Green Disclosure Practices and Corporate Performance: A Predictive Indicator Model

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Abstract

Global warming and climate change have been the most challenging environmental problems the world is facing. This problem will affect the future of this planet which can be seen from different stances. Green disclosure refers to companies reporting their environmental impact, sustainability efforts, and eco-friendly initiatives. It aims to provide transparency about a company's commitment to environmental stewardship and its role in sustainable development. The study's three main goals are first, to examine the various theoretical frameworks that support green disclosure, giving readers a thorough understanding of the concepts, theories, and principles involved; second, to analyse and assess the green disclosure practices of a few chosen companies in the cement and automotive industries, showing how these sectors manage and report their environmental impact; and last, to develop a model that explains the significance of various green disclosure indicators, which will aid in evaluating and forecasting the environmental performance of companies. One-way ANOVA, correlation method, and neural network have been used to predict key indicators for the success or sound financial performance of the company. The result shows notable differences in the environmental disclosures made by the 26 companies chosen from the cement and automotive industries. The results imply that businesses with strong green disclosure policies vary from one another. Prediction of normalized importance material (GRI-1) found at the top priority with 80.4%, Biodiversity at 39.1%, and energy at 34.3% at second and third priority respectively

Key Words: Green disclosure practices, firm performance, GRI guidelines, global sustainability, prediction

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Introduction

Traditional accounting practices primarily focus on financial performance indicators such as revenue, expenses, and profits. Green accounting, on the other side, broadens this focus to consider how corporate activities impact the environment more broadly, including things like waste production, water use, carbon emissions, and social responsibility programs. The goal of green accounting, also referred to as environmental accounting, is to consider sustainability and the environment.

Environmentalism is both a societal and economic imperative for the modern world. Environmental

reporting has been viewed as a way of increasing the accountability of organizations regarding environmental issues *(Joshi et al., 2011)*.A business must prioritize all its stakeholders, including the environment, its owners, and management. Shortly, a company that engages in ecological preservation can benefit the local community and the business. *(Nengsih et al., 2023)***.**

The impact of green disclosure on firm performance may differ across industries, regions, and firm sizes. For instance, firms in environmentally sensitive industries might experience a more pronounced effect of green disclosure on their performance compared to those in less sensitive sectors *(Hassel et al., 2005)*. The efficacy of green disclosure methods can be impacted by regional market expectations and regulatory environments *(Luo et al., 2012).*

One way for businesses to take accountability for the environmental effects of their production processes is through green disclosure. The goal of the "green accounting" method of accounting is to include environmental expenses in the financial results of company operations. Policymakers seek an updated framework that includes green accounting due to claim that the GDP disregards environmental concerns. Green accounting's primary goal is to assist companies in comprehending and managing the possible trade-off between conventional economic objectives and environmental goals. Additionally, it expands the amount of crucial data that can be used to analyze policy concerns, particularly when those crucial details are frequently missed. It is believed that green accounting only guarantees weak sustainability, which is why it should be viewed as a first step toward strong sustainability.

Degradation of the environment cannot be tolerated at the expense of economic prosperity. Green disclosure is the most practical strategy for both ecological and economic development. Many summits and conferences have included a sustainable development framework in their action plans to address the urgent problems caused by climate change.

GRI Framework - A Brief Introduction

The Global Reporting Initiative (GRI), a prominent international organization, created the most popular methodology for sustainability reporting. Established in 1997, GRI provides standardized guidelines for organizations to measure and communicate their economic, environmental, and social performance. The GRI Standards, structured to apply to organizations of all sizes and sectors, aim to enhance transparency, accountability, and comparability in sustainability reporting. By adhering to these standards, businesses can track their impact on key sustainability issues, such as climate change, labour practices, human rights, and economic inequality, while providing stakeholders with credible, comparable, and reliable information. The GRI framework was broadened to incorporate economic, social, and governance factors in its reporting in 1998, following the formation of a multi-stakeholder Steering Committee. The GRI rules were initially released in June 2000, and then again in 2002. In 2006, the third version, or G3, was released. It included comprehensive guidelines for reporting sustainability. In 2011, G3.1 was released, and in 2013, G4 was released. KPMG survey reports from 2008 and 2013 state that the GRI framework is a commonly used format for reporting on environmental, social, and economic performance. The four categories in the GRI-G4 framework—Governance, Economic, Environment, and Social—have a distinct focus. Businesses that disclose their corporate sustainability report on these four categories under GRI rules. The governance area has seven components, the economic category has four, the environment category has twelve, and the social

category has twenty-nine. The Social category is divided into four subcategories: product responsibility, labour practices and decent employment, human rights, and society. According to the GRI-G4 framework, each facet has multiple indicators. There are 149 indicators spread across 52 distinct characteristics in the GRI-G4 Framework.

