Enhanced Environmental, Social, Governance (ESG) Claims and Escalated Poverty in Transport Section: A Case of Selected Corporate Sectors of Pakistan

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Abstract

Transportation is considered the backbone of any corporate sector, from the delivery of raw materials to final products in the market. In this way, the transport sector is the main contributor to carbon emissions in the environment. Environment, social, and governance (ESG) mechanisms are adopted by companies to reduce environmental burdens. Intriguingly, the people associated with the transport section are under the poverty line. This study is designed to evaluate the multidimensional poverty index (MPI) of people associated with the transport section of different corporate sectors of Pakistan, along with calculations of ESG scores and carbon emissions of those sectors. MPI values indicated an increasing trend along with escalated ESG score claims and carbon emissions. Regression analysis indicates an insignificant relationship between ESG and emissions, while Pearson correlation analysis has shown a strong relationship between MPI and emissions and a negative relationship between ESG and emissions. Principal component analysis (PCA) for the overall dataset indicated the highest variation by MPI in PC1, followed by emissions.

Keywords: ESG; MPI; Carbon Emissions; PCA; Transport; Regression

JEL Classification: Q53, Q50, H0, O10, I32

1. Introduction

Global climate change has been severely affected by greenhouse gas emissions where the transport sector is considered the major contributing factor. An estimated 93% of total energy demand is fulfilled by fossil fuels at the global level, among which only transport sector consumption is about 25%. The emission levels of this consumption have increased by almost 71% compared to the base year of 1990 due to the increased logistics, freight, and commuting needs of the world population. Road transport alone is responsible for 80-90% of these emissions,

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while 5-8% comes from rail, 1-2% from air and 1% from sea and water transport systems. This results in anthropogenic aerosols that affect local temperatures and precipitation, but the same record shows a strong opportunity for these sectors to limit emissions through strategic policy prescriptions (Hegerl et al., 2019).

In the context of Pakistan, the transport sector is the second largest energy consumer which utilizes 85% of the total oil consumption in the country. An estimated 36 million barrels of oil/day has been used globally for privately owned vehicles. The production of such huge carbon emissions from only one sector makes Pakistan the second most polluted country in terms of air quality index and fifth in terms of climate vulnerability, which ultimately causes a forced cost of about 8 percent to its GDP (Butt and Singh, 2023). In addition, climate change causes significant infrastructure damages, particularly electricity, which costs about 5.4 percent (US$25.3 billion) of GDP impact (Eckstein et al., 2021). According to the World Air Quality Index report, Pakistan is the second most polluted country after Bangladesh. The average air quality index (AQI) of 153, which is listed as unhealthy, is five times higher than the World Health Organization (WHO) exposure recommendation. The Pakistani cities of Karachi and Lahore were ranked 2nd and 9th, respectively, among the most polluted cities in the world, with PM 2.5 concentrations three and two times higher than the WHO exposure recommendation. The importance of business in promoting green technologies cannot be ignored. Trade is critical to greening the energy market because of its potential for clean energy technology transfer. Business openness benefits from efficient use of resources and economies of scale.

In addition, exports and imports can contribute better to green energy consumption. In short, trade liberalization will further encourage using renewable energy sources. Thus, green energy sources can be an essential factor in long-term economic growth and climate change. Empirical studies on the relationship between renewable energy consumption and foreign trade are few, and their results are often inconclusive, suggesting disagreements between economists and researchers. To date, the most common frame of reference for measuring corporate sustainability is the environmental, social, and governance (ESG) perspective (Cao et al., 2023). Often associated with ethical or socially responsible investing, ESG criteria have become key indicators of managerial competence, risk management, and non-financial performance. In addition, unlike the concepts of corporate social performance (CSP) or corporate social responsibility (CSR), ESG explicitly includes a wide range of environmental (e.g., climate change, energy, carbon dioxide emissions), social responsibility (e.g., human rights, product safety, and

employee welfare) and governance (e.g., board independence, corruption, shareholder protection).

