After the Shock
Reform, Resilience, and Economic Transformation in MENA
ERF 32nd Annual Conference
June 14-16 | Cairo, Egypt

2026

Material Topics in Corporate Sustainability Reporting:

Building Türkiye's First Structured Dataset

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Abstract

This paper offers the first systematic analysis of materiality disclosures in Türkiye by developing three novel data components: a Sustainability Report Database covering 705 BIST-listed firms (2016–2024), a Materiality Dictionary of 3,607 unique topics grouped into 39 sub-topic and 10 thematic ESG clusters, and an integrated panel combining firm-level disclosures with detailed firm-level financial indicators. Using a combined human–machine text-classification approach, the study documents substantial heterogeneity in firms' materiality practices, alongside increasing convergence around themes such as climate risk, energy, business ethics, employee-related issues, and supply chain sustainability. Econometric analyses show that firm size, profitability, liquidity constraints, and market risk significantly predict both reporting likelihood and choice of reporting framework (GRI, Integrated, SPK, ESRS), while the inclusion of a materiality analysis itself is largely unrelated to financial characteristics. The findings provide a scalable empirical foundation for emerging-market sustainability research and inform regional efforts to harmonize ESG disclosure standards.

Key Words: Sustainability reporting, Materiality analysis, ESG disclosure

1 Introduction

The rapid transformation in corporate sustainability disclosure frameworks—particularly the EU's Corporate Sustainability Reporting Directive (CSRD) and Türkiye's Sustainability Reporting Standards (TSRS)—has reshaped the ESG reporting landscape. Materiality analysis, a process that identifies which environmental, social, and governance (ESG) topics are relevant for both companies and their stakeholders, is now central to these frameworks. However, empirical understanding of materiality analyses, especially in emerging economies like Türkiye, remains limited.

While leading standards such as GRI, SASB, and IFRS place materiality at the core of reporting, most companies lack transparency about the methods they use to define "material" topics. Existing literature (e.g., Fiandrino et al., 2022; Christensen et al., 2021) highlights substantial variability in the conceptualization and execution of materiality analysis across jurisdictions. Studies such as Farooq et al. (2021) and Machado et al. (2021) show that although firms frequently reference materiality processes, they rarely disclose how topics are identified or prioritized. Font et al. (2016) and Torelli et al. (2020) emphasize weak stakeholder engagement, while Grewal et al. (2020) and Khan et al. (2016) demonstrate that transparent materiality disclosures positively influence investor decisions. Yet, we know little about the actual content of these disclosures—what topics are prioritized, how this changes over time, and what firm-level factors shape these outcomes.

In Türkiye, empirical work is especially sparse. Canlı & Serçemeli, 2024 has begun to explore how listed firms reference materiality, but there is no structured, publicly available dataset or thematic classification of material topics in Turkish reports. Moreover, existing studies do not provide a scalable empirical foundation for understanding how materiality practices evolve, how firms differ in their topic selections, or how these patterns relate to financial and structural firm characteristics.

This study addresses the significant empirical gap in understanding the structure and content of materiality disclosures in Türkiye by conducting a systematic examination of the material topics reported by 705 Borsa İstanbul (BIST) companies between 2016 and 2024. The objective is to document the evolution, composition, and heterogeneity of material topics disclosed under contemporary sustainability reporting frameworks and to relate these patterns to observable firm characteristics such as size and financial structure as well as industry dynamics that shape firms. To do so, the study introduces three core innovations: (i) the construction of the most extensive firm-level sustainability report database for Türkiye, (ii) the development of a comprehensive "Materiality Dictionary" that classifies 3,607 unique topics into 39 sub-topic and 10 topic clusters, and (iii) the implementation of an integrated empirical analysis that links disclosure practices with firms' financial and structural attributes.

A comprehensive dataset of sustainability reports was compiled from publicly accessible corporate sources for the 2016–2024 period. Reporting activity increased substantially over time, peaking at 175 reports in 2023. The low figure for 2024 reflects the lag in publication, as most 2024 reports are expected to be released in late 2025; thus, the dataset

will be updated accordingly. To enable comparative firm-level analysis, this study builds two complementary data structures: (i) sustainability performance indicators extracted directly from the reports, and (ii) firm-level financial indicators obtained from the Public Disclosure Platform (KAP) of Türkiye. These datasets were merged to construct the first integrated sustainability reporting–financial database for the country. The combination of text-based disclosure data and detailed financial indicators provides a unique empirical environment for examining how sustainability reporting and materiality practices relate to firms' economic and operational characteristics.

The empirical workflow consists of four methodological stages. First, sustainability reports were digitized and rendered into machine-readable text using OCR where necessary. Materiality-related content was isolated via targeted bilingual (Turkish–English) keyword filtering. Second, disclosed material topics were manually reviewed and coded for a subset of firms to establish a consistent and replicable classification architecture. This process generated the initial structured database of material topics. Third, the complete set of disclosed topics was analyzed using a combination of human evaluation and advanced natural language processing techniques—including TF-IDF weighting, Latent Dirichlet Allocation (LDA), and BERTopic—to identify semantic proximities among topics and to construct a consolidated "Dictionary of Priority Topics" tailored to the Turkish reporting context. Finally, descriptive analyses were conducted to characterize cross-sectional and temporal patterns, while clustering algorithms (e.g., K-means) were employed to detect distinct firm-level reporting profiles. This multi-method approach allows the study not only to document materiality practices, but also to quantify their structure in a replicable and scalable way.

Overall, the study makes several contributions to the literature and practice of sustainability reporting in emerging markets. It provides the first systematic mapping of materiality disclosures in Türkiye, offering a structured and scalable database of 3,607 unique material topics organized across 39 thematic clusters. It assembles a firm-level dataset that links material topics with sustainability performance indicators and financial attributes. It introduces a combined human–machine classification approach that enhances the reproducibility and comparability of materiality analyses. Most importantly, it integrates these contributions within an empirical framework that uncovers the relationship between firms' financial characteristics and their sustainability reporting behavior, reporting-framework choices, and materiality practices. Finally, it documents how material topics vary across firms and over time, generating new empirical evidence on the evolving architecture of ESG reporting in Türkiye and informing both policymakers and practitioners seeking to strengthen the implementation of TSRS, GRI, and other international standards.

The paper is structured into five sections. Section 1 introduces the motivation, research gap, and core contributions of the study. Section 2 describes the construction of the Sustainability Report Database and summarizes reporting patterns among BIST-listed firms. Section 3 presents the development of the Materiality Dictionary and provides a comprehensive overview of the material topics disclosed by companies. Section 4 outlines the empirical framework and reports the main findings on the financial and structural determinants of sustainability reporting and materiality practices. Finally, Section 5 concludes by discussing the broader implications of the results for firms, regulators, and sustainability reporting standards.

2 Sustainability Reports in Türkiye

The history of sustainability reporting can be traced back to the 1980s. A major step toward formalizing these practices came with the establishment of the Global Reporting Initiative (GRI) in 1997, which aimed to create a globally applicable framework for sustainability disclosures. The first full version of the GRI Sustainability Reporting Guidelines (G1) was released in 2000, and by 2014 the European Union issued its first directive requiring certain companies to report on sustainability matters. Today, sustainability reporting has become an integral part of annual corporate reporting.

In Türkiye, to the best of our knowledge, the earliest examples of sustainability reports date to 2007. Since then, the number of reports has grown steadily, and companies now follow a range of different reporting standards. Because these reports primarily serve investors and other market participants, firms listed on Borsa İstanbul are especially likely to adopt sustainability reporting practices.

For this study, we collected sustainability reports for 705 companies listed on BIST. Each company's website was examined individually to determine whether it had published a sustainability or integrated report since 2016. We also conducted additional online searches to identify reports that might be hosted on other platforms. Through this process, we found that by 2023, 176 of the 705 firms had published a report. All reports were downloaded and stored in a secure cloud repository. Table 1 summarizes the information we compiled for each company.

Table 1. Data Collected

Variable	Definition	Source
Ticker	The company's stock market name for identification in financial markets.	KAP (Public Disclosure Platform of Türkiye)
Sector Classification	TRBC, The Refinitiv Business Classification	The Refinitiv
Company	The official name of the company.	KAP (Public Disclosure Platform of Türkiye)
Province	The province where the company's headquarters is located.	KAP (Public Disclosure Platform of Türkiye)
Reporting Year	The year for which sustainability data is reported.	Report itself.
Report Type	The type of sustainability or integrated report (e.g., GRI, SASB)	Report itself.
Subsidiary Status	Indicates whether the company is a subsidiary of another parent company.	Report itself.
Annual Report Status	Whether the report is an annual publication (Yes/No).	Report itself.