Other Frameworks

Task Force on Climate-related Financial Disclosure (TCFD)

The Financial Stability Board (FSB) launched the Task Force on Climate-related Financial Disclosures (TCFD) to create a framework for firms to disclose financial risks and opportunities associated with climate change. The TCFD was introduced in 2017 to enhance and raise the transparency of climate-related data in financial markets so that lenders, investors, and other stakeholders may make better decisions. Its guidelines, which assist businesses in identifying and evaluating the financial impact of climate change on their operations, centre on four main areas: governance, strategy, risk management, and metrics and targets. The TCFD framework is extensively utilized in various industries and nations, promoting worldwide coherence in climate-related financial reporting and cultivating an enhanced comprehension of the financial effect of climate change.

Sustainability Accounting Standards Board (SASB)

Businesses can identify, manage, and report on financially relevant sustainability challenges with the assistance of industry-specific standards provided by the independent, non-profit Sustainability Accounting Standards Board (SASB). To bridge the gap between financial performance and environmental, social, and governance (ESG) factors, SASB standards were developed. Additionally, they want to increase the transparency and comparability of sustainability statistics across various businesses. These recommendations, which consider 77 distinct industries, guarantee that businesses concentrate on the ESG concerns that have the most bearing on their operational and financial results. By bringing sustainability reporting into line with investor and other financial stakeholder expectations, SASB encourages improved risk assessment and decision-making. By incorporating significant ESG considerations into financial reporting, businesses may enhance long-term value creation and stay up to date with changing global sustainability trends with the assistance of SASB.

Carbon Disclosure Project (CDP)

A global non-profit organization called the Carbon Disclosure Project (CDP) forces businesses, municipalities, and areas to reveal the environmental consequences, especially those that have to do with deforestation, water security, and climate change. Since its founding in 2000, CDP has offered a standardized framework for environmental reporting, enabling businesses to evaluate their sustainability initiatives and provide essential information to stakeholders such as the public, investors, and regulators. Organizations can identify environmental risks and opportunities by concentrating on accountability and transparency through CDP, which encourages a change toward more sustainable operations. The information gathered by CDP's yearly questionnaires is an essential tool for evaluating business climate policies, tracking advancement toward sustainability objectives, and promoting

international initiatives to reduce climate change and safeguard natural resources. The disclosures made by CDP have an impact on decision-making in several industries, encouraging conscientious environmental stewardship.

Literature Review

The study looked into what motivates green innovation and evaluates how it might affect risk mitigation and financial performance. It investigated the elements that support the uptake of green innovation. Second, it looks at how risk mitigation and FM performance are affected by green innovation. The study concluded that applying green innovation improves financial value and emission performance while lowering credit risk and financial volatility. For investors, regulators, and legislators, These observations are highly beneficial because they give them the knowledge they need to make wise decisions about green investments and the creation of laws that promote sustainability through green innovation *(Liu, 2023).* The study examined banking firms listed on the Indonesia Stock Exchange between 2012 and 2021 using a quantitative methodology and panel data regression. Ordinary least squares and statistical methods are used in the analytical approach. The findings indicate that while green accounting lowers business value, sustainability performance has a favourable impact. However, ESG disclosure has no bearing on a company's worth. Green accounting and sustainability performance must be emphasized if they are to have a favourable impact on the company. This can be achieved by integrating it into its operations and improving the effectiveness and efficiency of its implementation *(Lindawati et al., 2023).*

