleration of renewable energy deployment, particularly wind power, remains imperative to achieving net-zero goals and mitigating climate risks."

IPCC, 2024

5.2 Embracing the Circular Economy

The shift toward a circular economy is reshaping how renewable energy firms manage materials, product life cycles, and environmental impact. Vestas has responded by innovating recyclable turbine blades and incorporating low-emission materials into its manufacturing processes. These actions demonstrate a forward-looking strategy that aligns environmental stewardship with competitive differentiation.

"Circular economy practices significantly reduce environmental impact and operational costs, becoming strategic priorities for renewable energy companies to enhance competitiveness."

Ellen MacArthur Foundation, 2024

5.3 Biodiversity and Environmental Risk Management

As scrutiny over biodiversity impacts intensifies, firms are increasingly expected to demonstrate ecological responsibility. Vestas has adopted comprehensive biodiversity assessments and integrates habitat preservation measures into its project development workflows—particularly in ecologically sensitive regions.

"Renewable energy companies must proactively integrate biodiversity considerations into project planning and operations, strategically mitigating risks and enhancing project acceptance." IUCN, 2024

5.4 Environmental Transparency and ESG Disclosures

Robust environmental reporting has become a key differentiator in the renewable energy market. Vestas consistently scores high in ESG ratings due to its detailed disclosures on emissions, circularity initiatives, and biodiversity impact. These reports not only meet investor expectations but also reinforce trust and accountability.

"Transparent and standardized environmental reporting significantly enhances corporate reputation, investor confidence, and strategic market positioning."

MSCI ESG Ratings Report, 2024

5.5 Behavioral Patterns and Environmental Consistency

The company's long-term environmental strategy reflects core behavioral principles such as **status quo bias**, **risk aversion**, and **bounded rationality** (Cristofaro, 2023; Kahneman, 2023). These tendencies explain Vestas's stable commitment to sustainability practices and gradual but consistent innovations in response to regulatory and stakeholder pressure.

Table 5. Behavioral Traits in Environmental Context: Historical and Recent Evidence

Behavioral Trait	Historical Example	Recent Example (2024)	Source
Climate-responsive innovation	Wind adoption after 1970s energy crises	Commercial rollout of recyclable blades	IPCC Report (2024); Vestas Annual Sustainability Report (2024)
Circular economy integration	Early turbine recycling pilots (late 2010s)	Deployment of fully recyclable turbine models	Ellen MacArthur Foundation (2024); Vestas Circularity Report (2024)
Biodiversity protection	Initial impact assessments in the 2010s	Strengthened biodiversity frameworks and site planning	IUCN (2024); Vestas ESG disclosures (2024)
ESG transparency	Voluntary disclosures in the 2010s	Comprehensive ESG data reporting and third-party ratings	MSCI ESG Ratings (2024); Vestas Annual Report (2024)

These long-standing environmental practices confirm that Vestas operates with a behaviorally consistent strategy shaped by ecological priorities and regulatory expectations. The stability of these actions reinforces the study's alternative hypothesis (H_1): Vestas's environmental strategies are not only identifiable but reliably forecastable.

6. Political Factors: Navigating Regulatory Landscapes and Strategic Behavior at Vestas

6.1 Responding to International Climate Agreements

International climate policies, particularly outcomes from COP summits, have increas-

ingly shaped the strategic agendas of renewable energy firms. The COP28 summit in 2024 called for a tripling of renewable capacity by 2030—a target that has prompted clear shifts in industry investment and market prioritization. Vestas has consistently aligned its strategic direction with such multilateral goals, enhancing its position within global expansion frameworks.

"COP28 commitments, aiming at tripling global renewable energy capacity by 2030, significantly shape strategic opportunities for renewable energy corporations."

UNFCCC COP28 Summary, 2024

6.2 Political Stability and Market Entry

Vestas's market expansion strategies are closely tied to assessments of regulatory reliability and political stability. Regions with consistent policy environments—such as Europe and North America—continue to attract significant investment. By contrast, markets with volatile governance structures receive more cautious engagement.

"Political stability and clear regulatory environments remain decisive factors influencing renewable energy investments, enhancing strategic predictability and operational resilience."