The effects of poverty are multidimensional (Sadiq et al., 2023; Wen et al., 2021), making these economies more vulnerable. Ogutu and Qaim (2019) Proposed a system to reduce poverty through commercialization because it increases income and reduces multifaceted poverty. Determinants of the MPI are another tool for identifying factors contributing to poverty. It is estimated that agricultural productivity, efficient use of labor, and increased income through various livelihoods lead to multidimensional poverty (Gebrekidan et al., 2021).

The transportation sector is the backbone of every industry, and TCO_2 (Transport carbon dioxide) reached an unprecedented 8.25 (trillion) tons in 2019, registering a massive increase of about 80 percent between 1990 and 2019 (Shirley and Gecan, 2022). Pakistan also has higher traffic emissions, indicating increased traffic activity. Pakistan's ESG score is reported to be 0.516 (Jiang et al., 2022). The data shows an increase in transport activities, especially in the commercial sector of Pakistan, so the equivalent emissions of CO_2 are expected to rise to high levels. It is hypothesized that different corporate industries have increased their profits as increased transport activities indicate but the situation of employees/households associated with this sector needs to improve. Intriguingly, on the one hand, there are increased profits for the corporate sector. They claimed higher ESG scores, but at the same time, they neglected the core sector (transport), which is responsible for such profits. This way, the corporate sector contributed to increasing global carbon emissions, getting many profit and deteriorating the employees associated with the transport sector. Though, ESG is a rising concept of research, particularly for the corporate sector but still no study has been conducted to explore the main contributing sections responsible as key stakes in ESG reporting such as the transport section and their relationships with other social indicators i-e., poverty.

This study explores the complex interaction of emissions and poverty in the transport sector and their output as part of the environment, social responsibility, and governance, respectively. In this way, a new direction of study has been explored in terms of exploring the contributing factors for ESG. Keeping in view the above scenario, this study was designed with the objectives of to estimate the MPI of the households employed in the transportation section of different corporate sectors of Pakistan, CO_2 emission calculation along with ESG calculation of the relevant transport section, and exploring the relationship between MPI, CO_2 emissions, and ESG scores.

2. Literature Review

The Global Reporting Initiative (GRI) guidelines were first introduced in the 90's (Lambertz, 2022). At that time, it was the only initiative that provided guidelines for sustainability reporting. With the passage of time, the concept has been adopted by the corporate sector and adopted the sustainability reporting mechanisms. Several empirical studies have investigated the relationship between corporate performance and ESG, recently (Bonacorsi et al., 2024). It has been reported that corporate sectors having improved ESG have shown positive yields for investors (Auer and Schuhmacher, 2016; Nofsinger and Varma, 2014). However, there can be the possibility of misleading ESG scores as the ESG portfolio performance strongly depends on ESG rating providers (Halbritter and Dorfleitner, 2015). MSCI was founded in 1969 and develops and provides decision-making tools for investment-seeking institutes. Global stock indices, management tools, and income analytics are some examples of MSCI products and services that are recognized and accepted worldwide. MSCI ESG Intangible Value Assessment is one of MSCI's products. It provides assessments, research, and analysis of companies' risks and strengths arising from ESG (environmental, social, and governance) factors. Through an in-depth analysis of a company's ESG-driven factors, the report evaluates a specific company based on how well it manages risk or long-term value that may not be assessed through traditional financial reporting (e.g., To rate companies, MSCI collects and reviews documents such as annual reports (eg, Form 10-K), environmental and social reports, securities statements (eg, Form 8-K), company websites (Giese and Lee, 2019). ESG factors may also be pertinent to credit risk assessments, though there is limited empirical research on this topic. A significant portion of bank credit losses in Germany was linked to environmental risks (Bonacorsi et al., 2024), while Weber, Scholz, and Michalik (2010) demonstrated that sustainability criteria could forecast a borrower's financial performance and enhance the accuracy of credit ratings. Their findings indicate that banks incorporating environmental and social criteria in loan evaluations more accurately assess loan risks, suggesting that financial strength factors might affect a company's creditworthiness. They discovered a negative correlation between environmental sustainability and non-default loans, but no significant relationship between environmental sustainability and default loans. They speculate that if environmental investments negatively impact a firm's financial performance, a similar negative correlation should be seen in bad loans, leading them to conclude that firms in default likely failed to connect environmental performance with financial benefits. Chava (2014) found that firms with environmental concerns face higher interest rates on bank loans, along with higher capital costs, lower