The study's primary focus was on how environmental disclosure affects financial performance. Additionally, by using signalling theory and stakeholder analysis, the current study aims to provide new evidence about this connection and explore the mediating role of green innovation. The study examined a sample dataset of Chinese companies that were listed on the Shanghai and Shenzhen stock exchanges between 2005 and 2016. Through green innovation in Chinese companies, ESG disclosure directly and favourably affects a company's financial success - *(Malik et al., 2023).* This investigation examined a sample of 253 PROPER firms from 2015 to 2019 and employed a purposive sampling technique using annual and financial reports. According to this study, by stabilizing the use of eco-friendly materials, lowering emissions for the neighbourhood, and conserving energy, corporate social responsibility (CSR) can encourage green innovation in enterprises. Therefore, the relationship between corporate social responsibility and company performance can be mediated by green innovation. Research on the context of sustainable performance can benefit from theoretical contributions *(Novitasari and Tarigan, 2022).*

The study examined the ESG scores of almost 510 companies in 17 countries between 2010 and 2018. The findings of the descriptive and inductive statistical analysis indicate that European companies exhibit a higher degree of ESG compliance. Asian businesses are concurrently more rigorous in the energy industry, while their Pacific Island counterparts are more focused on technology firms. The study discovered that the market valuations (Tobin's-Q) and accounting performance (ROA and ROE) of GRI and non-GRI enterprises differ significantly *(Shaikh, 2021).* By using the Indonesian environmental index as a proxy for environmental disclosure, the aim of this study is to examine the connection between an independent board of commissioners, firm size, and environmental performance. The study's population consists of manufacturing and coal mining companies that follow "PROPER" and are listed on the Indonesia Stock

Exchange (IDX) between 2017 and 2019. The result of the study indicates that environmental performance has a significant beneficial influence on financial success. The idea has been confirmed, showing that companies that practice eco-efficiency and pay attention to environmental issues would be more profitable *(Ifada et al., 2021).*

The study found, companies who adopted proactive environmental measures are more advantageous when it comes to green innovation. Innovative green techniques are encouraged by environmental legislation. In a similar vein, company performance motivates the company to adopted innovative green practices. Furthermore, company performance contributes positively to optimism in the context of proactive environmental measures and green innovation. These results were a crucial addition to the limited body of knowledge regarding environmental measures at the corporate level in Pakistan *(Mulaessa and Lin, 2021).* The study found that CSR and green accounting have a major impact on financial performance, which in turn affects corporate value. In summary, using green accounting had an impact on raising revenue. Another advantage of cutting capital and insurance costs was that it reduced production costs overall, which might increase profitability. Investors will definitely respect and trust a company with a high CSRD. When making investment selections, it compels investors to evaluate the company's financial performance in addition to its CSR initiatives. The firm's value is affected by its ability to pay dividends, which increases with the amount of profit made *(Lusiana et al., 2021).*

The study focused on firm value and carbon emission disclosure. Firm value is positively impacted by environmental performance and green strategies in a major way. The implementation of a green strategy enhances the impact of carbon emission disclosure on the firm value. There is no proof that the green strategy increases corporate value through improved environmental performance. It was anticipated that the regulator would have the authority to force companies to carry out operations and provide reports regarding their environmental disclosures, including the Green Strategy and the properly and efficiently revealed Carbon Emissions. Businesses should increase their CSR efforts to boost their reputation and attract additional investors *(Rachmawati, 2021).* The study looked at data from manufacturing companies registered on the Indonesian Stock Exchange (IDX) between 2012 and 2016 spanning 107 years. The data was analyzed using the multiple linear regression technique and the Sobel test. This study discovered that green products and green process innovation act as a mediator in the relationship between EMA and business performance. According to this study, management that fosters environmentally friendly innovation will boost the performance of the company by encouraging more creative production from employees *(Putri and Soewarno, 2020).* A stakeholder perspective was used to examine the connection between the market, financial, and operational performance of Mediterranean companies—as measured by ROE, ROA, and Tobin's Q (TQ), respectively—and their disclosure of corporate social responsibility (CSR). The quantitative study's foundation was a cross-sectional and time-series analysis of 1,689 observations of 203 businesses listed in six Mediterranean countries. The theoretical model is based on stakeholder theory. The empirical data's conclusions demonstrated that while CSR disclosure did not influence financial performance, it negatively impacted market and operational performance (Buallay et al., 2020). The study focused on the impact of environmental and financial performance on business value cannot be mitigated by environmental disclosure *(Rinsman and Prasetyo, 2020).*

Research Methodology

Research Design

The sample comprised 26 companies of the highest pollutive industries i.e. cement and automobile have been selected for the study on behalf of the highest market capitalization. Therefore, in this paper, all these industries are considered, and our study consists of 531 samples which have a span of 5 years from 2019 to 2023. The data on environmental and financial performance have been collected manually from the corporate annual reports, social responsibility reports, or environmental reports that were disclosed on the official websites of firms.

