

Exploring the Green Transition: An Analysis Using QDA Miner on Annual Sustainability Reports

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Abstract. *This paper explores the fair-green transition by analyzing sustainable business practices narratives expounded by corporate professionals within the framework of major industrial corporations. Using QDA Miner software, a qualitative analysis was conducted on the annual sustainability reports of the 15 largest industrial companies globally, which are listed on stock exchanges in the United States. The analysis aimed to identify intriguing interconnections between categories by examining code frequencies, co-occurrences, and proximity, focusing on “Sustainability and Environment,” “Innovation and Energy,” and “Social Responsibility and Governance.” Results show a high frequency of entries related to “Climate” codes, as well as “Waste” and “Sustainability.” Cluster analysis highlights the significance of integrated resource management by identifying a strong association between the “Waste” and “Water” codes, emphasizing their increasingly important role in sustainable practices and the efficient use of resources. The study further illustrates the delicate balance required to integrate social and environmental responsibilities, especially in addressing “Community Development” and “Biodiversity.” This study outlines the importance of balancing environmental, economic, and social objectives in corporate sustainability efforts. As such, businesses must adopt sustainable practices to ensure long-term growth while minimizing adverse environmental impact, fostering innovation, and strengthening their social responsibility commitments.*

Keywords: fair green transition, sustainability and environment, innovation and energy, social responsibility and governance.

Introduction

Companies can now affirmatively link their actions to sustainable and reasonable environmental management objectives through a fair green transition. Rooted in principles such as the International Labor Organization guidelines and reinforced by commitments in international accords such as the Paris Agreement, the fair green transition seeks to make positive changes regarding climate and the environment without compromising the welfare of workers or vulnerable groups (Ghaleigh, 2019). As companies navigate the challenges of transitioning to a climate-conscious economy, social justice must be included in green plans to ensure a fair distribution of rewards.

Despite recent progress in incorporating sustainability into company operations, several obstacles remain, including insufficient funding and regulations surrounding such a strategy, as well as apprehension about implementing green practices initiatives (Clarke & Lipsig-Mummé, 2020; Merino-Saum et al., 2020). However, studies have shown that firms willing to integrate social justice with environmental sustainability are likely to be at the forefront of an emerging market and gain a competitive edge (Ağan, 2024; Hyldmo et al., 2024). Researchers note that in

the evolving green economy, competitiveness can come from corporate inclusivity, stakeholder engagement, and responsible governance, which enhance a company's resilience and reputation.

This paper presents a qualitative analysis of annual sustainability reports from the 15 largest industrial firms listed on U.S. stock exchanges, focusing on reports published in 2023 and 2024. The study examines the extent to which these companies incorporate the concept of a just green transition into their business strategies, pinpointing patterns of fairness, equity, and environmental responsibility within their sustainability disclosures. The relationships between the key categories are analyzed using QDA Miner software. The results illustrate how companies have prioritized Fair Green Transition Principles (as outlined above) through technological development and financial tools while addressing social justice concerns through inclusive business practices.

The study presents a mixed-method content analysis, including frequency, co-occurrence, and proximity analysis of textual sources, and is structured into four sections. The theoretical background provides an overview of relevant academic discussions and contains a section detailing the research methodology. The main findings are then examined considering their implications. Lastly, the conclusion presents current limitations and recommendations for future research.

Theoretical background

A fair green transition has emerged as a critical framework for ensuring social equity and worker welfare in the pursuit of sustainability and climate goals. In this context, businesses must align their strategic and operational practices with environmental imperatives and social justice. Institutional guidelines, such as those proposed by the International Labor Organization and commitments embedded in accords like the Paris Agreement, pose significant challenges in corporations' efforts to integrate innovation, resource efficiency, and stakeholder inclusiveness into their operations, thereby driving progress toward a greener economy that is also equitable and inclusive.