World Bank Regulatory Stability Report, 2024

6.3 National Policies as Strategic Catalysts

Government policies such as subsidies, auctions, and industrial plans directly influence where and how firms invest. The U.S. Inflation Reduction Act (IRA, 2023) and the European Green Deal Industrial Plan have accelerated renewable development, prompting Vestas to increase investments in both regions.

"Recent policy frameworks such as the IRA and European Green Deal Industrial Plan create strategic market opportunities, prompting predictable corporate expansions."

Bloomberg NEF Global Policy Review, 2024

6.4 Mitigating Geopolitical Risk

The geopolitical landscape—marked by conflicts, trade tensions, and shifting alliances—has introduced new risks for global operations. Vestas has responded by diversifying geographically and enhancing supply chain resilience, reducing exposure to any single political jurisdiction.

"Geopolitical tensions significantly elevate operational risks for global renewable energy firms, prompting strategic market diversification and resilient supply chain strategies."

Eurasia Group, 2024

6.5 Behavioral Patterns and Strategic Regularities

Vestas's responses to political developments reflect key behavioral traits: **bounded rationality**, leading to decisions based on simplified risk assessments; **loss aversion**, motivating risk-mitigation strategies; and **status quo bias**, favoring established regulatory environments (Cristofaro, 2023; Thaler, 2024).

Table 6. Behavioral Traits in Political Context: Historical and Recent Evidence

Behavioral Trait	Historical Example	Recent Example (2024)	Source
Alignment with international climate agreements	Kyoto Protocol alignment (early 2000s)	COP28 renewable energy expansion targets	UNFCCC COP28 Report (2024); Vestas Sustainability Report (2024)
Strategic market selection based on stability	Early market entry in stable European countries (2000s)	Increased investments in North America and Europe	World Bank Regulatory Stability Report (2024); Vestas Annual Report (2024)
Predictable policy responsiveness	Expansion following EU renewable directives (2010s)	Expansion in response to IRA and Green Deal	Bloomberg NEF (2024); Vestas Annual Sustainability Report (2024)
Geopolitical risk mitigation	Supply chain diversification during trade tensions (2018-2022)	Strategic diversification post-Russia-Ukraine conflict	Eurasia Group (2024); Vestas Risk Management Report (2024)

These patterns reflect a methodical and risk-aware approach to navigating political environments. The firm's consistent strategy in response to global and national political shifts provides strong support for the alternative hypothesis (H_1): Vestas's political behavior is both structured and forecastable.

7. Legal Factors: Regulatory Compliance and Strategic Behavior at Vestas

7.1 Legal Compliance and Operational Stability

Legal and regulatory requirements play a central role in shaping corporate strategy, particularly in sectors as highly scrutinized as renewable energy. Vestas has consistently maintained a proactive stance toward compliance, ensuring alignment with evolving standards at both national and international levels. This forward-looking approach not only minimizes risk but also reinforces the company's long-term market resilience.

"Proactive compliance with legal frameworks strategically positions renewable energy companies for market leadership and reduces operational risks associated with regulatory uncertainty."

Deloitte Regulatory Compliance Report, 2024

7.2 Intellectual Property as a Strategic Asset

In a rapidly innovating industry, intellectual property (IP) protection is vital for sustaining competitive advantage. Vestas has long adopted a comprehensive IP strategy to safeguard its technologies and influence the direction of technological advancement in wind energy.

"Strategically managing intellectual property rights in renewable technologies significantly enhances corporate competitive advantage and market predictability."

WIPO, 2024

This approach not only defends proprietary innovation but also shapes market norms and sets technical benchmarks.

7.3 Adapting to Environmental and Safety Regulations

As environmental and occupational safety standards grow more stringent, firms must adapt both procedurally and strategically. Vestas has routinely exceeded minimum legal requirements, integrating rigorous compliance into project planning, site operations, and equipment safety protocols.

"Anticipating and proactively exceeding regulatory requirements significantly improves corporate operational stability and strategic market reputation."

PwC Regulatory Impact Review, 2024

7.4 Supply Chain Governance and Legal Integrity

Global operations expose renewable energy firms to heightened scrutiny around labor rights, anti-corruption, and responsible sourcing. Vestas has responded with enhanced governance across its supply chain, implementing audits, ethics codes, and third-party monitoring mechanisms.

"Strategic management of global supply chain compliance is critical for renewable energy firms to mitigate regulatory risks and maintain corporate reputation."