institutional ownership, and fewer banks in their loan syndicates compared to firms without such issues. Devalle (2017) studied the impact of ESG performance on credit ratings among 56 Italian and Spanish public companies, confirming that social and governance factors significantly influence credit ratings, though environmental factors did not yield significant results. They advocate for integrating ESG factors into creditworthiness evaluations as they impact borrowers' cash flows and default risks, and they emphasize the need for further research on environmental variables and credit ratings. Our paper addresses this gap in the literature. Despite the recognition of ESG ratings' relevance by credit rating agencies, as noted in the Introduction, an empirical credit risk model explicitly incorporating ESG dimensions as default risk determinants is still lacking.

3. Methodology

A total of three corporate sectors were selected for this study, i-e., Oil and Gas Sector Companies (O&G), Beverages (Bev) and Waste Management (WM). Employees in these sectors associated with the transport section were sampled. 150 households were sampled, with an equal selection of samples from each industry (n = 50; $\sum_n$ = 150). Only those households were selected from the transport section of said sectors working with the same company without job shifts for the sampled period (2021-2023) to make reasonable annual comparisons. Questionnaires were developed and filled out from each household for MPI calculations in 2021, 2022, and 2023.

The Multidimensional Poverty Index (MPI) was calculated using education, health, and standard of living as three equally weighted dimensions, which are further classified into different indicators/sub-dimensions.

The Multidimensional Poverty Index (MPI) development consists of three equally weighted dimensions: education, health, and standard of living. These sectors are further classified into different sub-dimensions/indicators. The household in subject surveys is considered poor if it lacks 1/3rd of weighted indicators of the poverty threshold (k) due to MPI calculations (Alkire and Santos, 2010; Cao et al., 2023). The following equation (Eq. 1) shows the formula for calculating MPI:

$$M0 = H \times A = MPI \quad (1)$$

Here, H and A are the headcount ratio and average intensity of poverty, respectively, while M0 is the adjusted headcount ratio. The absolute rate of change was calculated using the following formula, using the MPI difference between two time periods.

$$\Delta M0 = M0\,(Yt2) - M0\,(Yt1) \quad (2)$$

MSCI's valuation method was used to calculate ESG scores. ESG Score Calculation (Giese and Lee, 2019) as below (Equation 3);

$$\sum_{i=1}^{n}(weighti \times industry\ scorei)/\sum_{i=1}^{n}(weighti)$$

Where i is the index security with available ESG score; weight refers to the closing index weight for security, and industry scores indicate the ESG score of security *i*. A detailed methodology (Giese and Lee, 2019) can be studied.

CO_2 equ (equ = equivalent) in tons as follows.

$$CO_2\ equ_{(GHG,\ fuel)} = Fuel_{consumption\ fuel} \times Emission\ Factor_{GHG,\ fuel} \quad (3)$$

Linear regression was employed through scatter plots in order to identify any relationship between ESG, MPI, and emissions. PCA is a widely used multivariate technique to explore latent factors and data reduction and the factors are then used to figure out any relationships among observed variables.

4. Results and Discussion

4.1. Multidimensional Poverty Index

The results of the Multidimensional Poverty Index (MPI) for the transport section of different corporate sectors are presented in Table 1, according to which an increasing trend of poverty has been observed from 2021-23. The highest MPI was observed for the Bev sector in 2023 (MPI: 0.62), followed by the O&G sector and WM sector with MPI of 0.51 and 0.33, respectively. The sector-wise trend was Bev > O&G > WM for the studied period of 2021-23. The year-wise absolute difference has shown that the highest increase in MPI was credited to the O&G sector with a difference of 0.16 between 2021-23, followed by the Bev sector and WM sector, respectively. The overall differences have shown the lowest inflation in MPI in the WM sector. The results of this study are compared with overall MPI values reported earlier and not transport-specific sections, as there are gaps in research for section or industry-specific MPI calculations. These results are higher than those reported in different studies at the province or national level (Awan and Aslam, 2011; Nawab et al., 2023; Qurat-ul-Ann and Mirza, 2021). This increase may be due to less sample numbers and section-specific MPI calculations as there is a higher chance of MPI values in neglected industrial sectors. The other trend is also contradictory where (Cao et al., 2023) reported a decreasing trend from 2014 to 2018 in poverty in terms of MPI but after that period, the country's business

activities were severely affected by Covid-19 and higher inflation owing to which it has a great possibility of increasing poverty ratio in the country. Further, the transport section, in general, and sector-specific, is always deprived of social security benefits.