The green transition offers strong signals for corporate strategy and operational practices. Businesses can foster this transition through innovation, resource efficiency, and social influence. Institutional frameworks serve as governance structures, allowing for alignment between corporate strategies and sustainability objectives. According to Lamperti et al. (2019), a mission-driven, state-led model presents the financial and institutional resources needed to facilitate a green transition. For corporations, this means embedding public policy strategies into business strategies, such as co-funding schemes and compliance with sustainability regulations. Creti and Ftiti (2024) highlight the impact of the European Green Deal on the corporate sustainability agenda. This alignment helps businesses prepare for regulatory changes by reducing internal compliance risks and increasing their competitiveness. Hence, it allows corporations to lead in green innovation, positioning them at the forefront of their industry.

Ağan (2024) introduced a new measure for Research and Development in renewable energy and green infrastructure, confirming a positive correlation with economic outcomes while reducing environmental impacts. Such efforts can reduce CO₂ emissions and drive sustainability while promoting continued growth. Corporations in industries with high energy consumption, such as manufacturing, may focus on energy-saving processes and cleaner production methods. Liao et al. (2023) underlines that the transition to renewable energy immediately reduces ecological footprints. This observation urges businesses to integrate renewable energy systems, optimize their supply chains, and develop environmentally friendly products. Javed et al. (2024) note that government subsidies and tax credits have played a crucial role in stimulating corporate investment in green technologies and advancing the fight against ecological crises. In their study, "Do green technology innovation, environmental policy, and the transition to renewable energy matter in

times of ecological crises? A step towards ecological sustainability,” targeted funding mechanisms are claimed to be crucial to promoting sustainable innovation. The study concludes that such policy-driven initiatives are not only contributing to green innovation and reducing ecological footprints but also aligning corporate strategy with global sustainability goals. This reveals how government subsidies and tax incentives for corporate investments in green technologies support sustainable innovation.

The fair green transition must be equitable, as corporate strategies must address social justice concerns. Cedergren et al. (2022) propose inclusive workforce transition programs, including updating initiatives for individuals impacted by automation or transitioning away from carbon-intensive sectors. These programs can aid inequity while boosting corporate reputation and employee loyalty.

Multinational corporations experience unique challenges and opportunities in every region. Hyldmo et al. (2024) challenge businesses to reform their supply chains to adhere to the principles of global justice, such as responsible sourcing of materials and the implementation of ethical labor practices. This EU initiative serves as an inspirational model for replicable green business models and a commitment to sustainability governance. Creti and Fiti (2024) emphasize the importance of sustainability efforts and encourage corporations to collaborate with corresponding communities (institutional stakeholders, labor, political society, and social groups affected by the green transition) to develop solutions. A partnership pillared by local-level governance, investor-backed venture capital, and corporate strategy strengthens equity in social capital structures. Furthermore, it enhances governance quality and government-led venture capital initiatives, all of which help align corporate strategy with sustainable energy transitions and equitable economic reforms. However, equitable benefit-sharing mechanisms can reduce the local environmental and economic consequences of operations, particularly in the extractive sectors.

In this context, transparency in the reporting of financial performance and sustainability objectives is imperative. Esterhuyse (2019) argues that effective sustainability reporting practices boost corporate reputation and investor relations. Karreman et al. (2014) note that annual reports, aligning narratives, and quantitative disclosures are instrumental in shaping investor perceptions. Longitudinal analyses of reporting practices, such as those by Cooper and Slack (2015), illustrate how corporate strategies and performance metrics offer insights into how firms address sustainability challenges.

Tools for qualitative data analysis have become mandatory in business reporting, especially for sustainability disclosures. Bryda and Costa (2023) discussed how tools like NVivo and ATLAS.ti facilitate the organized and reliable analysis of large datasets. By highlighting relevant topics and matching disclosures with stakeholder expectations, these technologies improve the dependability of corporate communication. Mayring (2000) explains that a conceptual coding framework is needed to extract actionable insights from qualitative codes. Cuva (2015) further suggests that methodological rigor is paramount for employing qualitative data analysis tools. Notwithstanding their challenges, using these elements enables researchers to conduct robust analyses that enhance transparency in corporate reporting.