Figure 1 presents the annual distribution of sustainability reports published by BIST-listed firms. In 2016, fewer than 50 reports were published, whereas by 2023 this number had increased substantially, reaching 176. The figure also shows a noticeable decline in the number of reports for 2024. This decline, however, does not reflect an actual contraction in reporting activity. Rather, it is attributable to the fact that 2024 reports are released throughout 2025, and the dataset remains incomplete at this stage. The full count

for 2024 will be finalized once all firms have published their reports by the end of the annual reporting cycle.

Figure 1. Number of Reports per Year

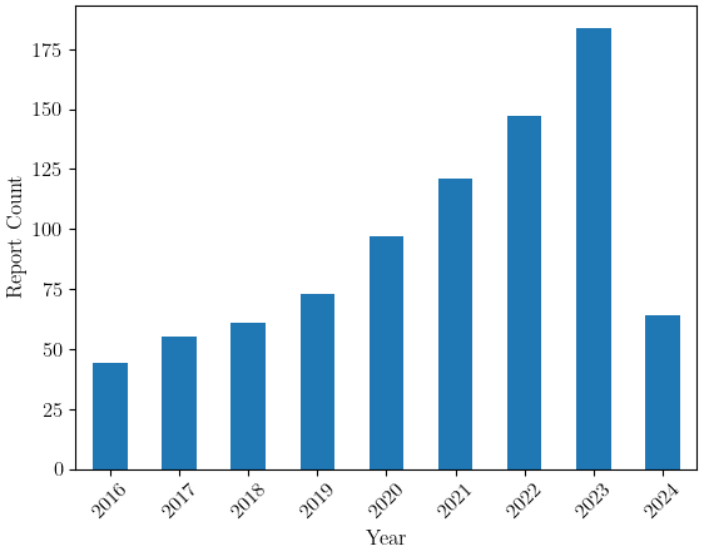


Figure 2 classifies the sustainability reports according to the reporting standards employed. It is important to note that a single report may reference more than one standard, and therefore the counts are not mutually exclusive. In 2016, most firms relied exclusively on the GRI framework when preparing their reports. By contrast, in 2023 the landscape became more diversified, with additional standards, most notably SASB, being increasingly adopted alongside GRI. This shift indicates a broadening of disclosure practices and a growing alignment with international reporting trends.

Figure 2. Number of Reports per Year by Standard

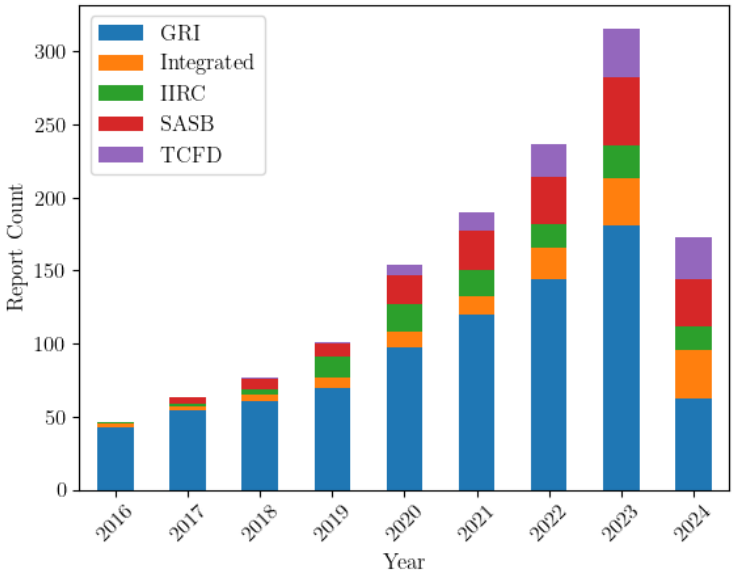


Figure 3. Number of Reports by Sector in 2023

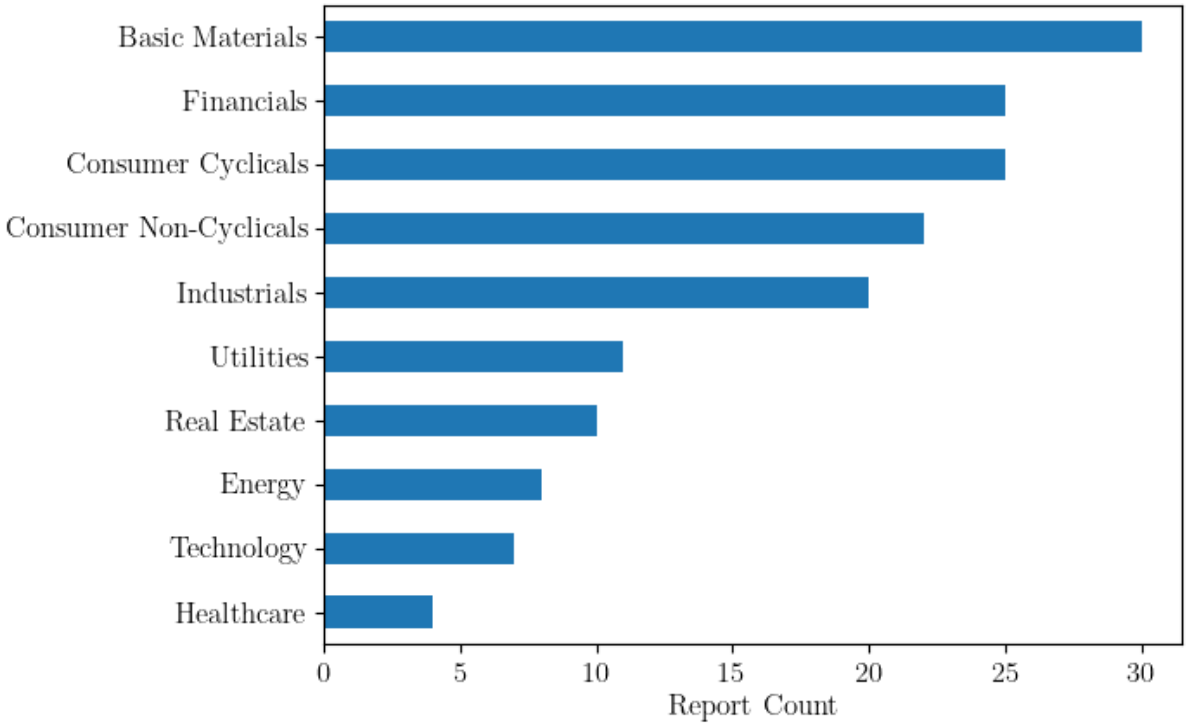


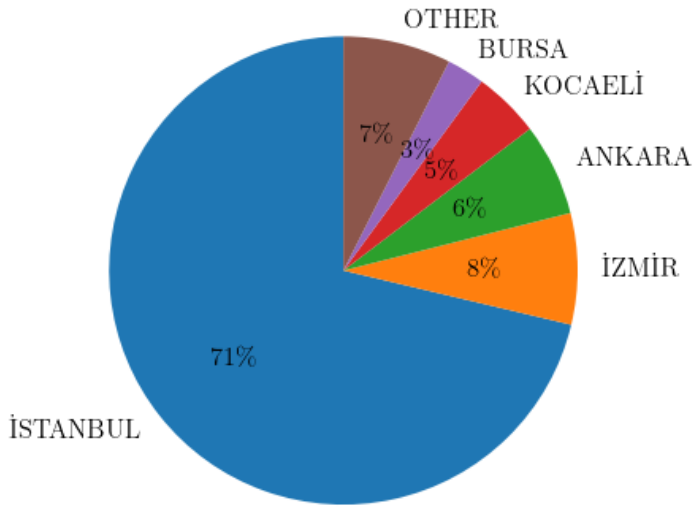
Figure 3 illustrates the distribution of sustainability reports across sectors and indicates a clear concentration of reporting activity in certain industries. *The Basic Materials*, *Financials*, and *Consumer Cyclicals* sectors exhibit the highest number of reports, each exceeding 25 reports. This pattern is consistent with international reporting trends, as these sectors typically face higher levels of regulatory scrutiny, investor expectations, and exposure to environmental and social risks. For instance, *the Basic Materials* sector includes mining, chemicals, and construction materials—industries that are inherently resource-intensive and therefore under stronger pressure to demonstrate responsible environmental management.

Sectors such as *Consumer Non-Cyclicals* and *Industrials* also show relatively high levels of reporting, reflecting their large market presence and the operational complexity associated with supply chains, labor practices, and environmental footprints.

In contrast, sectors including *Healthcare*, *Technology*, and *Energy* exhibit comparatively lower number of reports. This is partly due to the small number of energy companies listed on Borsa İstanbul relative to other sectors.

Figure 4 displays the provincial distribution of sustainability reports based on the headquarters location of each firm. Since the dataset relies on firms' registered headquarters, it is unsurprising that the majority of reporting companies are concentrated in İstanbul, which hosts the largest share of corporate headquarters in Türkiye and remains the country's primary financial and commercial hub.

