

**ESG Disclosure in Nepalese Commercial Banking: A FinBERT-
Based Computational Text Analysis of Annual Reports and Its
Relationship with Bank Profitability (2020/21-2024/25)**

Ajita Thapa

Faculty of Management, Tribhuvan University
Email: ajitathapa4444@gmail.com (Corresponding author)

Prashant Pokhrel

Faculty of Management, Tribhuvan University
Email: prashantpokhrel75@gmail.com

Kamal Upadhyaya

Faculty of Management, Tribhuvan University
Email: kamalupadhyaya11@gmail.com

Cite this paper Thapa, A., Pokhrel, P., & Upadhyaya, K. (2026). ESG disclosure in Nepalese commercial banking: A FinBERT-based computational text analysis of annual reports and its relationship with bank profitability (2020/21-2024/25). <i>The Journal of Development and Administrative Studies</i>, 34(1), 23-34. https://doi.org/10.3126/jodas.v34i1.100459	Abstract This study focuses on finding the information (ESG) provided in the annual reports of the commercial banks in Nepal and its connection with the bank profitability. This study applied a FinBERT-ESG natural language processing (NLP) model to analyze the ESG information in the annual reports of a group of commercial banks for a multi-year sample of annual reports in Nepal. A multidimensional ESG disclosure index was created to quantify the amount of each of the three ESG disclosure dimensions. The disclosure of ESG information differed significantly among the sampled institutions with foreign banks that are foreign joint venture banks disclosing significantly more ESG information than domestically owned private banks. Overall, governance was the most prevalent main ESG dimension reported in all sampled institutions, while there was sparse Environmental and Social reporting. In recent years, after the regulatory reforms that came into place, such as the update of the Environmental and Social Risk Management guidelines and the new national green finance taxonomy, the ESG disclosure trend has grown over time. A positive correlation was identified between ESG disclosure and Return on Assets (ROA) and Return on Equity (ROE). But a panel regression of the disclosure coefficient with ESG and bank-specific effects shows that this ESG disclosure coefficient is statistically insignificant. Hence, the positive correlation between ESG and profitability found across the sample could be mostly attributed to the influence of the ownership characteristics of those banks rather than a direct ESG disclosure profitability effect within banks. The findings point to significant variations in ESG reporting efforts among the commercial banks in Nepal and the need to take bank-specific features into account when accounting for the financial consequences of ESG reporting. Keywords: ESG disclosure, Sustainable finance, FinBERT, NLP, Text analysis, Nepalese banking, Green finance, Annual reports, Emerging markets, Bank profitability, Panel data JEL Classification: G21, Q56, M14, C89
--	---

1. Introduction

The Environmental, Social, and Governance (ESG) inclusion in corporate financial reporting is increasingly becoming a required part in contemporary global finance. Bank has a major role in this transition: as the primary intermediaries of capital allocation in most economies, their ESG disclosure practices reveal institutional commitment and play a role in shaping investor expectations (Scholtens, 2009). It also increasingly determines access to international financing and correspondent banking relationships, consistent with evidence that superior sustainability performance and disclosure is associated with reduced capital constraints (Cheng, Ioannou, & Serafeim,

2014). The market where sustainable financing concepts are still evolving ESG disclosure becomes essential for adjusting policy responses and identifying the implementation gaps. An important question arises whether ESG disclosure is merely a compliance exercise or whether it has any association with quantifiable financial outcomes like profitability.

Nepalese banking sector operates within an evolving sustainable finance landscape. The Nepal Rastra Bank (NRB) introduced Environmental and Social Risk Management (ESRM) Guidelines in 2018 and revised them in 2022 to include climate-related risks and released the Nepal Green Finance Taxonomy in 2024 as a first formal classification system for green economic activities in Nepal. Nepal has also committed to achieving net-zero carbon emissions by 2045 and requires an estimated USD 77 billion to meet its climate adaptation, mitigation, and sustainable development targets by 2030 (NRB, 2024). These regulatory and macroeconomic directives set the banking sector's ESG disclosure behavior as the major priority for Nepal's sustainable development financing agenda.

The empirical research on ESG disclosure in Nepalese banking system is limited and lacks sophisticated methodology. Majority of the existing studies are qualitative with small convenience samples and are published before the 2022 ESRM revision and 2024 Green Finance Taxonomy. The prior study has neither applied computational text analysis nor natural language processing (NLP) to measure ESG disclosure content in Nepalese bank annual reports on a scale. As well as the association of ESG disclosure with bank's financial performance is understudied. The self-reported survey data and qualitative interview-based studies have limitations in measuring volume, trends, over time and comparative variation in ESG disclosures across institution and are unable to identify the disclosure-performance relationship, a gap that systematic content-analysis approaches to disclosure measurement are specifically designed to address (Clarkson, Li, Richardson, & Vasvari, 2008).

This study addresses this gap in two stages. At first, it deploys FinBERT-ESG-9-categories, a domain-specific Natural Language Processing (NLP) model trained on financial text to automatically classify sentences into nine distinct Environmental, Social, and Governance (ESG) sub-themes, to classify and quantify ESG content across 35 annual reports of seven Nepalese commercial banks over five fiscal years (FY2020/21 to FY2024/25). The model classifies each sentence into one of nine distinct ESG topic categories and a non-ESG category and constructed an ESG disclosure index with multiple dimensions that captures both disclosure volume (ESG ratio) and thematic composition across Environmental, Social, and Governance pillars. But purely descriptive disclosure patterns cannot measure financial consequences. So, the study investigates the association between the ESG disclosure index and two measures of bank's profitability: Return on Assets (ROA) and Return on Equity (ROE), using both Spearman's rank correlation and a panel regression model with bank fixed effects.

This study makes five major contributions to literature. It is the first NLP-based empirical study of ESG disclosure in Nepalese banking; setting a methodological benchmark for future research in this and similar developing market contexts. It is the first study to statistically test the relationship between computationally derived ESG disclosure scores and bank profitability in the Nepalese context, employing both a correlation-based and a fixed-effects regression approach to distinguish association from within-bank effects. It provides bank-level evidence on how ESG disclosure has evolved across seven institutions over five fiscal years, covering two recent regulatory developments. It segregates ESG disclosure into nine granular topic categories and three pillars, identifying structural imbalances that aggregate ESG scores cannot capture. Finally, it generates institution-level findings directly actionable for NRB, the Nepal Bankers' Association, SEBON, and development finance partners engaged in Nepal's sustainable finance ecosystem.