By establishing solid institutional frameworks and embracing technological innovation, principles of social justice, and transparency, corporations will be well-equipped to effectively undergo the fair green transition. The present study bridges a significant gap in the existing body of research, addressing how corporate narratives illustrate a fair green transition from the perspectives of sustainability and environment, innovation and energy, and social responsibility and governance, as well as how these dimensions correlate. Compared to previous research, this

study highlights the impact of inclusion on the fair green transition by analyzing the annual sustainability reports of major industrial corporations, promising new insights into the linkages between sustainable practices, innovation, and strategic objectives.

Methodology

Research Design and Methodological Approach

This research analyzed 15 sustainability reports from leading companies using Provalis Research's QDA Miner 6.01.11, an advanced qualitative data analysis software. These top companies influence industry standards, shape sustainability policies, and drive industry-level transformation. The purposive sampling technique was used to obtain standardized data from large companies with comprehensive and comparable sustainability reports that are transparent about their environmental impact, governance quality, and socially responsible behavior, making them ideal case studies for sustainable business. The small pool of qualified firms reporting on corporate sustainability efforts offers a wealth of data about their potential to minimize environmental damage, manage governance risk, and promote social equity use cases.

The QDA Miner tool supports various document formats, including PDF and MS Word, and provides advanced features for frequency and statistical analysis. For these reasons, it is well-suited for mixed methods of research. As Silver (2014) points out, QDA Miner offers an intuitive interface, enabling both novice and experienced researchers to manage data, perform analyses, and generate visualizations effectively, making it a valuable tool for qualitative data analysis.

The selected companies span multiple sectors, including technology, pharmaceuticals, financial services, retail, and energy. Market capitalization ranged from \$499.15 billion to \$3.67 trillion, with an average of \$1.78 trillion. Most companies are listed on NASDAQ or the New York Stock Exchange (NYSE) and are headquartered in the United States. Scrutinizing their sustainability reports led to a new understanding of how major corporations integrate sustainability into their strategies and operations. Table 1 provides an overview of the companies included in the study. Berkshire Hathaway has been excluded from this analysis as it does not publish a sustainability report. As a holding company, its conglomerate includes over 80 subsidiary companies, each with independent sustainability efforts.

Table 1. Sample Companies

Company Name	TRBC Industry Name	Market Capitalization 2024 (USD billion)
Apple	Technology	3,67
NVIDIA	Technology	3,488
Microsoft	Technology	3,297
Amazon	E-commerce & Cloud Computing	2,387
Alphabet (Google)	Technology	2,148
Meta Platforms (Facebook)	Technology & Social Media	1,574
Tesla	Electric Vehicles & Energy	1,249
Broadcom	Semiconductors & Hardware	838.50
Walmart	Retail	769.26
Eli Lilly	Pharmaceuticals	743.47

Company Name	TRBC Industry Name	Market Capitalization 2024 (USD billion)
JPMorgan Chase	Financial Services	696.40
Visa	Financial Technology	601.85
Oracle	Technology & Cloud Services	531.18
UnitedHealth	Health Insurance	505.80
Exxon Mobil	Oil & Gas	499.15

Source: CompaniesMarketCap.com, 2024.

Data Coding Methodology and Analytical Techniques

In line with the research objective and based on the content of the annual sustainability reports, three major categories were identified: “Sustainability and Environment,” “Innovation and Energy,” and “Social Responsibility and Governance.” These categories embody key components of a just green transition, which not only upholds environmental protection but also integrates social responsibility and technological innovation to ensure equity and long-term sustainability. They reflect priorities in economic and regulatory contexts, such as the Corporate Sustainability Reporting Directive and the European Union Taxonomy Framework, which require companies to disclose their environmental and social impacts. These categories are becoming more prevalent in corporate sustainability reporting, emphasizing their role in long-term success and resilience. Each theme was assigned to a specific code throughout the reports, totaling 11 codes, as shown in Table 2.