Figure 4. Distribution of Reports by Province



3 Material Topics Dictionary of Turkish Companies

Materiality analysis is fundamentally linked to the structure of ESG reporting. Material topics represent the specific ESG issues that companies identify as significant for long-term value creation and for their broader impacts on society, the economy, and the natural environment. Because these topics form the basis of sustainability strategy, risk assessment, and disclosure practices, documenting them accurately is essential for understanding firms' priorities within the ESG framework.

3.1 Material Topic Collection

In this study, the material topics disclosed by BIST-listed companies were collected directly from their sustainability or integrated reports. Majority of the reports that are in our sample disclose material topics as shown in Figure 5.

Each material topic in a sustainability report was extracted exactly as written by the firms and entered verbatim into a structured Excel database to preserve the original terminology. When disclosures were written in Turkish, they were translated into English solely to enable comparability across firms, with the wording kept as close as possible to the original meaning.

To construct the materiality dictionary for Turkish companies for the 2016–2024 period, all material topics disclosed across the sustainability reports of BIST-listed firms were first collected into a single dataset. During this stage, identical topics appearing in different company reports were consolidated and recorded only once, after completing all text-cleaning procedures such as standardizing formatting, correcting typographical inconsistencies, and harmonizing linguistic variations. This process yielded a corpus of 3,607 unique material topics, representing the full set of distinct terms used by companies in their materiality analyses.

Figure 5. Reports with/out Material Topics by Year

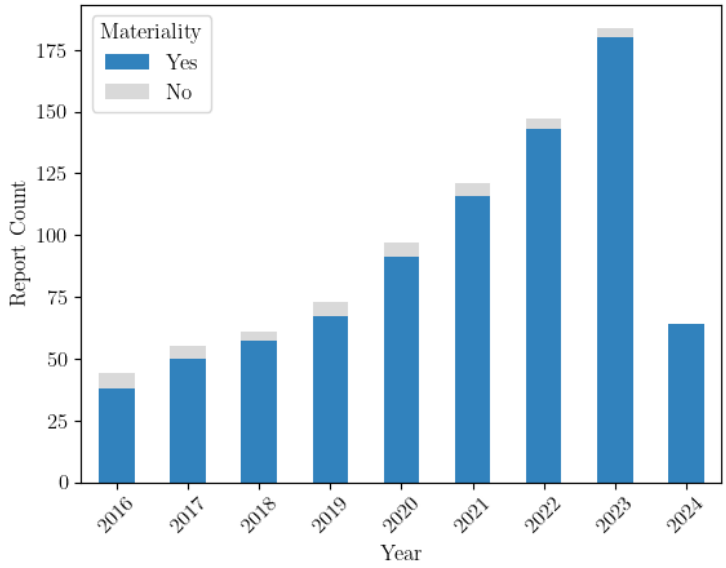
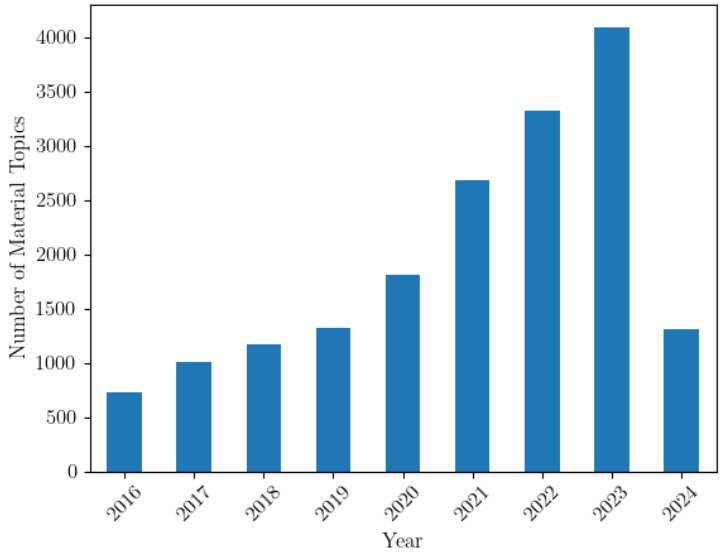


Figure 6 presents the number of material topics reported by year. As expected, the total number of topics increases in line with the growing number of sustainability reports published annually. More importantly, the widening variation in material topics over time indicates that firms differ substantially in how they define and prioritize material issues, reflecting sector-specific dynamics, strategic differences, and varying levels of reporting maturity.

Figure 6. Number of Material Topics by Year



3.2 Material Topic Clustering

The clustering process began by examining the full set of 3,607 unique material topics and organizing them into 39 sub-topic clusters derived directly from the content and meaning of the disclosures. These clusters were created through detailed human review, during

which each topic was assigned to the most appropriate thematic group. In cases where a topic had relevance to more than one area—such as "water and nature"—it was included in all applicable clusters to reflect its cross-cutting nature. After establishing the 39 sub-topic clusters, they were further consolidated into 10 broader topic clusters, representing higher-level ESG themes.

Manual classification can be prone to subjective judgement and human error. To validate and refine this structure, we applied a set of AI-driven and advanced NLP techniques, including TF-IDF, LDA, and BERTopic. These computational models independently generated 10 topic clusters, as is the case for human-coded structure. By combining qualitative assessment with machine learning and NLP, the study ensures a reliable and methodologically robust clustering architecture. This multi-method approach ultimately enabled the construction of a unique and comprehensive materiality dictionary specifically tailored to Turkish firms and the evolution of their sustainability reporting practices.

With the clustering framework firmly established through both human judgment and machine-learning validation, we now turn to the empirical structure of the material topics themselves. This section analyzes how the 3,607 unique topics disclosed by BIST-listed firms map onto the 39 sub-topic clusters and 10 topic clusters defined in the classification system.

3.2.1 Human-Coded Topic Clustering

Having established and validated the clustering architecture, this subsection provides a systematic characterization of the human-coded topic structure. The purpose is to assess how the full corpus of disclosed material topics populates the classification framework and to evaluate the empirical distribution of topics across clusters. The dataset comprises 3,607 unique material topics, each treated as an individual observation reflecting a discrete disclosure item. These topics were mapped onto 39 sub-topic clusters and subsequently aggregated into 10 higher-level topic clusters, following the hierarchical taxonomy developed earlier. Table 2 reports the resulting distribution, which serves as the quantitative baseline for evaluating the relative density, thematic concentration, and cross-cluster heterogeneity of materiality disclosures among BIST-listed firms.

Based on the comprehensive quantitative analysis of the 39 material sub-topic clusters, the three sub-topic clusters in Table 3 represent those with the most detailed coverage and the greatest number of distinct material topics. These areas show a deeper level of disclosure, indicating that companies consider them highly significant within their sustainability frameworks.

Table 2. Human-Coded Sub-topic and Topic Clusters

Topic Cluster	Sub-Topic Clusters	#Topics
Climate & Energy	Climate change, Carbon management, Energy efficiency, Transportation (smart & sustainable)	464
Pollution & Chemicals	Air quality, Water management, Soil quality, Chemicals management	147
Resources & Circularity	Waste management, Materials use, Packaging, Circular economy	229

Nature & Land Use	Natural resources, Biodiversity, Environmental protection, Sustainable food and agriculture	277
Workforce & Inclusion	Employees, Workforce development, Accessibility	451
Diversity & Wellbeing	Equality and diversity in workplace, General & occupational health, Social responsibility	436
Customers & Products	Product & general quality, Customer satisfaction management, Stakeholder engagement management	307
Governance & Risk	Corporate governance, Business ethics, Legal compliance, Risk management and business continuity	618
Economic & Market Value	Finance, Contribution to economy, Banking, Brand management, Sustainable products	468
Technology & Operations	Technology, Digitalization, Data and information security, Innovation and entrepreneurship, Supply chain management	546

According to Table 3, *Business Ethics*, *Employee*, and *Finance* are the three sub-topic clusters with the highest number of unique material topics. These areas show where companies provide the most detailed and structured sustainability disclosures. Their strong representation indicates that firms view these sub-topic clusters as essential material issues for achieving long-term sustainability performance and maintaining trust with their stakeholders.

Table 3. Sub-Topic Clusters with the Highest Number of Material Topics

Rank	Sub-topic cluster	# Topics
1	Business Ethics (Topic 16)	259
2	Employee (Topic 19)	226
3	Finance (Topic 23)	210

Business Ethics forms the core of the governance structure and ensures that integrity and transparency guide both internal management and external relations. Among its 259 unique material topics, the prevention of corruption and bribery stands out as the most important theme. Many companies emphasize their compliance with anti-bribery and corruption policies through statements such as *"Ethics, Compliance and Anti-Corruption"* or *"Prevention of Bribery and Corruption."* This focus shows that Turkish companies regard ethical conduct and the prevention of financial crime as fundamental principles of responsible governance. In addition, human rights appear as a closely related area, mentioned in connection with respecting individual and labor rights across supply chains.