2. Literature Review

2.1 Theoretical Framework

The ESG disclosures of banks are based on three interrelated theories. A theoretical framework for why organizations might release information as a result of social and institutional demands is provided by Legitimacy Theory. To be socially acceptable and accepted in society, organizations strive to gain and sustain legitimacy by matching their activities to the norms and expectations of the society (Suchman, 1995). In Nepal, the regulator of commercial banks, Nepal Rastra Bank (NRB) requires banks to adhere to Environmental and Social Risk Management (ESRM) and Corporate Social Responsibility (CSR) spending as a regulatory requirement. This shows minimum compliance but not necessarily real ESG integration or financial gains.

The Stakeholder Theory (Freeman, 1984) focuses on the fact that organizations exist within a context of various stakeholder groups and should take into account the various interests and expectations of these groups. Several key

players may play an important role in shaping ESG disclosure in Nepalese Commercial banks, such as NRB (regulatory authority), international development finance partners (IFC, BII, FMO), international parent institutions (Standard Chartered Group), and sustainability-focused investors. This study focuses on how stakeholder influence differs based on ownership structure. Sections 4.5 and 5.1 discuss further how this explains why ESG-profitability associations show ownership structure rather than direct causality.

According to Institutional Theory (DiMaggio & Powell, 1983), there are three ways in which institutions can become more similar, namely coercive, mimetic and normative isomorphism. NRB made progression on ESRM framework by introducing the Green Finance Taxonomy. These regulatory change acts as a coercive pressure expected to produce convergence in disclosure practices.

2.2 ESG Disclosure in Emerging Market Banking

The determinants and consequences of ESG disclosure in banking have attracted substantial scholarly attention across emerging market contexts. Finger et al. (2018) analyses the link between banks' application of the Equator Principles and financial performance in developed and developing countries. Bose et al. (2018) conclude that green-banking regulatory guidance from the Central Bank of Bangladesh had a positive impact on the level of green-banking disclosure. They also found that disclosure practices became more similar over time and that governance variables like the number of directors and institutional ownership influenced disclosure. Their finding that disclosure is predominantly compliance-driven, rather than reflecting substantive ESG integration, is directly relevant to the Nepalese context. The important facts established in South Asia specifically, are board size and foreign directors and female directors which emerged to be significant determinants of CSR disclosure among Pakistani banks (Ali, Rehman, Kanwal, Naseem, & Ahmad, 2022).

According to Ali et al. (2022), the governance factors such as board size and foreign and female directors have an impact on CSR disclosure in the Pakistani banks. Maji and Lohia (2023) investigate the link between ESG performance and firm performance in the Indian context and demonstrate that the impact of ESG and its individual pillars on firm performance may not be the same. Research in this area is limited in Nepal but increasing. One of the first systematic studies of green finance practices in Nepalese commercial banks has been carried out by Bhandari et al. (2024), revealing that compliance is the main motive for adopting green finance in the country. Despite the ambitious nature of the Green Finance Taxonomy (2024), Shrestha (2025) highlights that there are still implementation capacity constraints in Nepal's shift to green finance based on taxonomy. Similarly, Acharya et al. (2024) discover that the Nepalese banks are promoting green finance primarily through the facilitation of specific lending products, like funding for electric mobility, energy efficient housing, and renewable energy projects, as well as green savings accounts, yet these seem to be a sector-uniform strategy as opposed to a coordinated sector-wide approach.

2.3 NLP-Based ESG Disclosure Research

The application of natural language processing to ESG disclosure analysis has expanded substantially with the emergence of pre-trained transformer models. Loughran and McDonald (2011) established the seminal lexicon-based approach to financial text analysis, but subsequent research demonstrates the superiority of contextually aware transformer models for ESG classification. FinBERT (Huang et al., 2023) is the state-of-the-art domain-specific language model for financial text, pre-trained on 60,490 SEC 10-K filings, analyst reports, and earnings call transcripts. The FinBERT-ESG-9-categories variant used here-further fine-tuned on 14,000 annotated ESG and annual report sentences-achieves over 90% accuracy on held-out benchmarks. Chung and Latifi (2024) show that FinBERT-ESG achieves stronger classification performance than general-purpose and large language models on ESG text classification tasks. FinBERT-ESG has not previously been applied to South Asian or Nepalese banking annual reports, constituting a primary methodological novelty of this study.

3. Research Methods

3.1 Research Design

This study uses a longitudinal, quantitative research design based on computational text analysis of secondary data, along with a panel-based statistical test of the ESG-profitability relationship. The primary analytical tool for ESG measurement is the FinBERT-ESG-9-categories NLP model, that makes use of data from seven Nepalese commercial banks across five fiscal years. The design allows both cross-sectional comparison (differences across institutions at any given point in time) and longitudinal analysis (changes within institutions over time). Correlation and panel

regression methods are used to test the relationship between ESG disclosure and financial performance, the resulting ESG disclosure index is merged with hand collected profitability data from the same 35 annual reports.

3.2 Sample Selection

The target population consists of 20 A-grade commercial banks licensed by Nepal Rastra Bank as of FY2024/25. Purposive sampling was used to construct the sample based on two eligibility criteria: First, publication of English-language annual reports for all five fiscal years in the study window; Second, availability of machine-readable PDF annual reports. Seven banks satisfied both criteria: Everest Bank, Himalayan Bank, Kumari Bank, Laxmi Sunrise Bank, NMB Bank, Siddhartha Bank, and Standard Chartered Bank Nepal. The sample consists of two foreign joint venture banks (Standard Chartered Nepal and Everest Bank), one domestically owned bank with an IFC development finance partnership (NMB Bank), and four purely domestic private banks (Himalayan, Kumari, Laxmi Sunrise, and Siddhartha).

In order to preserve the anonymity of the institutions in reporting results, each bank has been randomly given a identified label (Sample 1 through Sample 7), which is employed throughout the text in Sections 4 and 5. The mapping between the labels of the sample and the identities of the banks is intentionally not disclosed as FinBERT-ESG-9-categories has not been independently validated in the Nepalese banking space, in order to prevent readers from inferring the ESG position of individual banks from the invalidated measurement tool in the Nepalese Banking space. In this section, and Appendix A (Table A1), bank names are used only in connection with the bank sample assignment and not to identify the sample banks.

3.3 Data Collection and Preprocessing

The annual report used in the study was downloaded in the pdf format from the website of the selected banks. Text was extracted using pdfplumber Python library (version 0.11). Only the first 80 pages of each report were analyzed due to the large size of the reports. Most of the pages of the report consisted of ESG related information as further manual verification was done. Language detection was done following the extraction at a sentence level using langdetect Python library. Characters were less than 30 removed because they were less likely to contain meaningful ESG related information. Sentences in Nepali language were removed as FinBERT model used only processed English-language text. Sentences longer than 500 characters were shortened before classification. This preprocessing stage was applied consistently to all 35 annual reports before ESG classification stage.