The keywords for each category are motivated by their immediate correlation with the Fair Green Transition principles and their potential to capture significant aspects associated with sustainability, innovation, energy, social responsibility, and governance. For the “Sustainability and Environment” category, terms such as “climate goals,” “carbon-free electricity,” and “biodiversity protection” reflect the primary environmental issues in the reports, namely climate action, carbon reduction, and biodiversity preservation. Similarly, “waste management” and “water consumption” represent environmental practices related to resource use and waste reduction. As far as the “Innovation and Energy” category is concerned, structures like “renewable energy,” “energy conservation,” and “technological advancements” indicate the ongoing shift towards adopting clean energy and innovative solutions. For the “Social Responsibility and Governance” category, the frequent use of “community development,” “social equity,” and “transparency” implies accountability for social empowerment, ethical governance, and corporate legitimacy.

The coding process was performed at paragraph level, with the software identifying relevant sections based on the coded terms. The content was manually verified to achieve the highest result accuracy. Both coding sessions were conducted collaboratively, with findings compared and differences reviewed in joint sessions. Final coding decisions were reached in a concluding session with both authors.

Table 2. Categories, Codes, and Words Searched in Documents

Categories and Codes	Words Searched
<i>Fair Green Transition: Sustainability and Environment</i>	
Climate	Climate goals, climate progress, climate crisis, climate solutions, climate justice, climate-conscious
Carbon	Carbon-free electricity, carbon reduction, carbon removal, carbon negative
Biodiversity	Improving biodiversity, protecting biodiversity, development biodiversity

Categories and Codes	Words Searched
Waste Management	Zero waste, waste management, packaging waste
Water	Water access, water consumption
Sustainability	Sustainable future, sustainable living, sustainability, sustainable
<i>Fair Green Transition: Innovation and Energy</i>	
Energy	Renewable energy, energy transition, clean energy, energy conservation, energy storage
Innovation	Innovation, technological advancements, research and development, innovative solutions
<i>Fair Green Transition: Social Responsibility and Governance</i>	
Community Development	Community development, social equity, community empowerment, local development, community engagement
Partnerships	Partnerships, strategic collaborations, cross-sector partnerships, joint ventures, corporate partnerships
Transparency	Transparency, reporting, open governance, accountability, disclosure

Source: Authors' own research.

The codes were analyzed based on the frequency with which they were mentioned individually in the reports, how often they appeared in combination, and the degree of similarity. The similarity between codes was assessed through co-occurrence, which refers to the situation where two codes appear together within the same paragraphs.

The annual sustainability reports of companies listed in the United States follow a formal structure and standardization, creating a uniform and clear presentation of information. Therefore, potential parallel coding could yield similar code lists. The final code list was generated by reviewing the keywords identified by QDA Miner, a measure that prevented the occurrence of irrelevant terms or phrases for this study.

Results and Discussions

Analysis of Codes' Frequencies

Figure 1 shows the distribution of codes in total codes (left) and in total number of cases (right). Detailed statistics for codes can be obtained from the authors. The codes are classified into three categories: "Social Responsibility and Governance," "Energy and Innovation," and "Sustainability and Environment." With significant variations in the frequency and distribution of codes, each category represents the focus and goals of the entities under analysis toward important strategic issues. The organizational focus on environmental issues is evidenced by the significant input of the codes in the "Sustainability and Environment" area. The most common code, "Climate," is present in 93.3% of instances and occurs 2,340 times, representing 27.5% of all codes. This shows the importance of climate-related concerns. The codes "Waste" (19%) and "Sustainability" (17.7%) are also often used, with the latter notably present in all cases, indicating its universal applicability across reports. In contrast, codes such as "Carbon" (0.2%) and "Biodiversity" (0.0%) exhibit low representation, indicating that these environmental domains are neglected.

With 1,378 counts, or 16.2% of all codes and 93.3% of observations, the "Energy" code is the most prevalent in the "Energy and Innovation" category. This suggests that energy-related subjects receive substantial interest, consistent with the worldwide trend toward sustainable energy practices and efficiency. On the other hand, "Innovation" occurs in only 86.7% of cases, with 155 counts (1.8%), indicating a low level of attention to technical development and creative approaches.

