Assessment of Corruption in Relation to Transition Indicators to a Sustainable Economy

Botond Géza Kálmán

Department of Finance and Accounting, Faculty of Economics,
John von Neumann University,
Izsáki út 10, H-6000 Kecskemét, Hungary,
e-mail: kalman.botond.geza@nje.hu; https://orcid.org/0000-0001-8031-8016

Judit Petra Koltai

Department of Statistics, Finance and Controlling, Széchényi István University,
Egyetem tér 1, H-9026 Győr, Hungary,
koltaij@sze.hu; https://orcid.org/0000-0003-3817-3030

Szilárd Malatyinszki

János Neumann University Faculty of Economics Department of Management and Business Law, Izsáki út 10, H-6000 Kecskemét, Hungary,
e-mail: malatyinszki.szilard@nje.hu

Abstract: This study examines how the areas of green transition that promote the implementation of sustainability are related to the perceived level of corruption. The investigation covers 41 countries. The environmental indicators were selected by the authors from the database of the Bertelsmann Stiftung (BS) Sustainable Governance Indicators (SGI) 2022 report after reviewing the literature. Due to its difficult measurement, corruption is usually measured by the perceived level of the presence of corruption, and the authors of this study also used this method in their research. Accordingly, the authors modelled the perceived presence of corruption using the time series of Transparency International's Corruption Perceptions Index. Based on their results, the state's performance in environmental policy plays the most important role, the impact of which is enhanced by participation in international environmental cooperation and treaties. These achievements are threatened by corruption and bureaucracy. Among the environmental indicators, the effect of gross greenhouse gas emissions is the strongest. This effect is negative, i.e. higher output increases the perception of corruption, which is indicated by a decrease in PCI.

Keywords: corruption, sustainability, environmental policy, green transition indicators

1 Introduction

Corruption remains a pervasive challenge globally, undermining economic stability, social equity, and environmental sustainability. While its economic and social impacts are well-documented, the implications of corruption on environmental governance and sustainability transitions are less explored. The shift towards a sustainable economy, characterized by green transition and environmental responsibility, demands robust governance and transparency to ensure its successful implementation. However, corruption can significantly hinder these efforts by distorting regulatory frameworks, misallocating resources, and weakening public trust in institutions.

The relationship between corruption and environmental policy is complex, as corrupt practices can undermine efforts to achieve environmental goals, particularly in countries where governance structures are weak [75], [74]. Prior research highlights that corruption often exacerbates environmental degradation by weakening enforcement and reducing the effectiveness of environmental regulations [1], [2]. Moreover, evidence shows that corruption can negatively affect climate policy outcomes, including renewable energy deployment and carbon emission reductions, by influencing policy design and resource allocation [3]. Weak institutional quality and low government accountability further hinder green transition processes, making environmental policies less effective in corrupt environments [4], [83].

Understanding the interplay between corruption and sustainability transitions is, therefore, crucial for developing effective policies that foster both economic development and environmental protection. This study seeks to explore these dynamics by examining how various indicators of green transition are related to perceived corruption levels across different countries. By analysing data on environmental governance and corruption perceptions, this research aims to shed light on the critical role of transparency and accountability in advancing sustainable economic practices.

2 Literature Background

The pursuit of a sustainable economy has become a paramount objective for countries worldwide, aiming to balance economic growth, social inclusiveness, and environmental protection [8, 76, 77, 78, 84]. However, the pathway to achieving sustainability is fraught with challenges [79, 82], among which corruption stands out as a significant impediment. Corruption undermines public trust, distorts policy implementation, and diverts resources from intended sustainable development projects [14], [15], [17]. Recent studies have shown that addressing corruption can improve environmental governance and the effectiveness of green transition policies [1], [3], [12], [13].

Recent organizational and human resource management research conducted during crisis periods highlights that governance quality, transparency, and adaptive crisis responses at the organizational level significantly influence long-term sustainability outcomes. Empirical evidence from Hungary demonstrates that crisis management measures in the HR area—such as flexible work arrangements, revised benefit systems, and trust-based leadership—contribute to institutional resilience and reduce governance-related inefficiencies during periods of systemic shock [89].