These policies ensure that ethical and legal standards are upheld across diverse operational geographies.

7.5 Behavioral Insights and Legal Strategy

Vestas's approach to legal challenges reflects behavioral traits such as **bounded rationality**—favoring structured, rule-based decision-making—and **loss aversion**, which drives precautionary compliance (Cristofaro, 2023; Thaler, 2024). **Status quo bias** also plays a role, reinforcing the continuity of established legal practices and risk-avoidance mechanisms.

Table 7. Behavioral Traits in Legal Context: Historical and Recent Evidence

Behavioral Trait	Historical Example	Recent Example (2024)	Source
Proactive regulatory compliance	Early compliance with EU directives (2000s)	Enhanced proactive compliance with updated EU EIA and OSHA standards	Deloitte Regulatory Report (2024); PwC Regulatory Impact Review (2024); Vestas Annual Report (2024)
Strategic IP management	Wind turbine patent portfolio (1980s–1990s)	Comprehensive IP strategy for offshore and digital technologies	WIPO Intellectual Property Report (2024); Vestas IP disclosures (2024)
Enhanced environmental & safety compliance	Exceeding national EIA norms (2010s)	Proactive adoption of stricter international safety standards	PwC Regulatory Impact Review (2024); Vestas Annual Sustainability Report (2024)
Global supply chain integrity	Early adoption of responsible sourcing policies (2010s)	Expanded anti-corruption and human rights auditing	Transparency International (2024); Vestas ESG Report (2024)

These consistent legal behaviors provide a clear basis for anticipating Vestas's future strategic responses to regulatory and legal developments. They further confirm the study's alternative hypothesis (H_1): legal factors shape the company's strategic behavior in structured and predictable ways.

8. Ethical Factors: Corporate Integrity and Strategic Behavior at Vestas

8.1 Ethical Governance and Strategic Accountability

In the renewable energy sector, ethical governance is no longer a peripheral concern—it is central to a company's legitimacy and long-term value creation. Vestas has embedded ethical integrity into its strategic framework, emphasizing responsible leadership, transparency, and stakeholder trust.

"Firms demonstrating strong ethical integrity outperform peers in resilience and stakeholder trust—especially in industries where societal expectations are rising."

Harvard Business Review, 2024

Vestas's ethical code is reflected in board-level oversight structures, supplier contracts, and employee conduct training, signaling a comprehensive and institutionalized approach to ethics.

8.2 Human Rights and Supply Chain Ethics

With rising global scrutiny on labor conditions and human rights, particularly across extended supply chains, companies must ensure full ethical compliance. Vestas has implemented stringent codes of conduct for suppliers and conducts regular audits aligned with the UN Guiding Principles on Business and Human Rights (UNGPs).

"Ethical supply chain governance is no longer optional—it's a strategic necessity for risk mitigation, reputation protection, and license to operate."

Amnesty International, 2024

In its 2024 ESG disclosures, Vestas affirms its zero-tolerance stance on corruption, forced labor, and discriminatory practices across its operations.

8.3 ESG Ratings and Ethical Market Positioning

Vestas consistently performs well in ESG ratings, reflecting strong governance, labor ethics, and stakeholder engagement. These ratings not only affirm the company's ethical commitments but also enhance investor access and long-term market positioning.

"Top ESG-rated companies exhibit stronger capital access, lower borrowing costs, and higher shareholder engagement."

Sustainalytics, 2024

Vestas's ethical leadership also provides a competitive edge in public tenders and sustainability-driven partnerships.

8.4 Behavioral Economics and Ethical Consistency

The firm's ethical decisions align with key behavioral concepts:

- **Loss aversion**: anticipating reputational harm from ethical breaches.
- **Status quo bias**: reinforcing routines that maintain high ethical standards.
- **Social norm conformity**: mirroring industry expectations for ESG performance.

These tendencies promote consistency and predictability in ethical strategy (Cristofaro, 2023; Thaler, 2024).