Compared to the other two categories, the “Social Responsibility and Governance” category has a lower overall presence. With 463 counts (5.4%) and a presence in 86.7% of instances, “Transparency” is the most prevalent code, highlighting its significance in promoting accountability and trust. On the other hand, “Community Development” is mentioned only 22 times (0.3%) and in 53.3% of cases, indicating a comparatively low level of attention to larger social projects. With 101 counts (1.2%), “Partnerships” remains underrepresented despite its potential to improve cooperation and accomplish sustainable objectives.

Sustainability and environment-related codes are the most common among the three categories, with an average of 27.5%. Energy and innovation-related codes come in second with 16.2%, whereas social responsibility and governance-related codes follow in third with 5.4%. Organizations prioritize environmental resilience and sustainable development in their strategies, as seen by the prevalence of climate-related codes, especially “Climate” and “Sustainability.” However, the low frequency of “Biodiversity” and “Carbon” implies that these areas may require additional focus. The comparatively low presence of “Innovation” suggests the unrealized potential for process and technical breakthroughs, despite the “Energy” code conveying a strong focus on energy practices. With a lower overall representation, the “Social Responsibility and Governance” category still attests to the value of “Transparency” while identifying gaps in social participation, as evidenced by the low presence of “Community Development.”

The efforts undertaken by organizations to comply with global sustainability goals are reflected in the distribution of codes, which distinctly center on energy efficiency, sustainability, and climate action. The lower occurrence of other codes, such as “Carbon,” “Biodiversity,” and “Community Development,” is indicative of areas that might require more attention and funding. Interestingly, the infrequent occurrence of “Innovation” points to the unrealized potential for promoting sustainability and long-term strategic progress despite its significance.

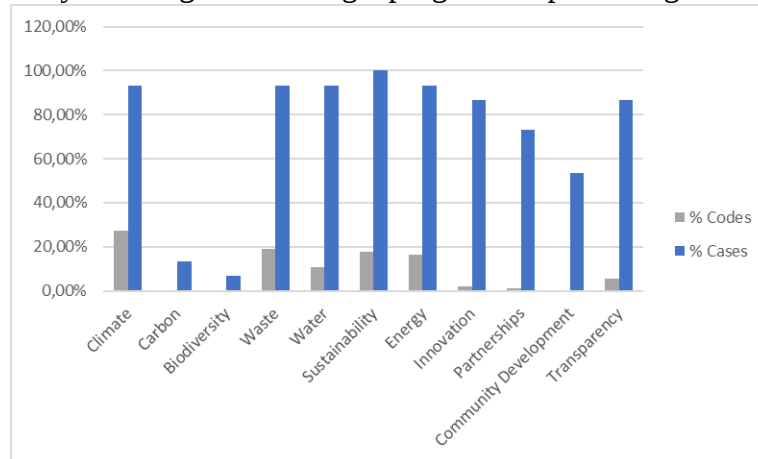


Figure 1. Codes frequency in total codes and number of cases

Source: Authors' own research, based on the QDA Miner software.

Link and Proximity Analyses

In the second stage of research, link and proximity analyses were conducted to identify relationships between codes and code categories (code co-occurrences and similarities). The proximity analysis provides an exclusive and comparative perspective on codes and their associations with other codes, whilst the link analysis identifies clusters of codes through the patterns of co-occurrences and similarities. As shown in Figure 2, clusters and connections were

formed among the 11 codes based on the similarity coefficient (SC), an index that indicates co-occurrence between the codes.