Table 1: Multidimensional Poverty Index (MPI) scores (0-1)

Sector	Year/MPI Scores (0-1)		
	2021	2022	2023
O&G	0.35	0.44	0.51
Bev	0.52	0.58	0.62
WM	0.28	0.31	0.33
Sector	Year wise MPI Absolute Difference		
	2021 vs 2022	2022 vs 2023	2021 vs 2023
O&G	0.09	0.07	0.16
Bev	0.06	0.04	0.10
WM	0.03	0.02	0.05

4.2. Transport Emissions (CO_2 equ × 1000 tons)

To summarize the results, descriptive statistics of transport emissions (CO_2 equ × 1000 tons) are provided in Table 2. Further, the box plots (Figure 1) also depicted the overall ranges and outliers for transport-related emissions in different corporate sectors of Pakistan. The annual carbon emissions are presented in Figure 2. The overall emissions trend has shown a gradual increase with time i-e., lowest in 2021 and escalated in the next consecutive years (2022 and 2023). The beverage sector has shown an increased average trend with emissions of 24.1 tons in 2021, 25 tons in 2022, and 26.8 tons in 2023 except O&G sector in 2023 where this sector has shown an increased jump to 28.4 tons of transport emissions. The WM sector has shown minor contributions in transport emissions, with 3.6 tons of emissions in 2021, followed by 3 and 3.9 tons in 2022 and 2023, respectively. It has also been observed that during summer, the Bev sector's transportation activities are at peak owing to higher demands for mineral water, juices, and other drinks.

Table 2: Descriptive analysis of emissions

Year	Sector	Emissions	
		Mean ± SD	Range (min-max)
2021	O&G	21.8±4.1	15-28
	Bev	24.1±6.4	13-33
	WM	3.6±0.8	2.4-5.1
2022	O&G	23.9±5.9	13-31
	Bev	25.0±6.3	16-33
	WM	3.0±0.5	2.1-3.7
2023	O&G	28.4±3.8	21-33
	Bev	26.8±4.0	20-34
	WM	3.9±0.4	3.3-4.5

Figure 1: Box plots showing descriptive statistics of emissions (CO_2 equ) values from 2021-23 for different corporate sectors of Pakistan