3.4 NLP Model: FinBERT-ESG-9-Categories

ESG classification was carried out using the FinBERT-ESG-9-categories model (Hugging Face model identifier: yiyanghkust/finbert-esg-9-categories) (Figure 1). The model was accessed through the Hugging Face Transformers library PyTorch backend. This model is a domain-specific extension of FinBERT that was pre-trained on 60,490 SEC 10-K and 10-Q filings, financial analyst reports, and earnings call transcripts, it was later fine-tuned using around 14,000 manually labelled sentences from ESG and annual report. According to (Huang et al., 2023), on the benchmark dataset the model achieved more than 90% classification accuracy. For each annual report, the first 200 qualifying sentences were given to the model for classification. The model classified each sentence into one of ten categories: Climate Change, Natural Capital, Pollution & Waste, Human Capital, Product Liability, Community Relations, Corporate Governance, Business Ethics & Values, and Non-ESG.

3.5 ESG Disclosure Index Construction

For each bank and year, four disclosure metrics are constructed. The first was the ESG Ratio which shows the percentage of classified sentences that were identified as related to ESG. The second metric: Topic Coverage Score counts how many different ESG topics appeared at least once in bank's annual report. The third metric: Pillar Balance shows how ESG sentences were distributed across Environmental (E = Climate Change + Natural Capital + Pollution & Waste), Social (S = Human Capital + Product Liability + Community Relations), and Governance (G = Corporate Governance + Business Ethics & Values) pillars; and the fourth measure was Dominant Topic which identified the ESG category that appeared most frequently for each bank in each year.

3.6 Profitability Data Collection

Return on Assets and Return on Equity are the two profitability indicators used in this study, which were manually extracted from the same 35 annual reports used for ESG classification. The ratios were manually calculated for the reports disclosing only data such as net profit, total assets, or book net worth. The annual report of four banks included the revised figures, showing bonus share adjustments, these revised values were used for internal

consistency. The ROE for Everest Bank in FY2024/25 was not disclosed so this was treated as missing. The number of observations for ROE based test was $N = 34$ and for ROA based tests was $N=35$.

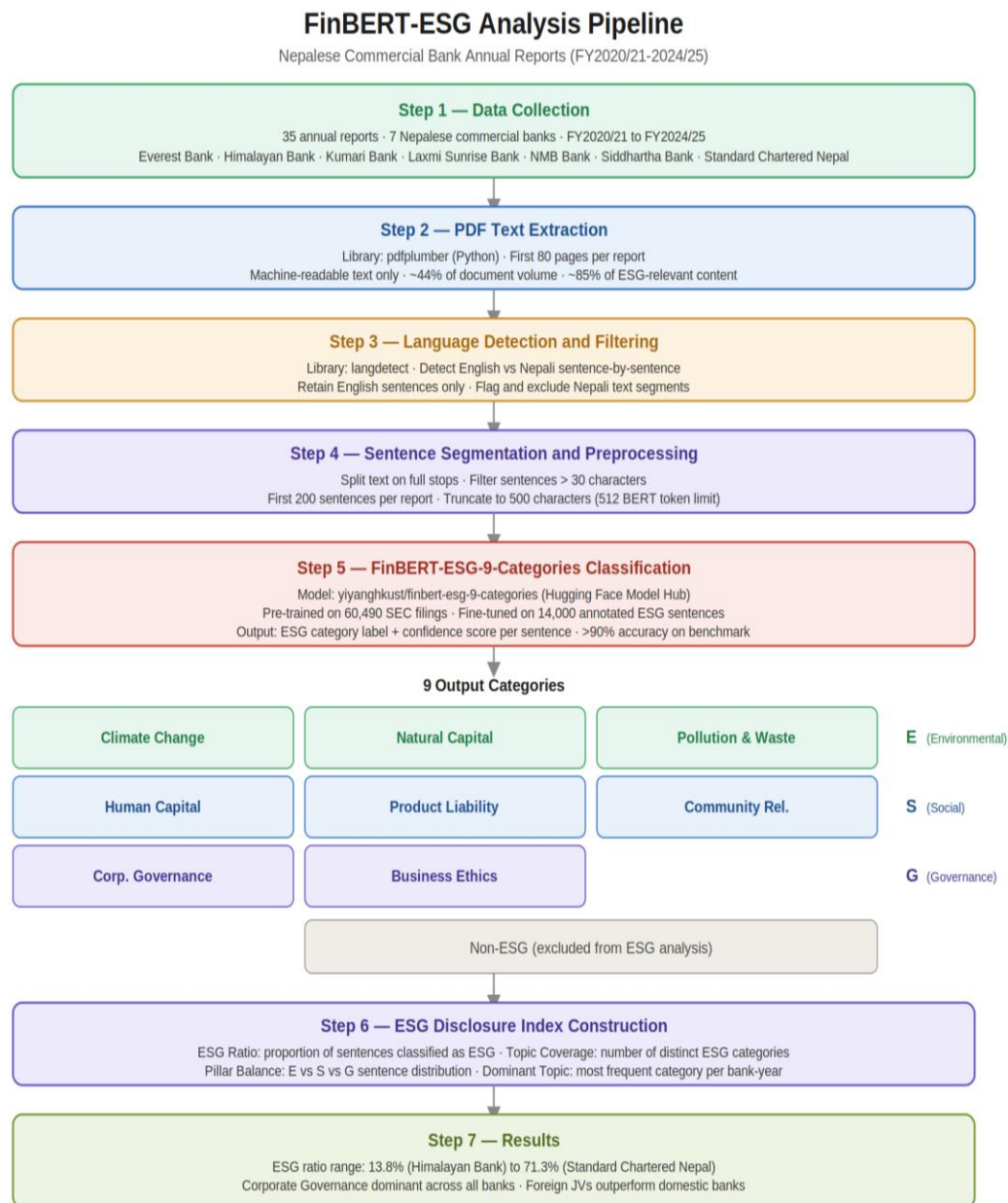


Figure 1: FinBERT-ESG-9-Categories Analysis Pipeline

Note: The pipeline processes 35 annual reports from 7 Nepalese commercial banks (FY2020/21–FY2024/25). Source: Authors own construction.