Tools and Techniques Applied

To provide basic information about the data collected Descriptive analysis has been administered. One Way ANOVA, the correlation method has been used for hypotheses testing and neural network for prediction of important indicators for success or sound financial performance of company

Content analysis Technique

is "used in this study for extracting information in a numeric form from the published sustainability reports of the select companies". A binary coding system is "used to measure the level of green disclosure reporting (GDR), i.e., '1' if the item is disclosed or '0' if the item is not disclosed, '2' if the item is disclosed in quantity form".

Research Objective

- To study various theoretical frameworks of green disclosure.
- To analyze green disclosure practices of selected companies in the cement industry and automobile industry.
- To develop a model explaining the importance of indicators

Research Hypothesis

H_{01}: There is no significant difference between environment disclosures among selected companies
H_{02}: There is no significant association between environment disclosures and firm performance among selected companies.

Analysis and Interpretation

Normality test

The Shapiro-Wilk test of normality has been used to ascertain whether or not the data is normally distributed. To give a general overview of the data gathered about environmental disclosure, Presumably, the data are normally distributed (H0). Table 3 presents the Shapiro-Wilk normalcy test findings.

Table 1Tests of Normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Industry	.360	130	.000	.634	130	.000
GRI 301: Materials	.158	130	.000	.911	130	.000
GRI 302: Energy	.172	130	.000	.947	130	.000
GRI 303: Water and Effluents	.268	130	.000	.892	130	.000
GRI 304: Biodiversity	.331	130	.000	.680	130	.000
GRI 305: Emissions	.103	130	.002	.952	130	.000
GRI 306: Waste	.178	130	.000	.931	130	.000
GRI 307: Environmental Compliance	.331	130	.000	.697	130	.000
GRI 308: Supplier Environmental Assessment	.442	130	.000	.587	130	.000
net_margin	.502	130	.000	.084	130	.000
success	.517	130	.000	.409	130	.000

a. Lilliefors Significance Correction

Additionally, the S-W statistic for the normality test was determined to be significant because all variables' p-values were less than 0.05, indicating that the data for all variables is normally distributed. As a result, the normalcy null hypothesis is accepted. Given that the Shapiro-Wilk test result indicates that the data are normal, the study's parametric tests were applied to the data to analyze them further.

Hypotheses Testing

H_{01}: There is no significant difference between environment disclosures among selected companies

Table 2 ANOVA

GRI 301: Materials	Between Groups	3.258	13	.251	4.433	.000
	Within Groups	6.558	116	.057		
	Total	9.816	129			
GRI 302: Energy	Between Groups	.984	13	.076	1.844	.044
	Within Groups	4.761	116	.041		
	Total	5.745	129			
GRI 303: Water and Effluents	Between Groups	1.473	13	.113	2.948	.001
	Within Groups	4.458	116	.038		
	Total	5.931	129			
GRI 304: Biodiversity	Between Groups	1.034	13	.080	8.212	.000
	Within Groups	1.123	116	.010		
	Total	2.157	129			
GRI 305: Emissions	Between Groups	3.150	13	.242	3.917	.000
	Within Groups	7.176	116	.062		
	Total	10.325	129			
GRI 306: Waste	Between Groups	2.212	13	.170	2.752	.002
	Within Groups	7.172	116	.062		
	Total	9.384	129			
GRI 307: Environmental Compliance	Between Groups	.558	13	.043	.550	.888
	Within Groups	9.050	116	.078		
	Total	9.608	129			
GRI 308: Supplier Environmental Assessment	Between Groups	3.320	13	.255	3.522	.000
	Within Groups	8.413	116	.073		
	Total	11.733	129			

As can be seen from Table 2, there is a substantial difference in the mean values of these environment disclosure indicators, as evidenced by the p-values for "Material," "Energy," "Water and effluents," "Biodiversity," "Emissions," "Waste," and "Supplier environment assessment" being less than.05. Therefore, If the remaining disclosure regarding compliance is found to be larger than 0.05, the hypothesis is accepted; otherwise, the null hypothesis is rejected at the 5% level of significance. As a result, it is concluded that the 26 businesses selected from the cement and automobile industries varied significantly in their environmental disclosures.