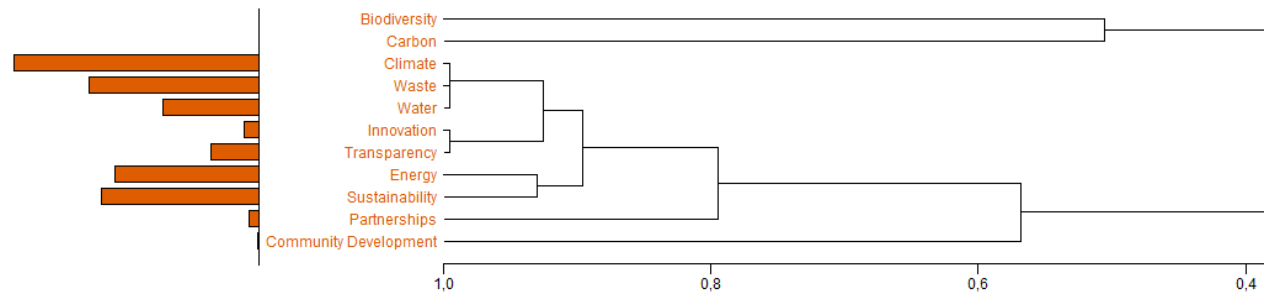


Figure 2. Links between codes identified by cluster analysis

Source: Authors' own research, based on the QDA Miner software.

The degree to which two concepts are related is known as conceptual similarity, and it is determined by how high their branches converge in the analysis. In the context of the study, the lower the merging, the more comparable the concepts are. For example, "Climate," "Waste," and "Water" are closely related, indicating a significant relationship between protecting water resources and managing waste. The dendrogram illustrates how the hierarchy of relationships arranges ideas from the most specific, like "Waste" and "Water," to the more general, like "Sustainability," which includes more expansive notions like "Energy" and "Innovation." A similarity scale is depicted by the horizontal bar at the bottom, where ideas that are placed closer to one another are more alike. Specific observations from the graph reveal that "Biodiversity" and "Carbon" stand out as distinct concepts, branching separately from others. This suggests that they are treated as relatively independent subjects within sustainability.

The strong correlation between "Waste" and "Water" highlights the significance of integrated resource management. "Sustainability" and "Energy" emerge as major categories in the investigation, linking many facets of sustainability.

Finally, considering its unique place within sustainability, "Community Development" is somewhat isolated, connected to "Partnerships" but separated from other ideas.

Figure 3 presents the similar coefficients between all codes in a matrix format, with the most informative values found outside of the confident diagonal, indicating the co-presence of concepts. These correlations highlight the co-occurrence of different aspects of the green transition in public discussion, providing a clearer picture of the links between different sustainability elements. One of the strongest relationships is between "Climate" and "Energy," with a value of 0.867. This suggests that climate conversations often have energy dimensions, especially in the case of renewable energy production, supporting organizational initiatives to use cutting-edge technologies to enhance energy efficiency and satisfy environmental goals. This is closely followed by "Climate" and "Sustainability" at 0.933. Further reinforcing these interconnections is the perfect value of 1 between "Climate" and "Waste," indicating that waste management is consistently discussed alongside climate-related topics. This may reflect a growing focus on circular economic principles and the reduction of waste in the context of mitigating climate change. Additionally, "Energy" discussions are often paired with references to "Innovation," as demonstrated by a significant correlation of 0.929.

Beyond environmental considerations, social dimensions play a vital role in sustainability efforts. The consistently high values observed in the "Community Development" row and column underscore the importance of community involvement and development. These aspects are

frequently mentioned alongside nearly all other concepts, highlighting the need for an inclusive and people-centered approach.

While certain pairs of concepts are strongly connected and highly related, others exhibit weak correlations, meaning they are rarely mentioned together. For instance, “Biodiversity” and “Transparency” (transparency is an important governance tool that underpins environmental efforts) have a limited value of 0.077. However, this does not mean they are not connected at all—it indicates that the two are not frequently mentioned in the same context in the analyzed document set. On the other hand, “Waste” and “Biodiversity” have a lower correlation of 0.071, indicating a less common relationship, suggesting the need for further exploration.