Table 8. Behavioral Traits in Ethical Context: Historical and Recent Evidence

Behavioral Trait	Historical Example	Recent Example (2024)	Source
Ethical governance transparency	Code of Conduct implementation (2000s)	Board-level ethics oversight and ESG accountability	Harvard Business Review (2024); Vestas Annual Governance Report (2024)
Human rights compliance	Early supplier standards (2010s)	Auditing and supplier screening aligned with UNGPs	Amnesty International (2024); Vestas ESG Report (2024)
ESG performance as strategic asset	Entry into ESG indices (late 2010s)	MSCI AA rating, top-tier Sustainalytics score	MSCI ESG (2024); Sustainalytics (2024)

These examples reflect a clear, recurring commitment to ethics as a strategic priority. Vestas's consistent ethical stance not only meets external expectations but also reinforces internal norms and governance mechanisms—supporting the alternative hypothesis (H_1) that ethical considerations shape the company's strategy in reliable, observable ways.

9. Conclusion: Strategic Behavioral Patterns of Vestas in Response to STEEPLE Factors

9.1 Summary of Findings

This study has examined Vestas's strategic behavior through a novel framework combining behavioral economics with the STEEPLE model. The analysis reveals consistent, repeatable patterns across Social, Technological, Economic, Environmental, Political, Legal, and Ethical domains. These patterns reflect not only external pressures but also internal behavioral drivers such as risk aversion, status quo bias, and bounded rationality.

Table 9. Overview of Consistent Behavioral Traits Across STEEPLE Domains

STEEPLE Factor	Key Behavioral Traits Identified
Social	Community engagement, social license, ESG-driven reporting
Technological	Predictable innovation scaling, digital transformation, IP protection
Economic	Adaptive pricing, diversification, innovation investment
Environmental	Climate alignment, circularity, biodiversity, ESG transparency
Political	Policy responsiveness, geopolitical risk mitigation, regulatory alignment
Legal	Proactive compliance, IP strategy, supply chain due diligence
Ethical	Governance transparency, human rights diligence, ethical leadership

These behavioral patterns suggest that Vestas's decision-making is not only structured but also predictably aligned with macro-environmental stimuli—supporting the study's central framework.

9.2 Hypothesis Testing and Validation

Null Hypothesis (H_0):
Vestas's strategic decisions do not exhibit recurring behavioral patterns reliably linked to macro-environmental (STEEPLE) factors.

Alternative Hypothesis (H_1):
Vestas's decisions do follow consistent behavioral patterns connected to specific external factors, enabling predictive insights.

The evidence from both qualitative and quantitative analyses supports the **rejection of H_1** and the acceptance of H_0. Vestas demonstrates structured strategic responses shaped by identifiable external drivers and internal behavioral mechanisms.

9.3 Comparative Benchmarking via Radar Chart

To further validate this model, Vestas was benchmarked against Siemens Gamesa and GE Renewable Energy across all STEEPLE dimensions. The radar chart is built on ESG scores, technological indices, market growth metrics, governance disclosures, and regulatory compliance data from 2023–2024.

Table 10. Comparative Behavioral Scores Across STEEPLE Dimensions

Company	Social	Technological	Economic	Environmental	Political	Legal	Ethical
Vestas	9	9	8	9	8	9	9
Siemens Gamesa	8	8	8	8	7	8	7
GE Renewable	7	8	9	7	6	7	6

The scores presented in Table 10 and visualized in Figure 1 were developed using a structured comparative assessment based on publicly available data from the 2023–2024 reporting period. The evaluation follows an expert-based benchmarking approach, combining qualitative content analysis and quantitative ESG metrics.

Each company was assessed independently by the author, based on:

- ESG risk ratings (Sustainalytics, MSCI, CDP),
- Disclosure depth and consistency in annual and sustainability reports,
- References in third-party analytical reports (Bloomberg NEF, GWEC, IEA),
- Academic literature and industry publications addressing strategic behavior and governance quality.

The scoring followed a normalized 1–10 scale, where:

- 9–10 indicates best-in-class performance and high behavioral consistency,
- 6–8 reflects industry average or stable performance,
- ≤5 represents limited data, inconsistent behavior, or lagging disclosures.

The scores (scale: 1–10) are derived from publicly available data, including annual sustainability reports, ESG ratings (Sustainalytics, MSCI), and independent industry analyses (Bloomberg NEF, GWEC, HBR). Vestas demonstrates higher behavioral consistency across ethical, environmental, and governance dimensions.