The second key sub-topic cluster, *Employee*, represents the social dimension of sustainability, emphasizing how companies manage human capital and maintain positive relationships with their workforce. With 226 unique material topics, this area highlights the commitment of Turkish firms to providing a fair, safe, and supportive working environment. The most common themes within this category include employee satisfaction, engagement, and loyalty. Many disclosures link these outcomes to fair

working conditions, training opportunities, and career development. High levels of employee satisfaction are presented not only as a social responsibility but also as a strategic advantage that improves productivity and long-term success. The consistent inclusion of employee rights further reinforces this focus, reflecting companies' recognition of their workforce as a central pillar of sustainable growth.

The third sub-topic cluster, *Finance*, represents the economic pillar of sustainability, showing how companies manage their financial performance while integrating environmental and social considerations into their decision-making. With 210 unique material topics, this area highlights the growing importance of responsible investment and the inclusion of sustainability criteria in financial activities. The most emphasized theme is the integration of environmental, social, and governance (ESG) principles into lending and investment decisions. Rather than focusing only on profit and returns, many companies refer to *"Responsible Finance"* or *"ESG Impact in Lending"*, indicating an effort to link financial growth with positive social and environmental outcomes. This reflects a broader shift in the Turkish corporate context, where financial success and sustainability are increasingly seen as interconnected goals rather than separate objectives.

Taken together, these three sub-topic clusters demonstrate the areas where Turkish companies show the widest diversity of material issues. Their broad scope and detailed sub-topics suggest that firms view ethics, people, and finance as the core pillars of sustainable corporate performance, shaping both their internal practices and external accountability.

Table 4. Sub-Topic Clusters with the Lowest Number of Material Topics

Rank	Sub-topic cluster	# Topics
39	*Chemicals*	16
38	*Packaging*	24
37	*Soil*	35

Based on the quantitative summary derived from the sub-topic clusters, *Chemicals*, *Soil*, and *Accessibility* are the three sub-topic clusters that show the lowest number of unique material topics within the overall dataset (Table 4). It is important to note that this analysis measures the range and diversity of unique material topics, not their frequency or repetition across companies. In other words, these figures indicate how many different sub-topics exist under each theme rather than how often they appeared in corporate disclosures. Taken together, these patterns highlight the uneven distribution of material topic diversity across the ESG spectrum, underscoring the need to examine each pillar in greater depth.

Table 5 presents the analysis of sub-topic clusters related to environmental issues which reveals a highly diversified structure, with 17 sub-topic clusters and a total of 1,256 unique material topics related to environment. The distribution indicates that climate-related issues form the core of environmental materiality for BIST-listed firms.

Specifically, material topics under *Climate Change* and *Energy* sub-topic clusters both appear as the most frequently reported material topics related to environmental issues, with 143 unique entries each, demonstrating that companies tend to treat climate mitigation and energy management as interlinked priority areas. Similarly, *Carbon Management* (133 topics) and *Sustainable Products* (139 topics) sub-topic clusters show

that firms increasingly emphasize decarbonization efforts and the environmental performance of their product portfolios.

Table 5. Environmental (E) Sub-Topic Clusters

Sub-Topic Cluster	# Topics
Climate Change	143
Waste Management	77
Natural Resources	47
Air	32
Soil	25
Water Management	74
Carbon Management	133
Biodiversity	58
Environment	110
Materials	71
Packaging	24
Chemicals	16
Circular Economy	57
Energy	143
Sustainable Products	139
Sustainable Food and Agriculture	62
Transportation, Smart and Sustainable Cities	45
Total (Environmental Topics)	1,256

The prominence of the broader *Environment* sub-topic cluster (110 topics) suggests that many firms still provide general environmental material topics rather than highly specific sub-themes. This reflects a strategic grouping of diverse issues under umbrella categories.

Sub-topic clusters such as *Circular Economy* (57), *Biodiversity* (58), and *Sustainable Food & Agriculture* (62) appear with moderate frequency, indicating emerging but still developing areas of environmental focus within Turkish companies' materiality assessments.

Overall, the material topics related to environment demonstrate that climate, carbon, and energy related themes dominate companies' environmental agendas. In contrast, resource efficiency, regenerative practices, and circularity are increasingly recognized but remain comparatively less emphasized.

The material topics related to the "Social" pillar of ESG is summarized in Table 6. There are 10 sub-topic clusters with a total of 1,243 unique material topics related to social issues.

The most prominent material topics related to social issues appear in categories directly related to the workforce and stakeholder relations. Employee-related topics (226 unique topics) constitute the largest sub-cluster, reflecting the centrality of labor rights, working conditions, employee well-being, and human capital development in corporate sustainability agendas. Similarly, *Workforce Development* (155 topics) and *Equality and Diversity in the Workplace* (158 topics) sub-topic clusters demonstrate that firms increasingly recognize inclusion, diversity, upskilling, and talent management as material areas influencing organizational performance and competitiveness.

Stakeholder-centered sub-clusters such as *Customer Satisfaction and Customer Management* (114 topics) and *Stakeholder Engagement* (139 topics) appear as major sub-clusters, indicating that companies place strong emphasis on maintaining trust and transparency with customers and broader stakeholder groups. The relatively high number of topics within *Social Responsibility* sub-cluster (188 topics) also suggests that firms continue to adopt traditional CSR-oriented framing in their materiality assessments—aligning broader community and societal expectations with corporate strategy.

Other sub-clusters, including *General Health, Occupational Health and Safety* (90) and *Contribution to Economy* (89), underline that firms identify both internal well-being and external socio-economic impact as key material topics related to social issues.

Table 6. Social (S) Sub-Topic Clusters

Sub-Topic Cluster	# Topics
Social Responsibility	188
Employee	226
Contribution to Economy	89
Customer Satisfaction, Management	114
Stakeholder Engagement / Management	139
Accessibility	30
Workforce Development	155
General Health, Occupational Health and Safety	90
Equality and Diversity in the Workplace	158
Product and General Quality	54
Total (Social Topics)	**1,243**

Finally, Table 7 presents the Governance pillar of ESG which contains 12 sub-topic clusters and a total of 1,525 unique material topics related to governance, making it the most extensive of the three ESG categories. This indicates that companies tend to report a broader and more diverse range of governance-related material topics, reflecting both regulatory pressures and the strategic importance of governance for sustainable value creation.

Business Ethics (259 topics) sub-topic cluster emerges as the single largest sub-cluster related to governance, highlighting that ethical conduct, anti-corruption, and integrity-related issues form the backbone of corporate governance priorities. Closely following sub-clusters are *Finance* (210 topics) and *Supply Chain Management* (165 topics)—two areas that are directly tied to operational resilience, risk exposure, and value chain stability.

Risk Management and Business Continuity sub-topic cluster (148 topics) also appears prominently, showing that firms increasingly recognize the material importance of organizational resilience in the face of economic, geopolitical, and climate-related disruptions.

Technological transformation-related sub-topic clusters—including *Technology* (98 topics), *Digitalization* (72 topics), and *Data and Information Security* (104 topics)—reflect the growing strategic relevance of digital infrastructure, cybersecurity, and technological capacity. The strong representation of these topics suggests that companies increasingly associate digital readiness and data governance with long-term sustainability and competitive performance.

Smaller clusters such as *Brand Management* (34) and *Banking* (45) are included by specific sectors or companies but contribute to the overall diversity of governance-related material topics.

Table 7. Governance (G) Sub-Topic Clusters

Sub-Topic Cluster	# Topics
Corporate Governance	120
Business Ethics	259
Legal Compliance	91
Technology	98
Data and Information Security	104
Finance	210
Risk Management and Business Continuity	148
Supply Chain and Supply Chain Management	165
Brand Management	34
Innovation and Entrepreneurship	139
Banking	45
Digitalization	72
Total (Governance and Operational Topics)	**1,485**

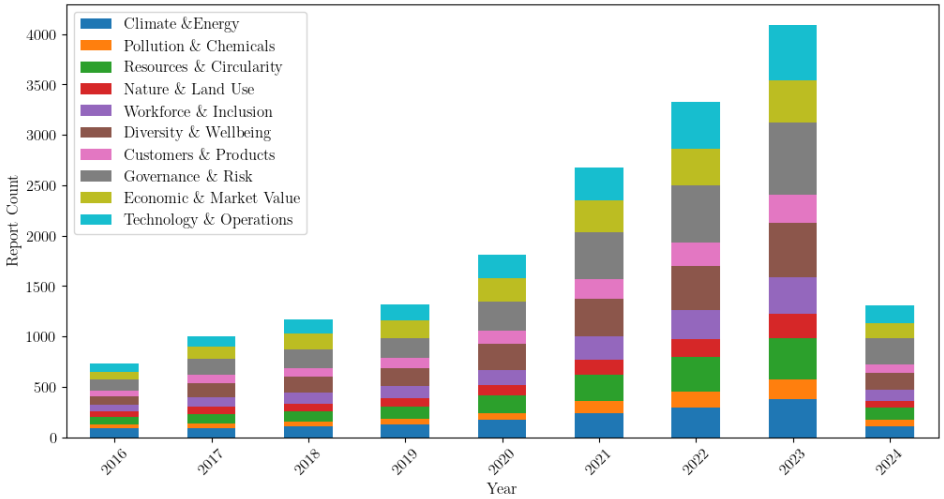
In the human-based coding stage, the 39 sub-topic clusters were consolidated into 10 broader topic clusters. Figure 7 presents how these topic clusters are distributed across sustainability reports between 2016 and 2024. The figure shows a clear upward trend in the overall number of disclosed material topics, particularly after 2020, reflecting the rapid expansion of sustainability reporting practices and the growing adoption of global reporting standards in Türkiye.