Pearson correlation analysis

H_{02}: There is no significant association between environment disclosures and firm performance among

selected companies

Table 4 displays the correlations between the variables. An association among all the eight indicators of environmental disclosure has been presented.

Table 3 Correlation

	GRI 301: Materials	GRI 302: Energy	GRI 303: Water and Effluents	GRI 304: Biodiversity	GRI 305: Emissions	GRI 306: Waste	GRI 307: Environmental Compliance	GRI 308: Supplier Environmental Assessment
GRI 302: Energy	0.442							
	0							
GRI 303: Water and Effluents	0.528	0.544						
	0	0						
GRI 304: Biodiversity	0.523	0.376	0.369					
	0	0	0					
GRI 305: Emissions	0.597	0.573	0.713	0.438				
	0	0	0	0				
GRI 306: Waste	0.46	0.457	0.615	0.21	0.509			
	0	0	0	0.016	0			
GRI 307: Environmental Compliance	-0.13	-0.293	-0.27	-0.035	-0.133	-0.079		
	0.141	0.001	0.002	0.692	0.132	0.371		
GRI 308: Supplier Environmental	0.247	0.306	0.665	0.171	0.466	0.482	-0.082	
	0.005	0	0	0.052	0	0	0.356	
Assessment	-0.122	-0.059	-0.134	-0.069	-0.098	-0.121	0.091	-0.051
net_margin	0.166	0.503	0.13	0.437	0.267	0.172	0.301	0.568

Table 3 indicates that Environment disclosures are significantly and positively correlated ($p < 0.01$), which tentatively supports H2 while Environmental disclosure is negatively correlated with financial performance (net margin) ($p > 0.01$).