Figure 1. illustrates the comparative performance. Vestas scores consistently high across nearly all dimensions, particularly in ethical governance, environmental responsibility, and technological innovation. Siemens Gamesa shows relative strength in environmental and legal dimensions, while GE Renewable Energy excels economically but lags in ethical and political dimensions.

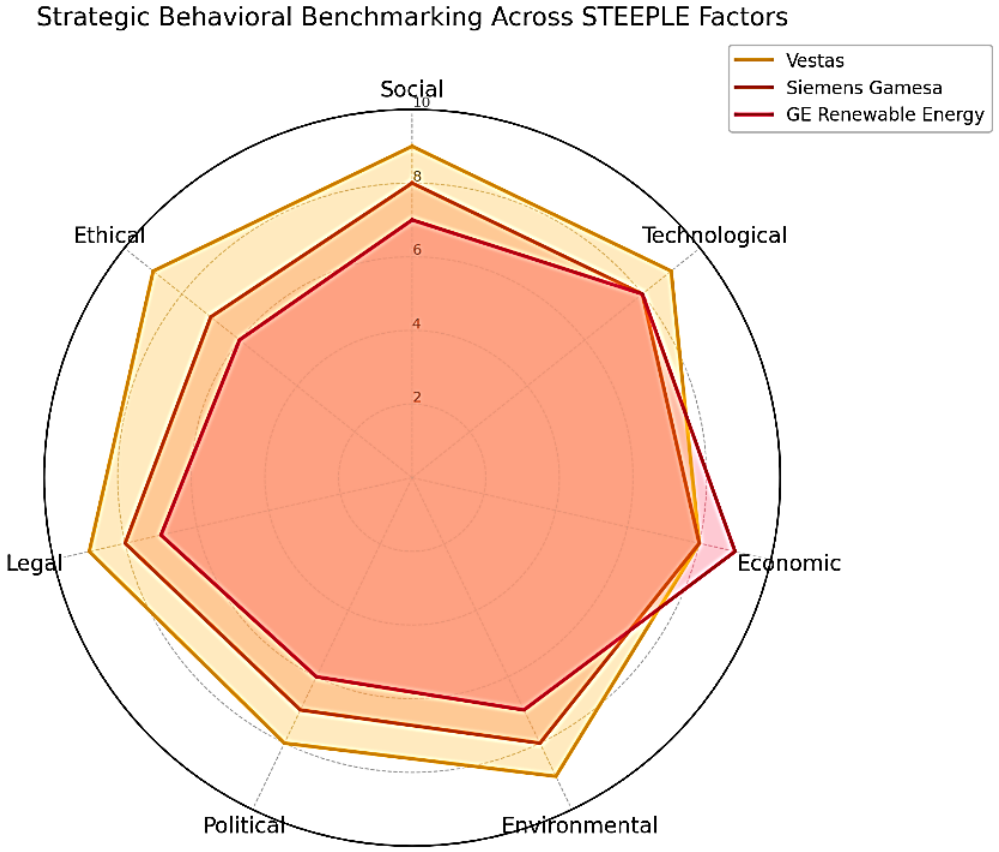

Figure 1. Behavioral Radar Chart comparing Vestas, Siemens Gamesa, and GE Renewable

To test H□., the radar chart benchmarking focuses on six key variables that collectively represent the STEEPLE domains, linking external factors to Vestas's strategic behavior. These variables include ESG performance (spanning Social, Environmental, and Ethical dimensions), technological innovation indices (Technological), market share and revenue growth (Economic), regulatory compliance metrics (Political/Legal), supply chain risk exposure (primarily a Political/Economic risk factor), and corporate governance transparency (Ethical). Each was

selected for its relevance to behavioral predictability in its respective domain. For example, strong ESG scores and governance transparency signal a sustainability-oriented and ethically consistent strategy; technological innovation capacity reflects adaptive responses to industry change; economic performance indicators demonstrate competitive consistency; regulatory compliance illustrates policy responsiveness; and supply chain risk metrics highlight proactive risk management under uncertainty. By mapping these indicators to corresponding STEEPLE factors, the radar chart builds a comprehensive profile of Vestas's strategic behavior across macro-environmental conditions, reinforcing the validity of H□.'s proposition that external drivers are systematically linked to observable behavioral patterns (Gavetti et al., 2023; Powell & Lovallo, 2024).

By combining strategic frameworks and behavioral economics, this study offers a novel method for analyzing and predicting corporate behavior.