The most striking increase occurs in 2022 and 2023, where the total number of material topics rises sharply across nearly all clusters. This pattern aligns with regulatory and market developments—such as the acceleration of EU sustainability regulations, heightened investor expectations, and growing awareness of ESG risks—which collectively encouraged more comprehensive materiality analyses by firms. The temporary drop in 2024 is expected, as most 2024 reports are published in 2025 and were not yet available at the time of data collection.

Among the topic clusters, *Governance & Risk*, *Economic & Market Value*, and *Technology & Operations* show substantial growth, suggesting that firms increasingly view governance quality, financial resilience, and digital transformation as core components of sustainability. Environmental clusters—particularly *Climate & Energy*, *Resources & Circularity*, and *Nature & Land Use*—also exhibit consistent increases, reflecting stronger attention to climate risks, resource efficiency, and biodiversity impacts. Social clusters, including *Workforce & Inclusion* and *Diversity & Wellbeing*, expand steadily as well, indicating greater emphasis on human capital and workplace-related issues.

Overall, the figure demonstrates that materiality disclosures in Türkiye have not only increased in volume but have also diversified significantly across all ESG domains. This expansion suggests a broadening understanding of sustainability among Turkish firms and highlights the dynamic evolution of ESG priorities over the last decade.

Figure 7. Human-Coded Topic Clusters by Year



3.2.2 Alternative Clustering Methods

In addition to the human-coded materiality taxonomy, three computational clustering approaches—AI-based clustering, BERT contextual embeddings, and Latent Dirichlet Allocation (LDA)—were applied to validate the robustness of the topic structure and assess whether machine-generated clusters resemble the human-coded framework. Each method was configured to produce ten clusters to facilitate comparability across techniques. The results from each model are presented in Figures 8-10.

AI-Based Clustering Results

The AI-based clustering model organizes the 3,607 disclosed material topics into ten coherent thematic groups (Figure 8). The largest cluster, *Human Capital, Labor Rights, Diversity and Workplace Wellbeing*, contains over 550 topics, reflecting companies' strong emphasis on employee-related issues in sustainability reporting. The second-largest cluster relates to *Environment, Climate Change, Energy and Emissions Management*, with more than 520 topics, mirroring the prominence of environmental issues observed in the human-coded taxonomy.

Figure 8. Distribution of Material Topics Across AI-Generated Clusters

Other clusters—corporate governance, customer and product issues, social impact, circular economy, digitalization, and supply chain responsibility—also emerge clearly. The distribution shows substantial convergence between AI-generated and human-coded clusters, indicating that the semantic information embedded in the corpus naturally reproduces high-level ESG structures.

BERT-Based Clustering Results

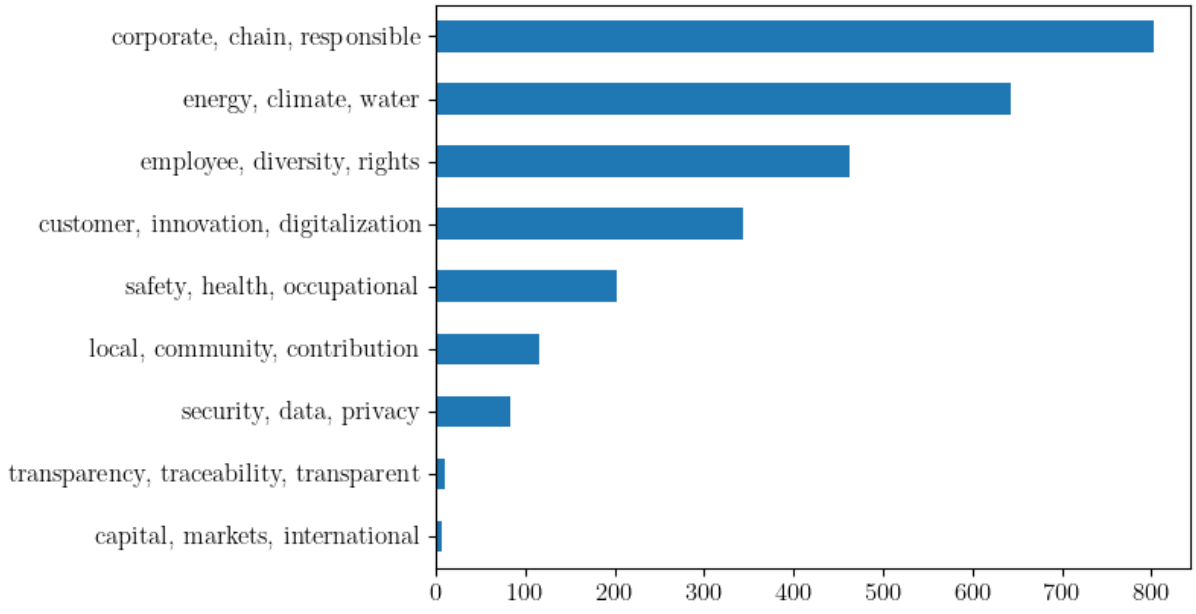
The BERT model yields ten clusters characterized by higher semantic precision but less even distribution (Figure 9). The largest cluster, *"corporate, chain, responsible"*, contains more than 800 topics—substantially larger than the analogous governance or supply-chain clusters in the human-coded framework. This indicates that BERT embeddings tend to merge governance, responsibility, compliance, and value-chain topics into one dense semantic field.

The second-largest cluster, *"energy, climate, water"*, includes more than 650 topics, showing that BERT tends to aggregate environmental disclosures into a single broad domain, instead of distinguishing between climate, water, energy, or natural-resource topics.

The third cluster, *"employee, diversity, rights"* (~500 topics), aligns closely with the human-coded Human Capital domain, confirming that human-capital themes remain salient across methods.

Additional clusters—customer innovation, occupational safety, community engagement, cybersecurity, transparency—demonstrate BERT's ability to detect subtle semantic relationships. Notably, BERT isolates *data privacy and cybersecurity* into a standalone cluster, which differs from the broader Technology & Operations classification in the human-coded taxonomy.

Figure 9. Distribution of Material Topics Across BERT based Clusters



LDA Topic Modeling Results

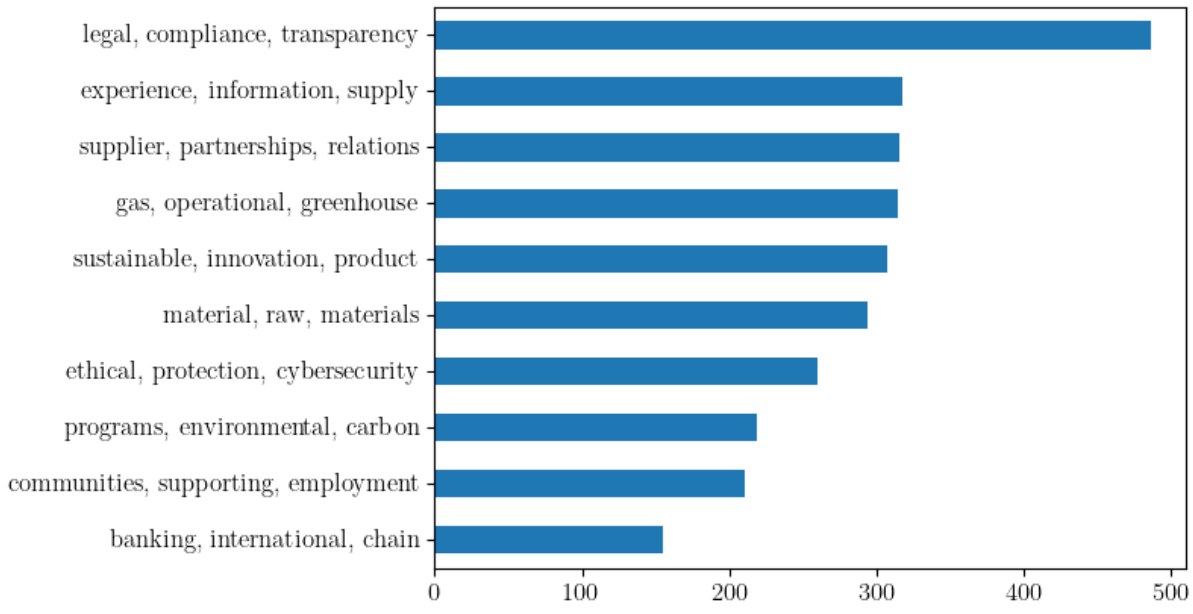
The LDA model produces ten probabilistic topics with broader and more overlapping semantic boundaries (Figure 6). The largest cluster—"legal, compliance, transparency"—contains nearly 500 topics, showing strong emphasis on governance, ethics, and transparency.