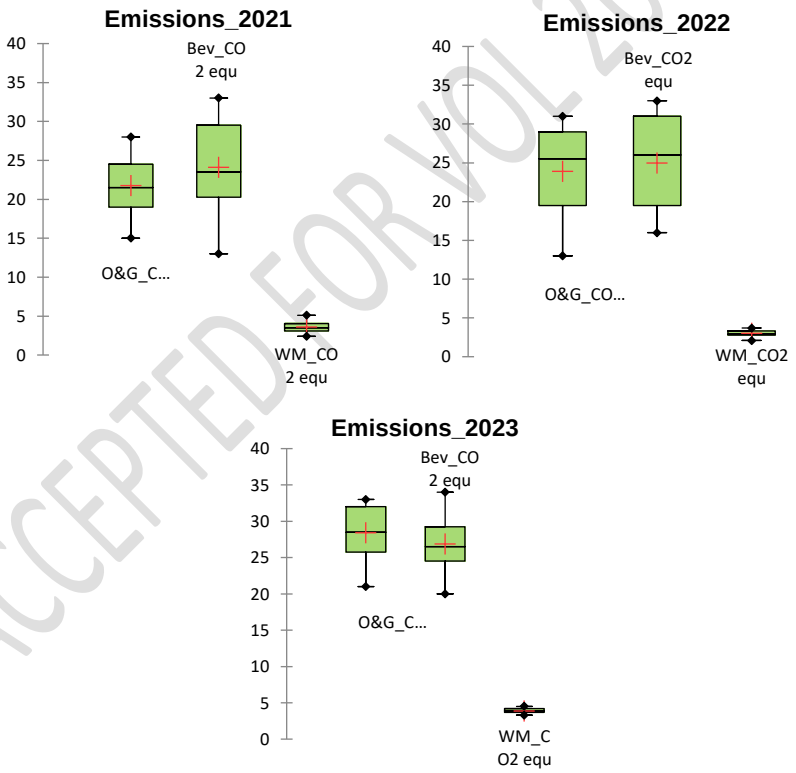
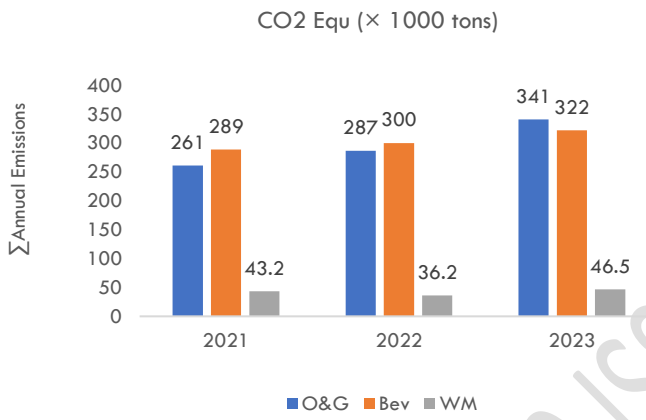


Figure 2: Annual emissions (CO_2 equ × 1000 tons) of different corporate sectors of Pakistan (2021-23)



4.3. ESG Scores

The ESG discussion is expanding not only among practitioners but also among researchers. Indeed, a large body of empirical research has recently been published on ESG performance and its determinants. For example, most previous studies have focused on a few or single determinants (Chen et al., 2022; Disli et al., 2022), limited geographic coverage, or using a single data provider. In addition, most of the related papers showed inconsistencies in their results and contradicted each other. Mooneeapen, Abhayawansa, and Mamode Khan (2022) concluded that the ability of a country's citizens to participate in their government's elections and make their voices heard, as well as political stability and the absence of violence, are associated with lower ESG performance and in contrast, Cai, Pan, and Statman (2016) confirmed that countries with weak civil liberties and political rights have a lower CSP.

Similarly, some authors recognize industrial influence as the strongest externality or an essential influence on ESG performance (Crace and Gehman, 2023). On the other hand, others have emphasized the relative insignificance of this role. In addition, articles on the role of financial performance in determining ESG performance have shown inconsistent results, ranging from articles emphasizing a positive relationship to articles finding no relationship (Garcia et al., 2017). As these contradictions still need to be adequately addressed, comparing results and fully understanding what determines and drives ESG performance remains difficult.

The current study employed the MSCI rating ESG methodology which is considered the least risky series (Jain et al., 2019). The descriptive results are shown in Figure 3 and Table 3 according to which there is an increasing ESG rating trend annually in all studied corporate sectors of Pakistan (Figure 4). The highest average ESG scores were observed for the WM sector (0.87±0.05) in 2023 followed by Bev (0.86±0.05) and O&G sector (0.80±0.08). Similar sector-wise trends were observed for 2021 and 2022. The reason for higher ESG scores by the WM sector might be attributed to companies' higher legal compliance pressure as this sector is mostly a sub-contract part of the corporate sector. Further, the scope of the WM sector is limited with minimum human resource utilization, so compliance against different social programs, i-e., Employees' Old Age Benefit (EOBI) and Social Security are easy to follow.