Predicting soundness of financial performance and green disclosure

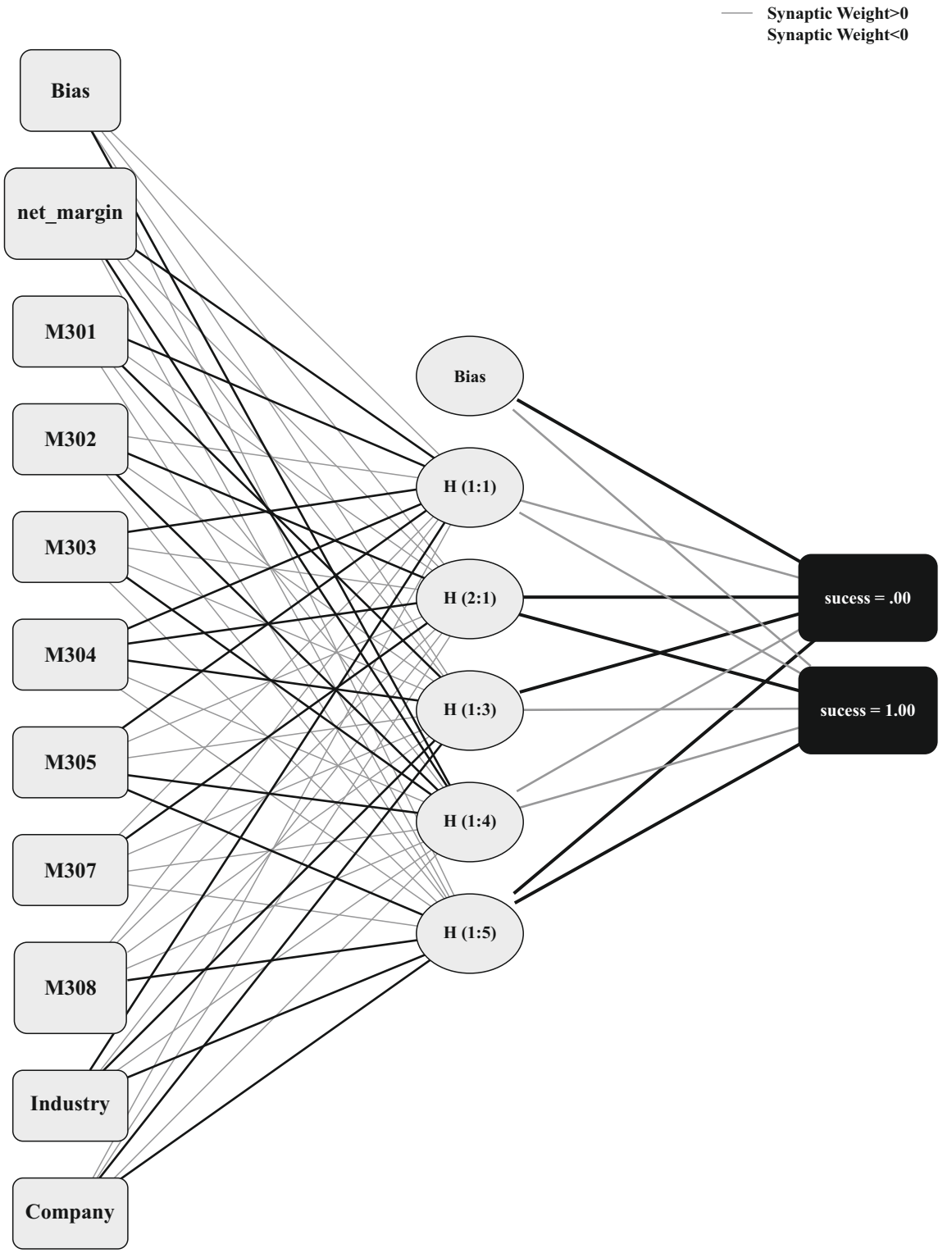

Figure 1 Output layer functions

The given graphic displays a neural network model with input, hidden, and output layers as well as the synaptic weights that reflect the connections between them.

Input Layer:

- The input layer consists of several features, such as net_margin, M301, M302, M303, M304, M305, M307, M308, Industry, and Company.
- There is also a bias input that connects to the hidden layer nodes.

Hidden Layer:

- The model has a single hidden layer with five nodes (H (1:1) to H(1:5)).
- Each input node (including the bias) is connected to all the hidden layer nodes with synaptic weights that can be either positive (blue lines) or negative (grey lines). The activation function for the hidden layer is the *Hyperbolic Tangent (tanh)* function, which allows for capturing non-linear relationships between inputs.

- **Output Layer:**
- The output layer has two nodes representing the classification of success=0and success=1.
- These nodes are connected to all hidden layer nodes, allowing the network to output a probability distribution over the two classes.
- The activation function for the output layer is *Softmax*, which is commonly used for multi-class classification problems to produce probabilities that sum up to 1.

- **Synaptic Weights:**
- The synaptic weights (connections) between the input layer and hidden layer, and between the hidden layer and output layer, are visualized using lines.
- *Blue lines* indicate positive synaptic weights, which suggest a positive influence from the input or hidden layer neuron.
- *Grey lines* indicate negative synaptic weights, which suggest a negative influence.
- The diagram visualizes the complexity of the relationships between input features and output predictions. This neural network is intended for binary classification, with outputs for success=0.0 (failure) and success=1.0 (success). Neural network structure and its visualization provide insights into how the model processes the input features to classify outcomes as success=0.0 or success=1.0. Further analysis, such as examining the importance of individual features or tuning the model, could enhance predictive performance.

Table 4 Classification

Sample	Observed	Predicted		
		.00	1.00	Percent Correct
Training	.00	0	13	0.0%
	1.00	0	78	100.0%
	Overall Percent	0.0%	100.0%	85.7%
Testing	.00	0	5	0.0%
	1.00	0	34	100.0%
	Overall Percent	0.0%	100.0%	87.2%

Dependent Variable: success

The overall percent accuracy for the testing sample is 87.2%, which indicates that 87.2% of the cases in the model accurately predicted the testing results.