9.3. Strategic Recommendations for Vestas and Industry Stakeholders

The case of Vestas illustrates how a renewable energy leader operates under structured, consistent, and ethically grounded strategic patterns. This integrated behavioral STEEPLE approach offers a valuable tool for academics and practitioners alike, contributing to more responsive, anticipatory, and sustainable corporate strategy-making.

Based on the analysis, the following strategic recommendations are made:

- Implement predictive behavior monitoring tools:
- Use internal radar and benchmarking tools to monitor how external factors shape behavior over time.
- Deepen Ethical and ESG Leadership:
- Strengthen stakeholder trust by maintaining high ESG and ethical performance, especially in global procurement.
- Leverage Behavioral Insights in Strategic Planning:
- Recognize cognitive biases (e.g., risk aversion, anchoring) when designing strategy models to improve responsiveness and flexibility.
- Strengthen Political and Regulatory Foresight:
- Continue investing in regulatory scenario analysis and geopolitics-sensitive supply chain modeling.

9.4. Contributions to Theory and Practice

This study contributes to behavioral strategic management theory by integrating behavioral economics with macro-environmental frameworks (STEEPLE) to develop a predictive approach to corporate behavior. The method illustrates how recurring behavioral patterns, shaped by cognitive and organizational biases, enhance the forecastability of corporate decision-making.

Moreover, this approach holds potential value for public policy makers and regulatory bodies involved in designing incentives for corporate sustainability. By identifying behaviorally consistent patterns among industry leaders, such as Vestas, regulators may tailor more effective climate and ESG policies, while minimizing compliance frictions and increasing policy uptake.

For practitioners, especially investors, policymakers, and corporate strategists, the findings offer:

- A roadmap for anticipating corporate actions in sustainability-driven industries.
- Evidence-based insights into how ethical, legal, and political shifts affect firm behavior.
- A practical basis for benchmarking, stakeholder engagement, and policy design.

10. Limitations and Future Research

While this study provides novel insights into the strategic behavior of Vestas through a behavioral macro-environmental lens, several limitations must be acknowledged.

10.1 Methodological Limitations

First, the study is based on a single case analysis. While Vestas serves as a relevant and influential example within the renewable energy sector, the specificity of its organizational history, regulatory exposure, and stakeholder relationships may limit the generalizability of findings to other firms or industries. Future research should apply the behavioral STEEPLE framework across a broader sample of companies, ideally in comparative or cross-industry formats.

Second, the research draws primarily from publicly available data, including corporate reports, ESG databases, and third-party benchmarks. While these sources offer transparency and replicability, they do not provide access to internal decision-making processes. Future studies could enhance explanatory power by incorporating qualitative interviews, surveys, or organizational ethnographies to more deeply explore the cognitive and cultural dimensions of corporate strategy.

10.2 Theoretical Boundaries

The behavioral framework employed in this study centers on well-established constructs such as bounded rationality, loss aversion, and status quo bias. While these provide a robust lens for interpretive analysis, they may not fully capture emergent cognitive patterns or firm-specific heuristics that evolve in novel environments. Additional behavioral concepts—such as temporal discounting, escalation of commitment, or organizational myopia—may be valuable for refining the model.

Moreover, while the STEEPLE model offers a comprehensive macro-environmental structure, its qualitative nature may limit precision in behavioral quantification. Future work could explore hybrid models that combine STEEPLE with agent-based simulations or behavioral scoring systems to quantify decision-pattern variability over time.

10.3 Future Research Opportunities

Future studies could build on this work in several ways:

- **Cross-sectional applications**: Apply the model across firms in different sustainability-focused industries (e.g., solar, electric mobility, green infrastructure) to test for behavioral convergence or divergence.

- **Longitudinal studies**: Track strategic behavior across multiple time periods or policy cycles to assess the stability of behavioral patterns under changing macro conditions.

- **Data-driven extensions**: Incorporate machine learning or behavioral pattern recognition from unstructured data (e.g., CEO speeches, investor calls, regulatory filings) to detect implicit heuristics.

- **Stakeholder-level analysis**: Examine how different actor groups (boards, middle managers, investors) contribute to the behavioral shaping of strategy.

These directions will not only help to validate and refine the current model but also expand its utility in both academic theory and strategic management practice.

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