Table 3: Descriptive analysis of ESG scores

Year	Sector	ESG Scores	
		Mean ± SD	Range (min-max)
2021	O&G	0.68±0.08	0.58-0.82
	Bev	0.75±0.10	0.58-0.89
	WM	0.79±0.07	0.68-0.88
2022	O&G	0.74±0.11	0.58-0.89
	Bev	0.82±0.07	0.68-0.89
	WM	0.84±0.04	0.78-0.92
2023	O&G	0.80±0.08	0.67-0.89
	Bev	0.86±0.05	0.77-0.93
	WM	0.87±0.05	0.78-0.94

Figure 3: Box plots showing descriptive statistics of ESG values from 2021-23 for different corporate sectors of Pakistan

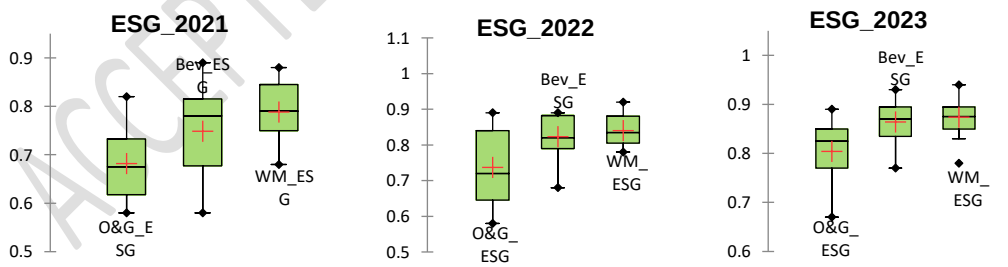


Figure 4: Annual average ESG scores of different corporate sectors of Pakistan (2021-23)

4.4. Relationship of Emissions, ESG Scores, and MPI

The regression results of emissions vs ESG are presented in Figure 5 for different corporate sectors of Pakistan. The linear regression (r^2) through scatter plots has shown an insignificant relationship (O&G emissions vs ESG = 0.03; Bev emissions vs ESG = 0.001 and WM emissions vs ESG = 0.01). These values are inconsistent with theoretical assumptions and observed data, as when the emissions are increased, it is expected to increase growth in ESG scores. This indicates that ESG score claims are different from increased emissions and there is a gap in actual ESG situation and reported data (ESG calculations based on data assumptions reported for studied corporate sectors of Pakistan). Ali, Zahoor, Saeed, and Nosheen (2023) reported that sustainability alone is negatively related to performance using the pool-fixed regression analysis, particularly for the oil and gas sector. Ng, Lye, Chan, Lim, and Lim (2020) indicated that in order to pursue ESG goals, financial development is important and better development leads to higher ESG scores which is contradictory to the results of this study as the corporate sector is growing financially but their ESG scores are not compatible with financial growth. Further, the Pearson correlation analysis (r) indicated (Table 4) that no correlation has been observed between CO_2 equ and ESG scores, which indicates inconsistency among emissions vs higher ESG claims of the studied corporate sector of Pakistan. A higher correlation (r) was observed between MPI and emissions, indicating higher transport activities and increased poverty. A negative correlation (r) between ESG and emissions also highlighted the false claims of the corporate sector about improved ESG scores. A PCA analysis was conducted to elucidate the overall data variation further. Figure 6 shows the variation and

contribution of relevant factors in the whole data according to which highest emissions follow MPI for the O&G sector in PC1 factor loadings.

Figure 5: Regression analysis (r^2) of emissions vs ESG scores for different corporate sectors of Pakistan

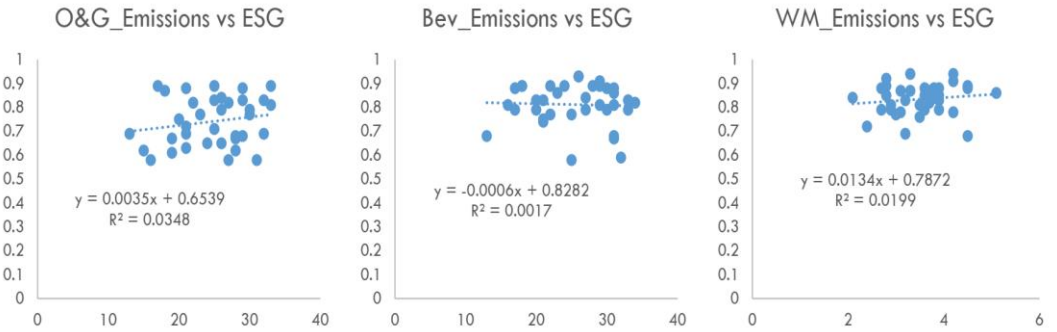
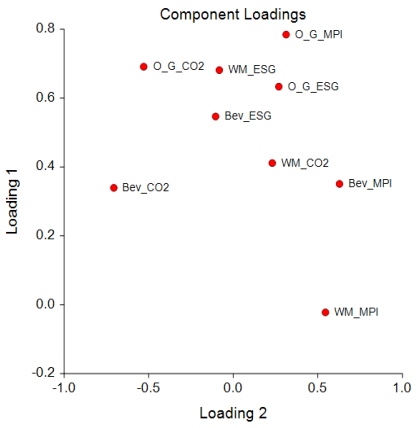