Normalizes importance

Table 5 Independent Variable Importance

	Importance	Normalized Importance
net_margin	.218	80.4%
GRI 301: Materials	.055	20.3%
GRI 302: Energy	.093	34.3%
GRI 303: Water and Effluents	.033	12.3%
GRI 304: Biodiversity	.106	39.1%
GRI 305: Emissions	.047	17.3%
GRI 307: Environmental Compliance	.106	39.1%
GRI 308: Supplier Environmental Assessment	.271	100.0%
Industry	.045	16.6%
Name of companies	.026	9.7%

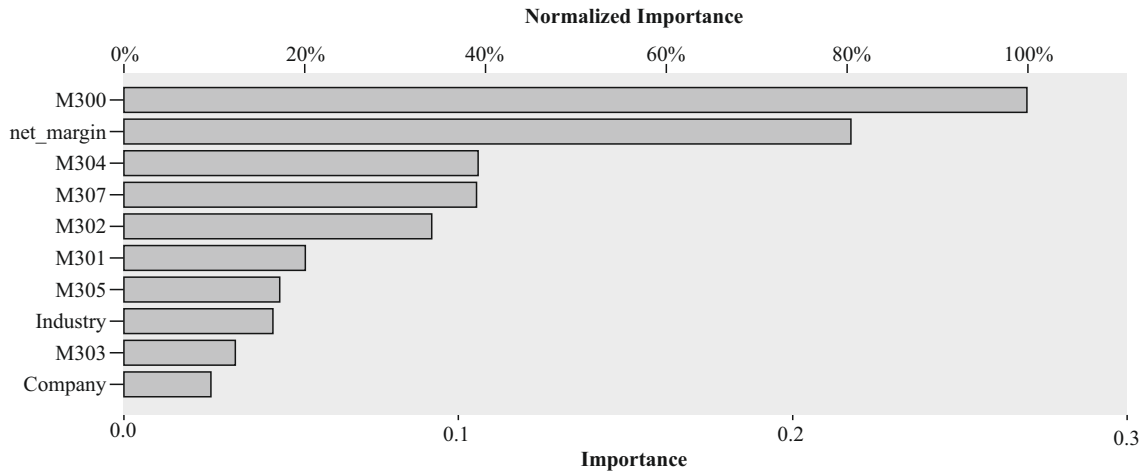

Figure 2 Normalized Importances

Table 5 and figure 2 presents the importance of indicators towards success or sound financial performance of the companies. Material (GRI-1) was found to the top priority with 80.4%, Biodiversityat 39.1%, and energy at 34.3%as second and third priority respectively while Water and Effluents found at the last with 12.3% out of the eight indicators of GRI.

Conclusions

The study on green disclosure practices and their impact on corporate performance underscores the increasing importance of sustainability in modern business operations. By developing a predictive model for green disclosure indicators, the research highlights how environmental transparency can serve as a critical factor in evaluating a company's financial health and market standing. According to the research, businesses with strong green disclosure policies have a higher chance of winning over investors, improving their reputation as a brand, and achieving superior long-term results. Green disclosure is not just a legal necessity but also a strategic advantage, as seen by the increasing emphasis on sustainability and corporate responsibility around the world.

Practical Contribution and Managerial Implications:

From a practical standpoint, for managers, investors, and legislators, the report offers insightful information. Managers may match their environmental plans with business goals by using the predictive model to find the important green disclosure indicators that drive performance. Using this model as a guide will help improve sustainability reporting procedures and incorporate environmental considerations into important business choices. The results give investors a framework for evaluating a company's sustainability risk and potential, which enables individuals to choose investments more wisely. Policymakers can also benefit by understanding which disclosure practices are most effective, helping them shape regulations that encourage transparency and sustainability.

Future Scope:

The study offers up a number of research directions. To comprehend the differing effects of green disclosure across industries, more research might examine the application of predictive models in many domains. The evolution of green disclosure policies and their long-term effects on corporate success may also be better understood through longitudinal research. In order to gain a deeper comprehension of the full range of Environmental, Social, and Governance (ESG) practices and their impact on business performance, Future research may additionally examine how green disclosure, social, and governance aspects interact. Including a wider range of markets in the geographic scope could also aid in confirming the model's suitability for use in various regulatory contexts.

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