3.7 Statistical Analysis

This study uses four statistical techniques. To begin with, descriptive statistics, the mean, standard deviation, minimum, median, maximum of each bank's ESG disclosure index across five-year study period were calculated. The Kruskal-Wallis test was then used to examine whether differences in ESG disclosure ratios across the seven banks were statistically significant. This test was selected as appropriate for small sample size and non-normal distribution of data as a non-pragmatic alternative for one-way ANOVA. The third method applied was the Mann-Whitney U test, to assess whether the foreign joint venture banks disclose more ESG content compared to domestically owned banks. The fourth statistical method involved computation of Spearman's rank correlation coefficient between ESG disclosure index and both profitability measures ROA and ROE, to test the relationship between ESG disclosure and bank profitability. This is consistent with the non-parametric approach adopted earlier in this study, the analysis was additionally supported by an ordinary least square (OLS) panel regression specified as follows:

$$\text{Profitability}_{it} = \beta_0 + \beta_1 \text{ESG_Ratio}_{it} + \sum_k \gamma_k \text{Bank}_{ik} + \epsilon_{it}$$

Where, i indexes bank, t indexes fiscal year and Profitability it is alternately ROA and ROE. Bank fixed effects (Σ_k Bank _{k}) are included to absorb all the time-invariant characteristics unique to each bank such as ownership structure, institutional size, and managerial approach that might otherwise confound the estimated relationship between ESG disclosure and profitability. By controlling for the differences between banks, this model studies the relationship between ESG disclosure and profitability within each bank over time, similar to the approach adopted in comparable South Asian banking studies (Ali et al., 2022; Maji & Lohia, 2023). All statistical procedures were carried out using the SciPy and statsmodels libraries in Python 3.13.

4. Results

4.1 Descriptive Statistics and ESG Disclosure Ratio by Bank

Table 1 shows descriptive statistics for the ESG disclosure ratio across the seven sampled Nepalese commercial banks. The overall mean ESG ratio of 35 bank-year observations is 44.40% (SD = 22.09%), with a range of 12.0% to 78.5%, indicating notable variation in ESG disclosure depth across Nepalese commercial banks. Sample 7 records the highest average ESG ratio at 71.3%, while Sample 2 records the lowest at 13.8%. There is a gap of 57.5 percentage points. Figure 2 presents these results visually. The Kruskal-Wallis test confirms that differences in ESG disclosure ratios across the seven sampled banks are highly statistically significant ($H(6, N=35) = 22.263, p = 0.001$). It rejects the null hypothesis of equal ESG disclosure across institutions. The Mann-Whitney U test further confirms that foreign joint venture banks (mean ESG ratio = 61.85%) disclose significantly more ESG content than domestically owned private banks (mean = 33.42%), with the difference being highly significant ($U = 170.0, p = 0.001$). These statistical results confirm that the differences observed in ESG disclosure across Nepalese commercial banks reflect real operational differences rather than random sampling variation.

Table 1: Descriptive Statistics -ESG Disclosure Ratio by Bank (FY2020/21-2024/25)

Banks	N	Mean (%)	SD (%)	Min (%)	Median (%)	Max (%)
Sample 7	5	71.3	4.2	67.5	68.0	78.5
Sample 6	5	54.4	3.8	49.5	54.0	61.5
Sample 5	5	53.4	9.8	43.5	53.5	70.5
Sample 1	5	52.4	13.2	27.0	57.5	62.0
Sample 3	5	33.7	16.8	13.0	34.0	60.5
Sample 4	5	31.8	20.1	13.0	27.0	68.0
Sample 2	5	13.8	1.6	12.0	13.0	16.0
Overall Sample	35	44.40	22.09	12.0	52.4	78.5

Note: ESG ratio = proportion of classified sentences assigned to any ESG category. Source: Authors' calculations based on FinBERT-ESG-9-categories model output.

Table 2: Statistical Test Results-ESG Disclosure

Test	Statistic	p-value	Result
Kruskal-Wallis (across all 7 banks)	$H(6)=22.263$	0.001	Significant differences across banks ***
Mann-Whitney U (Foreign JV vs Domestic)	$U=170.0$	0.001	Foreign JV banks disclose significantly more ***

Note: ** $p < 0.001$. Foreign JV banks: Sample 7, Sample 1 (mean = 61.85%). Domestic private banks: Sample 2, Sample 3, Sample 4, Sample 6 (mean = 33.42%). Source: Authors' calculations using SciPy library, Python 3.13.*

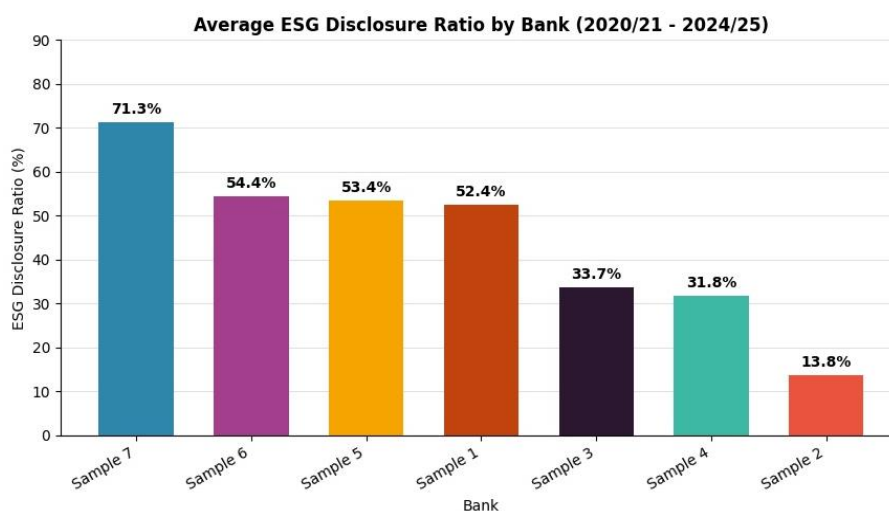


Figure 2: Average ESG Disclosure Ratio by Bank (FY2020/21–2024/25)

Source: Authors' calculations based on FinBERT-ESG-9-categories model output.

4.2 Longitudinal ESG Disclosure Trends

Figure 3 presents the year-wise ESG disclosure ratio for each bank across the five-year study period, highlighting a few clear trends. Sample 1 made the biggest jump, climbing from 27.0% in FY2020/21 to 62.0% in FY2022/23. There is a 35-percentage-point increase over two years before stabilizing at approximately 57–58% in subsequent years. Sample 7 has a very high ESG ratio overall across the study period (average 67–74%). There was a peak ESG ratio of 78.5% in FY 2023/24. Sample 5 showed the most stable growth, rising from 45.0% in FY2020/21 to 70.5% in FY2024/25. Sample 2 remained at the bottom with only slight variations between 12.0% and 16.0% and remained around a compliance-floor.