Two subsequent clusters—"experience, information, supply" and "supplier, partnerships, relations"—capture customer experience and supply-chain networks. Unlike BERT, which merges these themes, LDA separates customer-focused and supplier-focused content, which reflects its reliance on word-co-occurrence patterns.

Environmental topics appear across clusters such as "gas, operational, greenhouse" and "programs, environmental, carbon", while "material, raw, materials" isolates resource-related disclosures into a separate group. Another topic—"communities, supporting, employment"—blends human capital with community development, a typical feature of probabilistic models.

Overall, LDA yields more diffuse and mixed clusters but remains consistent in emphasizing governance, environmental impacts, and supply-chain relations.

Figure 10. Distribution of Material Topics Across LDA based Clusters



This section has focused on constructing the Materiality Dictionary—an essential analytical tool that defines the full universe of material topics and provides a standardized structure for interpreting firms' sustainability disclosures. Because the credibility of this dictionary depends on the reliability of its classification, it was validated using multiple clustering techniques, including AI-based embeddings, BERT contextual models, and LDA topic modeling. The convergence of these independent methods around similar thematic groupings demonstrates the robustness and internal coherence of the dictionary's architecture. By combining human judgment with machine-driven validation, the study establishes a solid and standalone methodological foundation for analyzing material topics.

4 Empirical Framework and Integrated Firm-Level Dataset

This section introduces the empirical framework used to analyze the determinants of sustainability reporting, reporting-framework choice, reporting dynamics, and materiality practices among Borsa İstanbul–listed firms. Complementing the qualitative and text-analytic findings presented in earlier sections, the econometric component relies on a firm-year panel that combines detailed sustainability disclosures with financial and structural attributes of each firm.

This integrated dataset enables a systematic assessment of how reporting behavior relates to firm size, profitability, leverage, liquidity, market valuation, risk exposure, and industry structure. The empirical analysis proceeds by first identifying the financial and structural correlates of sustainability reporting, then examining the factors associated with the adoption of different reporting frameworks, subsequently modeling firms' transitions into reporting over time, and finally analyzing the financial determinants of materiality analyses. The subsections that follow describe the data sources, variable construction, and summary statistics that underpin the econometric analysis.

4.1 Data Sources

The empirical analysis draws on two complementary datasets. Firm-level financial and market information is obtained from the LSEG (Refinitiv Eikon) Fundamentals database, which provides annual observations for all companies listed on Borsa İstanbul. These data include total assets, return on assets, debt-to-assets ratio, liquidity ratios, Tobin's Q, historic beta, and additional balance-sheet and market-based indicators. TRBC industry classifications drawn from the same source are used to construct sector fixed effects.

Sustainability-related variables are derived from the TEDUsTRC Sustainability Reporting Database compiled by the TED University Sustainable Trade Research Center researchers. This database among many other indicators, records, for each firm-year, whether a sustainability or integrated report was published, the reporting framework referenced (including GRI, Integrated/IIRC, SPK, ESRS, SASB, TCFD, IFRS S1/S2, TSRS, and CSRD), the presence or absence of a materiality analysis, and the material topics disclosed at different complexity levels. Additional firm characteristics, including establishment year used to compute firm age and province identifiers used to construct geographic fixed effects, are incorporated to complete the merged panel.

4.2 Variables and Summary Statistics

The empirical analysis employs a set of firm-level variables that link sustainability reporting outcomes with financial and structural characteristics of Borsa İstanbul-listed firms. Sustainability reporting is captured by the binary variable

$$\text{Report}_{it} = \begin{cases} 1, & \text{if firm } i \text{ publishes a sustainability or integrated report in year } t, \\ 0, & \text{otherwise.} \end{cases}$$

To examine firms' adoption of specific reporting standards, additional indicators are constructed for the Global Reporting Initiative (GRI_{it}), the Integrated Reporting <IR> Framework or IIRC (Integrated_{it}), the SPK Sustainability Principles Compliance Framework (SPK_{it}), and the European Sustainability Reporting Standards (ESRS_{it}). A further variable identifies the use of any remaining standards, including SASB, TCFD,

IFRS S1/S2, TSRS, and CSRD. Materiality practices are measured using a binary variable:

$$\text{Materiality}_{it} = \begin{cases} 1, & \text{if firm } i \text{ conducts materiality analysis in its report in year } t, \\ 0, & \text{otherwise.} \end{cases}$$

Financial and structural variables are sourced from the LSEG (Refinitiv Eikon) Fundamentals database. Firm size is defined as the natural logarithm of total assets,

$$\ln(\text{Assets}_{it}),$$

while profitability is measured using return on assets,

$$\text{ROA}_{it} = \frac{\text{Net Income}_{it}}{\text{Total Assets}_{it}}.$$

Leverage is captured by the total-debt-to-total-assets ratio,

$$\text{Debt Ratio}_{it} = \frac{\text{Total Debt}_{it}}{\text{Total Assets}_{it}},$$

and liquidity by the current ratio,

$$\text{Current Ratio}_{it} = \frac{\text{Current Assets}_{it}}{\text{Current Liabilities}_{it}}.$$

Systematic risk is proxied by historic market beta (β_{it}), and Tobin's Q_{it} is used to capture market valuation and growth opportunities. Firm age is computed as the difference between the reporting year and the firm's establishment year. TRBC industry classifications and province identifiers serve as controls for sectoral and geographic heterogeneity.

Table 8. Summary Statistics for Key Variables

Variable	Definition	Mean	Std. Dev.	Min	Max	Obs
$\ln(\text{Assets}_{it})$	Log of total assets	11.85	2.05	4.50	22.70	3197
ROA_{it}	Return on assets (%)	12.48	73.41	–927.61	774.21	2966
DebtRatio_{it}	Total debt / total assets	0.27	0.26	–0.64	4.62	3083
CurrentRatio_{it}	Current assets / current liabilities	1.96	2.32	0.00	55.22	2600
β_{it}	Historic beta	0.75	0.89	–4.50	7.40	2561
Q_{it}	Tobin's Q	1.92	2.71	0.00	89.40	2365
Age_{it}	Firm age (years)	30.10	19.67	1.00	128.00	3721
Report_{it}	Sustainability report indicator	0.166	0.372	0	1	5090
Materiality_{it}	Materiality analysis indicator (Report=1)	0.953	0.212	0	1	846
GRI_{it}	GRI framework indicator	0.983	0.129	0	1	846
Integrated_{it}	Integrated/IIRC indicator	0.152	0.359	0	1	846
SPK_{it}	SPK framework indicator	0.343	0.475	0	1	846
ESRS_{it}	ESRS indicator	0.013	0.112	0	1	846

Table 8 presents summary statistics for the core variables employed in the econometric analysis. The values reflect substantial variation across firms in size, profitability, leverage, and risk exposure, and illustrate the uneven but growing adoption of sustainability reporting and materiality practices across the sample period.

4.3 Econometric Specification

The empirical analysis examines the relationship between firm-level characteristics and sustainability disclosure practices using a descriptive modeling framework without claiming causality. Because the dependent variables in all stages of the analysis are binary or non-negative integer outcomes, the estimations are carried out using Poisson pseudo–maximum likelihood (PPML), which accommodates heteroskedasticity, permits the inclusion of high-dimensional fixed effects, and produces consistent estimates under a wide class of distributional assumptions. For firm i in year t, the baseline specification takes the form

$$E\left(D_{it} \mid X_{it}, \alpha_s, \alpha_p\right) = \exp\left(\beta' X_{it} + \alpha_s + \alpha_p\right),$$

where D_{it} denotes the disclosure outcome of interest. In the first part of the analysis, $D_{it} = \text{Report}_{it}$, indicating whether a firm publishes a sustainability report. In subsequent stages, D_{it} denotes the adoption of specific reporting frameworks, the transition into first-time reporting, and the presence of a materiality analysis. The vector X_{it}contains the firm-level controls described earlier, including the logarithm of total assets, profitability, leverage, liquidity, historic beta, Tobin's Q, and firm age. The terms α_s and α_p represent TRBC industry and province fixed effects, respectively, which absorb sector-specific and geographic heterogeneity in reporting practices.