	Biodiversity	Carbon	Climate	Community Development	Energy	Innovation	Partnerships	Sustainability	Transparency	Waste	Water
Biodiversity	1	0,5	0,071	0,125	0,071	0,077	0,091	0,067	0,077	0,071	0,071
Carbon	0,5	1	0,143	0,111	0,143	0,154	0,182	0,133	0,154	0,143	0,143
Climate	0,071	0,143	1	0,571	0,867	0,929	0,786	0,933	0,929	1	1
Community Development	0,125	0,111	0,571	1	0,571	0,615	0,462	0,533	0,615	0,571	0,571
Energy	0,071	0,143	0,867	0,571	1	0,929	0,786	0,933	0,929	0,867	0,867
Innovation	0,077	0,154	0,929	0,615	0,929	1	0,846	0,867	1	0,929	0,929
Partnerships	0,091	0,182	0,786	0,462	0,786	0,846	1	0,733	0,846	0,786	0,786
Sustainability	0,067	0,133	0,933	0,533	0,933	0,867	0,733	1	0,867	0,933	0,933
Transparency	0,077	0,154	0,929	0,615	0,929	1	0,846	0,867	1	0,929	0,929
Waste	0,071	0,143	1	0,571	0,867	0,929	0,786	0,933	0,929	1	1
Water	0,071	0,143	1	0,571	0,867	0,929	0,786	0,933	0,929	1	1

Figure 3. Link analysis – the matrix perspective

Source: Authors’ own research, based on the QDA Miner software.

“Water,” “Waste,” and “Transparency” emerge as fundamental categories with the highest SC values (up to 1.000). The significant clusters that developed between them suggest a strategic emphasis on environmental resource management and accountability.

Conclusion

The findings corroborate institutional focus on environmental matters, specifically climate-related ones. The frequency of the codes “Climate,” “Waste,” “Water,” “Innovation,” and “Sustainability” is distinguishable. The shift toward sustainable and durable environmental practices is reflected in these codes, where climate responsiveness is heavily featured. Key regions, such as “Carbon” and “Biodiversity,” are not fully covered, meaning certain environmental challenges remain overlooked and need more focus and investment.

The study characterizes “Energy,” “Sustainability,” and “Innovation” by outlining the strong interplay between terms. This shows the indispensable role of technology and energy efficiency adaptation in promoting the scope of sustainable practices. A strong linkage between “Energy,” “Climate,” and water-related codes was also identified, yet “Innovation” appears to be underemphasized for applying technological advancements that could mitigate environmental impact.

The “Social Responsibility and Governance” category draws out “Transparency” as the linchpin function, including accountability and the expansion of environmental initiatives, especially in sustainability and resource management. “Community Development,” on the other

hand, ranks among the least localized concepts after “Sustainability,” indicating that organizations might not have fully leveraged the influence of social responsibility during their transition to a green phase.

These relationships between codes like “Water,” “Waste,” and “Transparency” are reinforced by cluster analysis with a focus on resource efficiency and environmental management. Nonetheless, the low integration of “Biodiversity” and “Community Development” signals that organizations may consider broadening their scope to better tackle these critical topics.

In conclusion, the study highlights the importance of organizations strengthening their commitment to full-blown sustainability in terms of social and environmental aspects. To close these gaps, companies need to align their strategies with the global sustainability agenda, leading to stronger long-term performance and meaningful contributions toward the world’s environmental and social goals.

This study is limited to annual sustainability reports, which represent a partial perspective on the fair-green transition as communicated through narratives of sustainable business practices written by corporate professionals within large industrial corporations. Future studies may be complemented with additional data sources like surveys, interviews, and audits from third-party firms for a more thorough understanding of sustainability initiatives. The sample, currently limited to large U.S. industrial firms, may be expanded with smaller companies and international contexts to uncover diverse sustainability strategies and reporting practices. Regulatory frameworks, stakeholder pressures, and industry-specific challenges also require further exploration. Moreover, combining text mining with an in-depth statistical analysis could provide better insights into the relationship between sustainability goals, strategic priorities, and operational performance, potentially offering richer knowledge of how these companies align with sustainability commitments.

Acknowledgements

This paper was co-financed by the Bucharest University of Economic Studies during the PhD program.

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