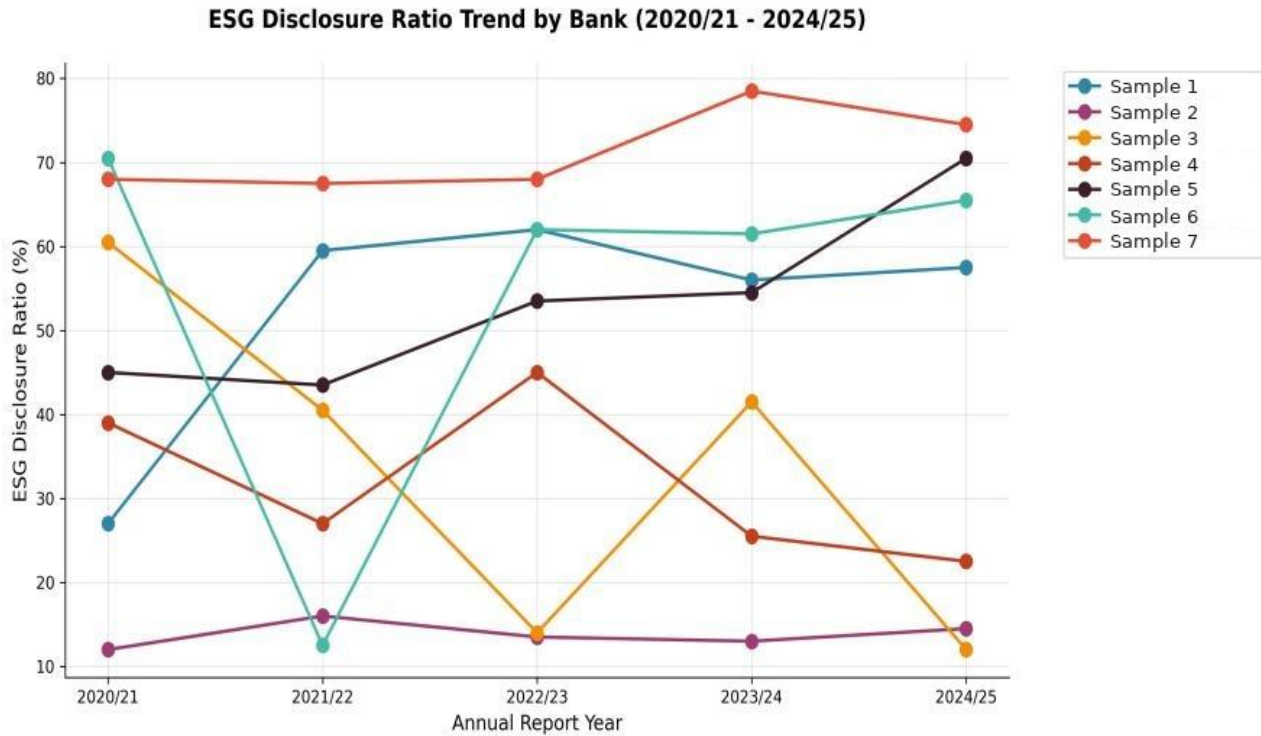


Figure 3: ESG Disclosure Ratio Trend by Bank (FY2020/21–2024/25)

Source: Authors' calculations based on FinBERT-ESG-9-categories model output.

4.3 ESG Topic Distribution

Table 3 and Figure 4 present the average sentence count per ESG topic category across the five-year study period for each bank. Corporate Governance is the dominant topic across all seven institutions, suggesting that Governance matters most in Nepalese banks ESG reporting. Sample 5 has the highest average of Corporate Governance sentences per report (55.0 sentences per report), followed by Sample 7 (49.0) and Sample 1 (49.4). Overall, Sample 7 had the highest average for the subject of Community Relations (37.2 sentences), and it was one of the most disclosed topics. The average boilerplate climate risk disclosure language is in sample 2, which has the highest Climate Change count (18.2 sentences), but the overall low ESG ratio.

Table 3: ESG Topic Distribution by Bank-Average Sentences per Topic (FY2020/21–2024/25)

Banks	Climate Change	Natural Capital	Poll. & Waste	Human Capital	Community Rel.	Corp. Gov.	Bus. Ethics	Non-ESG
Sample 1	8.0	0.4	0.4	15.2	16.4	49.4	0.0	~92
Sample 2	18.2	0.0	1.2	1.2	0.0	6.6	0.0	~166
Sample 3	3.2	0.0	0.0	12.6	11.6	28.6	0.0	~144
Sample 4	4.0	0.0	0.0	2.4	3.2	48.0	0.0	~142
Sample 5	9.0	0.2	0.2	5.2	27.4	55.0	0.0	~103
Sample 6	11.6	0.4	0.8	23.8	19.4	26.8	0.0	~118
Sample 7	12.8	2.2	1.0	18.2	37.2	49.0	0.0	~79
Sample Average	9.5	0.5	0.5	11.2	16.5	37.6	0.0	~121

Note: Values represent average sentences per annual report across FY2020/21–FY2024/25.

Source: Authors' calculations.

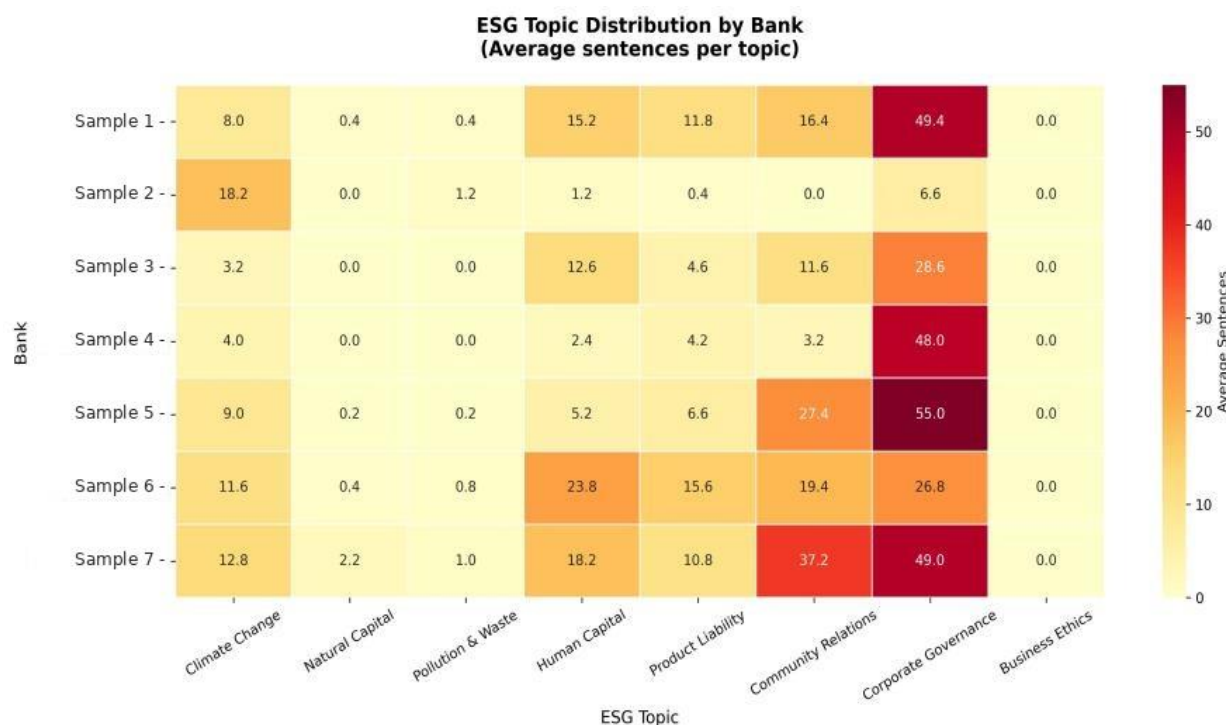


Figure 4: ESG Topic Distribution Heatmap by Bank

Source: Authors' calculations based on FinBERT-ESG-9-categories model output.