To study the determinants of sustainability reporting, the model is estimated separately with industry fixed effects, province fixed effects, and a combination of both. The analysis of framework choice follows the same specification, replacing the dependent variable with indicators for GRI, Integrated/IIRC, SPK, ESRS, or other disclosure frameworks. Reporting dynamics are examined in two ways. First, the determinants of first-time reporting are modeled using the lagged specification

$$E\left(\text{FirstReport}_{it} \mid X_{i,t-1}, \alpha_i, \alpha_t\right) = \exp\left(\gamma' X_{i,t-1} + \alpha_i + \alpha_t\right),$$

where α_i and α_t denote firm and year fixed effects. Second, overall reporting persistence is analyzed by regressing Report_{it} on lagged firm characteristics. Finally, the determinants of materiality practices are modeled using the indicator for whether a report contains a materiality analysis, conditional on reporting. For this outcome, the specification follows the same form as the baseline model, estimated separately with industry, province, and combined fixed effects.

Across all models, standard errors are clustered at the firm level to account for serial correlation in reporting behavior over time. This framework enables a consistent comparison of financial determinants across different dimensions of sustainability disclosure and provides a unified structure through which the results in the next section can be interpreted.

4.4 Empirical Results

Table 9 summarizes the associations between firm characteristics and the likelihood of issuing a sustainability report. Firm size exhibits the clearest pattern: the coefficient on

log total assets is positive, stable across specifications, and large in magnitude. A one-unit increase in size is associated with roughly a 38–43 percent higher probability of reporting. Profitability, measured by return on assets, is also consistently positive, indicating that financially stronger firms tend to report more frequently. By contrast, the current ratio is negatively related to reporting. Given the estimates (about –0.17 to –0.20), a one-unit increase in the liquidity ratio corresponds to a 17–20 percent lower probability of disclosure, and a one-standard-deviation increase (2.32 units) implies a 35–45 percent reduction. Firms with weaker liquidity positions therefore appear more likely to engage in sustainability reporting, potentially reflecting differences in transparency incentives. Historic beta is positive and economically meaningful, suggesting that firms with greater exposure to market risk are more inclined to disclose. Leverage and firm age display little systematic association with the reporting outcome.

Table 9. Determinants of Sustainability Reporting

Variable	Province FE	Sector FE	Province + Sector FE
ln (Total Assets)	0.380***	0.430***	0.432***
	(0.041)	(0.033)	(0.040)
Return on Assets	0.019***	0.018***	0.019***
	(0.004)	(0.003)	(0.003)
Debt Ratio	-0.002	-0.005*	-0.005
	(0.004)	(0.003)	(0.003)
Current Ratio	-0.168***	-0.197***	-0.188***
	(0.046)	(0.042)	(0.043)
Historic β	0.394***	0.383***	0.484***
	(0.100)	(0.100)	(0.092)
Tobin's Q	0.001	0.004	0.000
	(0.009)	(0.008)	(0.010)
Age	-0.002	-0.000	-0.001
	(0.003)	(0.002)	(0.002)
Constant	-6.179***	-6.811***	-6.872***
	(0.544)	(0.494)	(0.548)
Observations	1678	1807	1678
Pseudo R2	0.178	0.194	0.199

Table 10. Determinants of Framework Choice

Panel A (All Firms)

Variable	GRI	Integrated/IIRC	SPK	ESRS	Other
ln (Total Assets)	0.433***	0.703***	0.407***	0.727***	0.177
	(0.034)	(0.096)	(0.046)	(0.187)	(0.134)
Return on Assets	0.018***	0.026***	0.033***	-0.021***	0.022*
	(0.003)	(0.007)	(0.004)	(0.006)	(0.013)
Debt Ratio	-0.006*	-0.011	-0.015***	-0.044***	0.027
	(0.003)	(0.008)	(0.005)	(0.013)	(0.018)
Current Ratio	-0.198***	-0.216***	-0.256***	-0.207**	0.138
	(0.043)	(0.055)	(0.054)	(0.089)	(0.127)
Historic β	0.396***	0.056	0.678***	0.798**	-0.754
	(0.101)	(0.329)	(0.108)	(0.315)	(1.148)
Tobin's Q	0.005	0.009	0.006	0.007	0.055**
	(0.008)	(0.009)	(0.008)	(0.032)	(0.025)
Age	0.000	-0.005	-0.001	0.015	-0.029**
	(0.002)	(0.007)	(0.003)	(0.018)	(0.013)
Constant	-6.894***	-11.262***	-7.509***	-14.046***	-7.215***
	(0.505)	(1.284)	(0.627)	(2.943)	(1.568)
Observations	1833	1809	1809	1378	535
Pseudo R2	0.195	0.263	0.161	0.225	0.139

Panel B (Reporting Firms)

Variable	GRI	Integrated/IIRC	SPK	ESRS	Other
ln (Total Assets)	-0.001	0.364***	-0.025	0.429*	-1.267***
	(0.006)	(0.105)	(0.051)	(0.223)	(0.386)
Return on Assets	-0.000	0.007	0.018***	-0.058***	0.052***
	(0.000)	(0.008)	(0.004)	(0.022)	(0.010)
Debt Ratio	-0.000	-0.005	-0.012**	-0.054***	0.139**
	(0.001)	(0.009)	(0.005)	(0.016)	(0.057)
Current Ratio	-0.000	-0.057	-0.138	-0.391	6.084***
	(0.009)	(0.119)	(0.085)	(0.252)	(1.534)
Historic β	0.007	-0.122	0.344***	0.388	1.020**
	(0.010)	(0.352)	(0.116)	(0.328)	(0.414)
Tobin's Q	-0.003	0.140**	0.012	0.010	-0.151
	(0.004)	(0.065)	(0.047)	(0.315)	(0.106)
Age	0.001*	-0.004	-0.001	0.018	-0.121***
	(0.000)	(0.007)	(0.003)	(0.022)	(0.031)
Constant	-0.030	-6.213***	-0.673	-8.196**	1.712
	(0.078)	(1.454)	(0.707)	(3.831)	(3.543)
Observations	538	538	538	402	148
Pseudo R2	0.000334	0.131	0.0488	0.147	0.432

Table 10 reports the associations between firm characteristics and the choice of sustainability reporting frameworks, which differ in both complexity and regulatory status. SPK is a simple, legally required format in the Turkish context. GRI and Integrated/IIRC are extensive, voluntary international standards, while ESRS is the most demanding framework and is particularly relevant for firms with strong economic ties to the European Union.

In Panel A, firm size is the most systematic correlate of framework choice. Larger firms are more likely to use GRI, Integrated, SPK and ESRS, with coefficients between about 0.40 and 0.73, implying that increases in scale are closely associated with selecting more structured reporting formats. Profitability is positively associated with GRI, Integrated and SPK, and with the residual "Other" category, and negatively associated with ESRS. Given that SPK is mandatory, this pattern suggests that more profitable firms are more likely to both comply with the legal requirement and to adopt additional, more demanding voluntary frameworks such as GRI and Integrated, while ESRS adopters are not concentrated among the most profitable firms. Liquidity, measured by the current ratio, is negatively related to GRI, Integrated, SPK and ESRS, so firms with tighter liquidity positions are more often observed in these structured frameworks. Historic beta is strongly and positively associated with SPK and ESRS, consistent with firms facing higher market risk tending to rely on standardized or investor-oriented formats.

Panel B restricts the sample to firms that already issue a sustainability report and examines the choice among frameworks. Within this group, size remains important mainly for Integrated and ESRS: larger reporters are more likely to adopt these complex standards but are not systematically more likely to choose GRI or SPK. For profitability, the positive association remains for SPK and Other frameworks, whereas ESRS adoption is concentrated among firms with lower ROA, again suggesting that ESRS use reflects external pressures or EU-related considerations rather than financial strength alone. Liquidity continues to be negatively related to ESRS and positively related to the heterogeneous "Other" category. Historic beta remains a strong correlate for SPK and Other formats among reporters. Overall, the evidence points to a sorting pattern in which simple mandatory SPK reports are widespread, extensive voluntary frameworks such as GRI and Integrated are chosen mainly by large and profitable firms, and the most demanding ESRS standard is adopted by a smaller subset of firms that appear especially exposed to EU-related regulatory or commercial demands.