Table 4: Pearson Correlation Analysis (r) for MPI, emissions, and ESG scores (p-value < 0.05)

	MPI	*Emissions*	*ESG*
MPI	1		
Emissions	**0.806469**	1	
ESG	-0.69612	-0.66606	1

Figure 6: Component loadings for overall data set using PCA analysis



Component Structure Summary

PC 1	PC 2	PC 3	PC 4	PC 5
O_G_MPI	Bev_CO2	Bev_ESG	WM_CO2	WM_MPI
O_G_CO2	Bev_MPI	WM_MPI		
WM_ESG	WM_MPI	Bev_CO2		
O_G_ESG	O_G_CO2			
Bev_ESG				
WM_CO2				

Component Loadings

	Components				
Variables	**PC 1**	**PC 2**	**PC 3**	**PC 4**	**PC 5**
O_G_CO2	0.691147	-0.529369	0.009512	-0.033141	-0.342194
O_G_ESG	0.633278	0.269270	0.186147	-0.334104	0.360500
O_G_MPI	0.784461	0.312399	-0.016251	0.113837	-0.146648
Bev_CO2	0.339476	-0.706194	0.427826	0.063365	0.017810
Bev_ESG	0.546657	-0.104433	-0.702863	-0.048082	-0.260708
Bev_MPI	0.350957	0.628106	-0.261061	0.121023	0.100494
WM_CO2	0.411463	0.230482	0.349390	0.750682	0.005924
WM_ESG	0.681253	-0.082386	0.127108	-0.307386	0.308873
WM_MPI	-0.022087	0.545040	0.518551	-0.362860	-0.524907

5. Conclusions

An overall gradual increase in emissions has been observed from 2021-23, whereas ESG score claims also showed an increasing trend with time. MPI related to the transport section of the corporate sector shows an increased trend, possibly owing to the corporate sector's higher inflation and weak social inputs. No correlation has been observed between CO_2 equ and ESG scores, which indicates inappropriate claims of higher ESG achievements. In contrast, a higher correlation (r) was observed between MPI and emissions, clearly showing higher transport activities and an increase in poverty. Further, the negative correlation (*r*) between ESG and emissions also highlighted the inappropriate claims of the corporate sector about improved ESG scores. Overall, it is concluded that different corporate sectors of Pakistan have increased their transport activities in previous years, which indicates their increased business activities and profits. At the same time, such sectors claimed higher ESG scores and emissions, which contradicted each other. On the other hand, the people associated with the transport sector are getting poorer, which indicates that social input needs to be addressed more by the corporate sector of Pakistan. Further research is required in sector-specific MPI calculations, and their relationship with sustainability needs to be established.

5.1. Recommendations and Limitations

This study documents the investigation of ESG in relation to carbon emissions and poverty, particularly from the transport section of the corporate sector in Pakistan. Keeping in view the conclusions of this study, it is recommended to consider other sections of the corporate sector as well i-e., operations, technical, finance, public dealing, etc. As a policy recommendation, ESG reporting should be the core part of industries as legal pressure to develop such policies would be in line with the global SDGs agenda.

Certain limitations are also faced under the scope of this study i-e., the corporate sector is reluctant to produce any data related to ESG. Understanding the ESG reporting, and social and environmental compliances is another limitation to consider. Overall, considering the strengths and limitations, this study explores the opportunity to further study and optimize ESG reporting from the perspective of different contributing factors.

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