4.4 Environmental, Social, and Governance Pillar Analysis

Figure 5 breaks down the ESG information into three main areas: Environmental, Social, and Governance. Governance (G) is by far the most disclosed topic for all seven banks, making up about 57% of total ESG sentences, Social(S) Pillars come in second at around 30%, followed by Environmental (E) topics at just 13%. This Governance pillar dominance is observed across institutions, but the overall ESG disclosure depth varies across them. Sample 7 is the only bank where social topics come close to matching Governance, reflecting the global parent company's standards for community investment and human capital reporting frameworks. On the other hand, Sample 2 ESG content shows higher disclosure on Governance and Environmental issues (primarily climate change) categories, with minimum social disclosure.

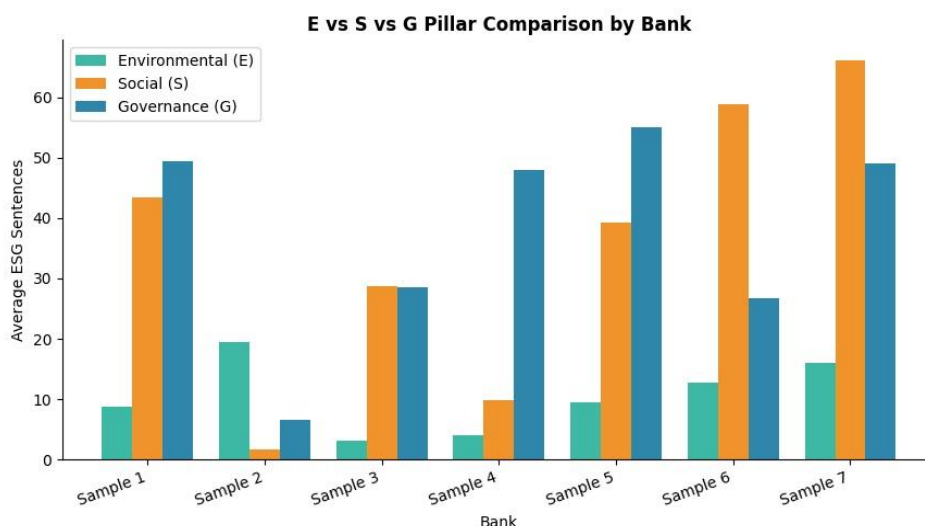


Figure 5: Environmental (E), Social (S), and Governance (G) Pillar Comparison by Bank

Source: Authors' calculations based on FinBERT-ESG-9-categories model output.

4.5 ESG Disclosure and Bank Profitability

This section tests if ESG Disclosure Index is statistically associated with bank profitability, even when taking individual bank differences into account. Table 4 presents Spearman's rank correlation between the ESG Disclosure

Index and both profitability measures. ESG Ratio is positively and significantly correlated with Return on Assets ($\rho = 0.651$, $p < 0.001$, 35) and Return on Equity ($\rho = 0.582$, $p < 0.001$, 34), bank-years with higher ESG disclosure tend to have higher profitability.

Table 4: Spearman's Rank Correlation-ESG Disclosure Ratio and Bank Profitability

Relationship	N	Spearman's rho	p-value	Result
ESG Ratio vs. ROA	35	0.651	<0.001	Significant positive correlation ***
ESG Ratio vs. ROE	34	0.582	<0.001	Significant positive correlation ***

Note: ** $p < 0.001$. N = 34 for ROE due to one missing observation (Everest Bank, FY2024/25; see Section 3.6).

Source: Authors' calculations, SciPy, Python 3.13.*

However, simple correlation may not be able to differentiate between ESG-driven effect and influence of other bank-specific characteristic such as ownership on profitability. Table 5 presents the panel regression from Section 3.7, in which such difference is absorbed by bank fixed effects. Once those factors are controlled for, the link between ESG reporting and profitability completely disappears for both ROA ($\beta = 0.0052$, $p = 0.335$) and ROE ($\beta = 0.0423$, $p = 0.382$). Even though the models explain a lot about the overall profit differences ($R^2 = 0.595$ and 0.500), that power comes almost entirely from the specific bank's identity rather than its ESG scores. Similar to Section 4.1, the fixed effect for Sample 7 is significantly positive in the ROA model ($\beta = 0.627$, $p = 0.030$), while Sample 3's is significantly negative in both models (ROA: $\beta = -0.592$, $p = 0.040$; ROE: $\beta = -6.744$, $p = 0.013$).

Table 5: Panel Regression Results-ESG Disclosure Ratio and Bank Profitability (Bank Fixed Effects)

Dependent Variables	ESG Ratio Coefficient	Std. Error	p-value	Model R^2	N
ROA	0.0052	0.005	0.335	0.595	35
ROE	0.0423	0.048	0.382	0.500	34

Note: Both models include bank fixed effects ($C(\text{Bank})$); reference category: Sample 1. Source: Authors' calculations, statsmodels, Python 3.13.

These results show that broad structural differences between institutions, specifically whether a bank is a foreign joint venture or a purely domestic bank mostly drive the link between ESG disclosure and profitability, rather than changes happening inside individual banks over time. This is in line with recent evidence from the Chinese banking sector, which indicates that foreign ownership, but not state ownership, is significantly positively linked to the disclosure of corporate social responsibility (CSR) (Zhang et al., 2026) and shows that the ownership-linked disclosure pattern found in the present paper is not a mere Nepal-specific artifact, but is more a reflection of the general disclosure pattern of emerging-market banking sectors. It suggests the relationship depends on the type of bank involved rather than individual bank actions, a direct implication for the policy discussion in Section 5.5.