Table 11 summarizes the dynamics of sustainability reporting. The first column examines the correlates of first-time reporting using lagged balance-sheet and market variables within a firm- and year-fixed-effects specification. None of the coefficients is statistically distinguishable from zero, and the estimates are imprecise, which is consistent with the small number of firms that initiate reporting in the panel. This pattern suggests that entry into reporting is episodic and not systematically related to the observed financial indicators. The second column shifts the focus to whether last year's characteristics are associated with the likelihood of reporting this year. Two variables display positive associations: lagged firm size and lagged Tobin's Q. Both coefficients are modest in magnitude and statistically significant at conventional levels, indicating that larger firms and firms with higher market valuations are somewhat more likely to continue or begin reporting. Other lagged financial indicators—profitability, leverage, liquidity, and market risk—exhibit no systematic relationship with reporting dynamics in this specification.

Table 11. Reporting Dynamics

Variable	First Report	Lagged Reporting
ln (Total Assets)	0.116	0.278*
	(0.756)	(0.161)
Return on Assets	0.009	0.001
	(0.024)	(0.004)
Debt Ratio	0.008	-0.000
	(0.020)	(0.004)
Current Ratio	0.086	-0.096
	(0.217)	(0.062)
Historic β	0.963	-0.037
	(0.941)	(0.165)
Tobin's Q	-0.004	0.086*
	(0.159)	(0.045)
Constant	-4.255	-3.944*
	(9.526)	(2.177)
Observations	312	616
Pseudo R2	0.132	0.0999

Table 12. Determinants of Materiality Analysis

Variable	Province FE	Sector FE	Province + Sector FE
ln (Total Assets)	-0.008	0.001	-0.002
	(0.009)	(0.007)	(0.008)
Return on Assets	0.001	0.000	0.000
	(0.000)	(0.000)	(0.000)
Debt Ratio	-0.000	-0.000	-0.000
	(0.000)	(0.001)	(0.001)
Current Ratio	-0.013	-0.011	-0.014
	(0.012)	(0.010)	(0.012)
Historic β	0.000	0.000	-0.000
	(0.018)	(0.018)	(0.016)
Tobin's Q	0.000	0.002	0.001
	(0.005)	(0.004)	(0.004)
Age	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
Constant	0.139	0.022	0.063
	(0.153)	(0.111)	(0.122)
Observations	535	538	534
Pseudo R2	0.00048	0.00081	0.00092

Table 12 summarizes how the inclusion of a materiality analysis in sustainability reports relates to firms' financial characteristics. Across specifications with province, sector, and combined fixed effects, the estimated coefficients are uniformly small and statistically indistinguishable from zero. Firm size, profitability, leverage, liquidity, market valuation,

market risk, and age show no systematic association with the use of materiality analysis, and the models have very limited explanatory power. These results indicate that, conditional on producing a report, the choice to include a materiality assessment does not vary meaningfully with observable financial attributes. Instead, the near-null pattern suggests that materiality practices are broadly homogeneous across reporting firms, consistent with the view that adoption is driven more by sectoral norms and reporting conventions—factors largely captured by fixed effects—than by financial conditions.

Evaluation and Next Steps

Taken together, the empirical findings highlight several regularities but also reveal the limits of purely cross-sectional and descriptive panel regressions for understanding the determinants of sustainability reporting practices. Firm size, profitability, and liquidity display clear associations with the likelihood of issuing a sustainability report and with the choice of reporting framework; yet these patterns flatten when conditioning on reporting maturity (materiality analysis) or on reporting initiation dynamics. The near-zero estimates in the materiality regressions, and the weak predictive content of lagged variables for first-time reporting, suggest that observable financial characteristics alone are insufficient to explain the deeper structure of firms' reporting behavior. These results underscore the preliminary and descriptive nature of the current analysis: they map correlations and reporting patterns but cannot speak to causal mechanisms or structural determinants.

A more rigorous investigation will require moving beyond reduced-form correlations toward designs that leverage exogenous variation. Several avenues are available for the next iteration of the paper. First, policy shocks -such as the SPK mandate, EU-driven ESRS adoption pressures, or changes in BIST disclosure rules- can provide quasi-experimental sources of variation for difference-in-differences or event-study strategies. Second, the staggered adoption of voluntary frameworks (GRI, Integrated/IIRC) could be studied using duration models, allowing the determinants of adoption timing to be estimated more cleanly. Third, firm-specific unobservables may be important drivers of reporting sophistication; identifying and modeling latent reporting styles or unobserved heterogeneity (e.g., via random-effects logit or correlated random effects) could capture persistent differences in disclosure culture. Fourth, linking these firm-level patterns to investor demand, foreign-ownership exposure, or EU export intensity would enable tests of whether reporting responds to external market pressures rather than internal fundamentals.

Finally, the descriptive patterns documented in this preliminary round serve as a necessary foundation for the causal phase of the paper: they identify where variation exists (reporting and framework choice), where it does not (materiality analysis), and where stronger identification strategies will be required (reporting dynamics). The next version of the paper will refine the empirical design accordingly, incorporating external shocks, richer micro-data, and more sophisticated time-series methods to uncover the mechanisms underlying sustainability disclosure behavior in Türkiye.

5 Policy Implications

This study makes three central contributions to the empirical understanding of sustainability practices in Türkiye. First, it develops the most comprehensive Sustainability Report Database assembled to date for Borsa İstanbul–listed companies. By systematically collecting sustainability, integrated, and annual reports for 705 firms over the 2016–2024 period, the study provides a longitudinal and scalable foundation for analyzing ESG disclosure behavior in an emerging market context. This database fills a major gap in the literature, where firm-level sustainability information has been fragmented, inconsistent, and often inaccessible.

Second, the paper introduces a new Materiality Dictionary that classifies 3,607 unique topics into 39 sub-topic clusters and 10 higher-level ESG clusters. This taxonomy—designed specifically for the linguistic and reporting characteristics of Turkish firms—offers the first structured framework for measuring how companies conceptualize material sustainability issues. The dictionary not only enables cross-firm comparability but also establishes a replicable methodology that future researchers can adopt to track the evolution of sustainability priorities across sectors and years.

Third, using these two novel datasets, the study conducts an empirical analysis that examines the determinants of sustainability reporting, the adoption of materiality analysis, and the distribution of material topics across firms. The results show that financial characteristics such as size, profitability, liquidity, and market risk significantly predict whether firms publish sustainability reports and whether they adopt frameworks such as GRI, Integrated Reporting, or ESRS. In contrast, the choice to conduct a materiality assessment appears less dependent on financial fundamentals and more influenced by institutional norms, external pressures, and sectoral expectations. The distribution of material topics also reveals clear patterns: Governance & Risk, Economic & Market Value, and Technology & Operations clusters dominate disclosures, while environmental topics—though prominent—remain narrower in scope compared to global peers.

Beyond these empirical insights, the findings carry broader policy implications for Türkiye and for the wider MENA region. The analysis shows that firms converge around a core set of ESG themes—such as climate risk, occupational health and safety, supply chain sustainability, and data governance—yet the methodological rigor of materiality assessments varies considerably across time and sectors. Early reports in Türkiye reveal fragmented and often unsystematic approaches, while more recent disclosures increasingly align with international standards such as GRI, SASB, and the EU's CSRD framework. This transition highlights both the rapid institutional learning taking place and the need for more structured guidance.

The methodology developed in this study offers a replicable roadmap for policymakers seeking to design or refine sustainability reporting frameworks. Many MENA countries face similar challenges: the absence of standardized reporting structures, weak enforcement mechanisms, and limited transparency regarding how firms determine material issues. The construction of a locally grounded Dictionary of Priority Topics provides regulators, stock exchanges, and standard-setters with an evidence-based tool for benchmarking disclosures, supporting assurance processes, and informing stakeholder consultations. Moreover, the database and dictionary—developed with open-access

principles—enable cross-country comparisons and support regional convergence toward global ESG norms.

As countries across the region increasingly pursue SDG-linked policy agendas and attempt to integrate into sustainable finance ecosystems, the ability to understand and evaluate firm-level materiality practices becomes critical. By documenting the drivers of ESG topic selection and tracking how disclosures evolve over time, this study contributes directly to regional efforts aimed at building a more credible, transparent, and data-driven ESG reporting landscape. It also supports alignment with key Sustainable Development Goals, particularly SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 16 (Peace, Justice, and Strong Institutions).

Together, these contributions establish a new empirical baseline for sustainability research in Türkiye and the broader region. By integrating a large-scale, hand-curated database, a systematic materiality classification, and firm-level econometric analysis, the study provides a platform for future work seeking to understand how companies internalize sustainability priorities and how regulatory, financial, and institutional dynamics shape ESG practices. Future research can build on this foundation by linking reporting behavior to real outcomes—such as investment, risk exposure, competitiveness, and transition readiness—and by exploiting policy shocks or EU-driven regulatory changes to identify causal mechanisms.

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