5. Discussion

5.1 Ownership Structure as the Primary Determinant of ESG Disclosure

The clearest finding of this study is the systematic relationship between bank ownership structure and ESG disclosure depth, confirmed by the Mann-Whitney U test ($U = 170.0$, $p = 0.001$). Sample 7 (71.3%) and Sample 1 (52.4%), which are foreign joint venture banks both rank in the top four disclosers, while the bottom three ranked banks are purely domestic private banks. The ESG reporting standards set by these banks' respective foreign parent institutions may also influence the reporting practices followed by their joint venture partners in Nepal. The ESG-profitability correlation documented in Section 4.5 is also explained by this same ownership variable. Because of the underlying advantages such as wider capital access, support from parent institutions, and well-established risk management system, joint venture banks seem to have higher ESG disclosure rate and better financial performance rather than just ESG disclosure leading to profitability, or vice versa.

Sample 5 is the highest-disclosing domestically owned bank, which suggests the possible influence of ESG reporting practices tied to an international development finance partnership. Such a partnership typically requires the bank to meet Environmental and Social Performance Standards, which encourages Sample 5 to integrate ESG practices and disclosure while other domestic banks without such partnerships may not have such external influence (Wright & Rwabizambuga, 2006).

5.2 The Compliance Floor: Sample 2

The low and stable ESG ratio of Sample 2 (average 13.8%, range 12–16% across five years) is consistent with a compliance-floor pattern that can be explained through Legitimacy Theory (Suchman, 1995). The bank may disclose the minimum ESG content necessary to meet regulatory requirements with less emphasis on internalizing the ESG

considerations into its strategic reporting approach. The bank's ESG ratio is relatively unchanged even after the 2022 ESRM revision. Despite having funds the lowest overall ESG ratio Sample 2 has highest Climate Change sentence count in the sample (18.2 sentences), which illustrates an important limitation of aggregate volume metrics. So, the quantity of the disclosure alone may not fully represent the quality or depth of ESG disclosure. Interestingly, Sample 2 recorded the sample's largest decline in profitability over the study period (ROE falling from 14.89% in FY2020/21 to 0.35% in FY2024/25), this shows bank-specific factors are also important in explaining profitability, rather than ESG disclosure itself for explaining the change in profitability, a point supported by the fixed-effects regression in Section 4.5.2.

5.3 Governance Dominance and Underdevelopment of E and S Pillars

The Governance pillar dominates the disclosure pattern across all seven sampled banks (average 57% of ESG sentences) which indicates a structural characteristic of Nepalese banking ESG reporting, appears to be related to the longer history of corporate governance regulations in Nepal, whereas the environmental and social regulation frameworks are still emerging. The limited Natural Capital, Pollution & Waste, and Business Ethics disclosures across the sample are concerning, given Nepal's biodiversity significance (Government of Nepal, Ministry of Forests and Soil Conservation, 2014) and the environmental risk exposure of commercial bank portfolios to hydropower and agricultural sectors (NRB, 2018, 2022). The mandatory E and S disclosure requirements in the ESRM framework may need to be strengthened to balance the current pillar distribution.

5.4 Regulatory Impact

The findings of the study over time suggest that the ESG disclosure behavior of the banks may be influenced by the regulatory environment. The largest increment in ESG ratio is of Sample 1 from 27% to 62% and Sample 5 from 45% to 70.5% between FY2020/21 and FY2022/23. These increments are consistent with the coercive isomorphic pressure explained through Institutional Theory (DiMaggio & Powell, 1983). The regulatory tightening through the 2022 ESRM revision may have contributed to observable alignment in institutional disclosure behavior among banks with sufficient capacity and management commitment. Sample 7's highest ESG ratio of 78.5% in FY2023/24 may reflect proactive voluntary alignment with the upcoming Green Finance Taxonomy, consistent with normative isomorphic pressure among internationally oriented institutions.

5.5 Policy Implications

The findings carry direct implications for Nepal's sustainable finance stakeholders. The gap between the highest and the lowest disclosing institution is 57.5 percentage points, which suggests compliance-based regulation alone is insufficient to produce uniform ESG disclosure. This gap would likely be reduced if the audited disclosure requirements aligned with the Green Finance Taxonomy are mandatory. The profitability findings in Section 4.5 suggest that the bank management is not encouraged to view ESG disclosure primarily as a driver of profitability. ESG disclosure and financial performance appear to be jointly influenced by ownership structure and international capital access; the implication of these findings is that policy should target disclosure quality directly rather than promoting it by claiming that it will increase profitability. For the Nepal Bankers' Association, the results support peer-learning mechanisms through NBA's Sustainable Finance Community of Practice. The case of Sample 5 shows that the development of finance partnerships having ESG covenants attached to lending facilities is effective way of capacity transfer; similar partnerships may improve ESG capacity independent of any direct profitability incentive.

6. Conclusion

This study presents the first computational text analysis of ESG disclosures in Nepalese commercial bank annual reports, to test the ESG-profitability relationship, employing FinBERT-ESG-9-categories to classify ESG content across 35 annual reports from seven institutions over five fiscal years. The overall mean ESG disclosure ratio is 44.40% (SD = 22.09%), with statistically significant differences across institutions (Kruskal-Wallis $H(6) = 22.263$, $p = 0.001$) and significantly higher disclosure among foreign joint venture banks (Mann-Whitney $U = 170.0$, $p = 0.001$). Corporate Governance is the most disclosed topic across all institutions, while the disclosure of Environmental and Social pillar is much lower. Longitudinal evidence suggests significant improvements of institutions with sufficient capacity might be associated with the 2022 ESRM revision, while others tend to meet compliance floor.

Further analysis finds a significant positive Spearman correlation between ESG disclosure and both ROA ($\rho = 0.651$, $p < 0.001$) and ROE ($\rho = 0.582$, $p < 0.001$). After controlling for bank specific characteristics, the study

indicates the effect of ESG-disclosure is not statically significant and the bank-specific differences such as types of banks and ownership structure may also have the association with profitability rather than ESG disclosure itself leading to profitability. Similar to Pakistani and Indian banking evidence, positive correlation between ESG disclosure and profitability may not always signal an independent relationship, while institutional differences may play an important role in explaining profitability.

This study has several limitations. The sample does not include government-owned banks and smaller A-grade banks. The 80-page extraction limit may not include disclosures beyond 80 pages and under-count disclosures in very long reports. FinBERT-ESG-9-categories was trained primarily on Western English-language text, so manual validation would produce higher confidence in findings while validating reports published in Nepalese context. The profitability analysis is carried out on a small panel (35 bank-year observations), making it harder to find statistically significant results, and limiting the additional control variables such as bank size. Some figures are restated comparative figures rather than as-originally-published figures (Section 3.6). Future research should include other types of banks and financial institutions in their sample, use sentiment analysis, test whether ESG disclosure in one year is related to profitability a later year, and examine whether the ownership-driven pattern persists as Nepal's sustainable finance regulatory framework matures.

References

- Acharya, S., Shrestha, S. K., Neupane, D., & Mahat, D. (2024). Exploring green finance practices for advancing sustainable development in Nepalese banking sector. *NPRC Journal of Multidisciplinary Research*, 1(8), 23–34. <https://doi.org/10.3126/nprcjmr.v1i8.73024>
- Ali, R., Rehman, R. U., Kanwal, M., Naseem, M. A., & Ahmad, M. I. (2022). Determinants of corporate social responsibility disclosure of banking sector in Pakistan. *Social Responsibility Journal*, 18(5), 1019–1034. <https://doi.org/10.1108/SRJ-08-2019-0272>
- Bhandari, M., Tiwari, G., Dhakal, M., & G. C., S. B. (2024). Green finance practices by Nepalese commercial banks: Fostering sustainable development in Nepal. *International Journal of Sustainable Development and Planning*, 19(5), 1989–1997. <https://doi.org/10.18280/ijstdp.190538>
- Bose, S., Khan, H. Z., Rashid, A., & Islam, S. (2018). What drives green banking disclosure? An institutional and corporate governance perspective. *Asia Pacific Journal of Management*, 35(2), 501–527. <https://doi.org/10.1007/s10490-017-9528-x>
- Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, 35(1), 1–23. <https://doi.org/10.1002/smj.2131>
- Chung, T. Y., & Latifi, M. (2024). *Evaluating the performance of state-of-the-art ESG domain-specific pre-trained large language models in text classification against existing models and traditional machine learning techniques*. arXiv. <https://arxiv.org/abs/2410.00207>
- Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, 33(4–5), 303–327. <https://doi.org/10.1016/j.aos.2007.05.003>
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147–160.
- Finger, M., Gavius, I., & Manos, R. (2018). Environmental risk management and financial performance in the banking industry: A cross-country comparison. *Journal of International Financial Markets, Institutions and Money*, 52, 240–261.
- Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Pitman Publishing.
- Government of Nepal, Ministry of Forests and Soil Conservation. (2014). *Nepal national biodiversity strategy and action plan 2014–2020*. Convention on Biological Diversity. <https://www.cbd.int/doc/world/np/np-nbsap-v2-en.pdf>
- Huang, A. H., Wang, H., & Yang, Y. (2023). FinBERT: A large language model for extracting information from financial text. *Contemporary Accounting Research*, 40(2), 806–841. <https://doi.org/10.1111/1911-3846.12832>
- Loughran, T., & McDonald, B. (2011). When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks. *The Journal of Finance*, 66(1), 35–65. <https://doi.org/10.1111/j.1540-6261.2010.01625.x>

Maji, S. G., & Lohia, P. (2023). Environmental, social and governance (ESG) performance and firm performance in India. *Society and Business Review*, 18(1), 175–194. <https://doi.org/10.1108/SBR-06-2022-0162>

Nepal Rastra Bank. (2018). *Environmental and Social Risk Management (ESRM) guidelines for banks and financial institutions*. https://www.nrb.org.np/contents/uploads/2019/12/Guidelines-Guideline_on_Environmental__Social_Risk_Management_for_Banks_and_Financial_Institutions_2018-new.pdf

Nepal Rastra Bank. (2022). *Environmental and Social Risk Management (ESRM) guidelines for banks and financial institutions (Revised)*. <https://www.nrb.org.np/contents/uploads/2022/02/Final-ESRM-with-cover.pdf>

Nepal Rastra Bank. (2024). *Nepal Green Finance Taxonomy*. <https://www.nrb.org.np/contents/uploads/2024/10/Nepal-Green-Finance-Taxonomy-2024-V1.pdf>

Scholtens, B. (2009). Corporate social responsibility in the international banking industry. *Journal of Business Ethics*, 86(2), 159–175. <https://doi.org/10.1007/s10551-008-9841-x>

Shrestha, B. S. (2025). From directed lending to green taxonomy: Sustainable finance adoption in Nepal's commercial banking sector. *Journal of Contemporary Review*, 3(3), 36–42. <https://doi.org/10.3126/jcr.v3i3.88125>

Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *The Academy of Management Review*, 20(3), 571–610.

Wright, C., & Rwabizambuga, A. (2006). Institutional pressures, corporate reputation, and voluntary codes of conduct: An examination of the Equator Principles. *Business and Society Review*, 111(1), 89–117. <https://doi.org/10.1111/j.1467-8594.2006.00263.x>

Zhang, H., Ji, J., Zhang, H., & Chen, L. (2026). Does ownership matter for corporate social responsibility disclosure in banks? Evidence from China. *Review of Quantitative Finance and Accounting*. <https://doi.org/10.1007/s11156-026-01519-4>

Appendix A: Sample Description

Table A1: Sample Banks and Annual Report Coverage				
Bank	Ownership Type	Reports (N)	Avg. Words	Study Period
Everest Bank	Foreign Joint Venture	5	52,121	FY2020/21–FY2024/25
Himalayan Bank	Domestic Private	5	29,574	FY2020/21–FY2024/25
Kumari Bank	Domestic Private	5	88,150	FY2020/21–FY2024/25
Laxmi Sunrise Bank	Domestic Private	5	39,440	FY2020/21–FY2024/25
NMB Bank	Domestic Private	5	55,015	FY2020/21–FY2024/25
Siddhartha Bank	Domestic Private	5	91,024	FY2020/21–FY2024/25
Standard Chartered	Foreign Joint Venture	5	58,081	FY2020/21–FY2024/25
Total		35	59,058	FY2020/21–FY2024/25

Note: Word counts reflect text extracted from first 80 pages per annual report. Banks are listed alphabetically; this order does not correspond to the Sample numbering used in Sections 4–5.

Appendix B: Technical Specifications

Table B1: NLP Pipeline Technical Specifications	
Parameter	Specification
NLP Model	yyanghkust/finbert-esg-9-categories (Hugging Face)
Model Base	FinBERT-domain-adapted BERT pre-trained on 60,490 SEC filings
Fine-tuning Data	14,000 manually annotated ESG and annual report sentences
Output Categories	9 ESG categories + Non-ESG (10 total)
Benchmark Accuracy	>90% on held-out ESG text benchmarks (Huang et al., 2023)
Programming Language	Python 3.13
Key Libraries	Transformers 4.x, PyTorch, pdfplumber 0.11, pandas, langdetect, SciPy, statsmodels
Pages Extracted	First 80 pages per annual report
Sentences Classified	First 200 qualifying sentences per report (minimum 30 characters)
Max Sentence Length	500 characters (512 BERT token limit)
Language Filter	langdetect library; Nepali sentences excluded prior to classification
Statistical Tests	Kruskal-Wallis, Mann-Whitney U, Spearman’s rank correlation, OLS panel regression with fixed effects (SciPy, statsmodels)
Analysis Completed	June 2026

Source: Authors’ own construction.