This literature review explores the relationship between corruption and transition indicators for a sustainable economy, focusing on how perceived corruption levels impact the effectiveness of green transition policies and environmental governance.

Corruption and Its Measurement and the Role of Environmental Indicators in Green Transition

Corruption is typically understood as the abuse of entrusted power for private gain [44]. Measuring corruption poses a substantial challenge due to its covert nature and the difficulty of obtaining reliable data. Consequently, scholars and organizations often rely on perception-based indices, such as Transparency International's Corruption Perceptions Index (CPI), which assesses the perceived levels of public sector corruption in various countries [28], [45]. While there are critiques regarding the reliance on perception data [2], it remains one of the most widely used metrics for cross-national corruption analysis.

Perception-based approaches are also widely applied in organizational and HR research, particularly when assessing trust, fairness, and ethical governance. Cross-cultural management studies show that perceived transparency and institutional fairness significantly affect employee adjustment and compliance in multinational environments, reinforcing the analytical relevance of perception-based indicators beyond the macro level [91].

At the organizational level, governance effectiveness also depends on the structure of HR processes and the involvement of external service providers. Comparative research from Hungary and Slovakia indicates that transparent outsourcing and clearly regulated HR responsibilities enhance accountability and reduce governance risks, indirectly supporting sustainability-oriented policy implementation [88].

The Role of Environmental Indicators in Green Transition

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Linking Corruption and Environmental Performance

There is a growing body of literature that examines the link between corruption and environmental performance. Corruption can significantly weaken environmental regulations, leading to higher emissions and lower environmental quality [10]. For instance, studies have shown that countries with higher levels of corruption tend to have poorer environmental outcomes, such as higher levels of pollution and greater deforestation rates [4], [35].

Corruption affects environmental governance through several mechanisms. First, it can lead to the preferential treatment of certain industries, undermining regulations designed to protect the environment [21]. Second, corruption can facilitate illegal activities such as logging and fishing, contributing to environmental degradation [27]. Finally, corruption can erode public trust in institutions, reducing compliance with environmental policies [48], [81].

Similar trust-related mechanisms have been identified in organizational contexts, where opaque HR practices—particularly in employee benefit systems—can reduce compliance and weaken institutional credibility. Empirical findings from Slovakia confirm that transparent and equitable benefit practices strengthen trust and support organizational stability, which is a prerequisite for broader sustainability engagement [92].

Impact of Corruption on Greenhouse Gas Emissions

Greenhouse gas emissions are a critical indicator of environmental performance and a central focus of green transition efforts. Studies have demonstrated a negative correlation between corruption and environmental quality, suggesting that corruption can lead to increased emissions [7], [47]. High corruption levels often result in weak enforcement of environmental regulations, allowing for greater emissions from industrial activities and reduced incentives for adopting cleaner technologies [46].

Research using data from Transparency International’s Corruption Perceptions Index and greenhouse gas emission statistics has shown that countries with higher corruption levels tend to have higher emissions [35]. This is particularly evident in countries where corruption is systemic and deeply ingrained in political and economic institutions, making it difficult to implement effective environmental policies [34].

Organizational-level crisis research further suggests that weak governance structures and inconsistent HR crisis responses may reinforce short-term decision-making, limiting investment in sustainability-oriented innovation during periods of uncertainty [90].

Corruption and Participation in International Environmental Agreements

Participation in international environmental agreements is another critical factor in advancing sustainable development goals. These agreements often require countries to adhere to stringent environmental standards and to engage in collaborative efforts to address global environmental challenges [25]. However, the effectiveness of these agreements can be significantly hampered by corruption [41].

Corrupt practices can undermine international cooperation by reducing the credibility of commitments and weakening enforcement mechanisms [18]. For example, countries with high corruption levels may fail to comply with international emissions targets or engage in fraudulent reporting practices to obscure actual environmental performance [9, 87]. This undermines the collective efforts needed to address global environmental issues, such as climate change and biodiversity loss.

The Relationship Between Bureaucracy, Corruption, and Environmental Policy Implementation

Bureaucracy plays a dual role in environmental policy implementation. On one hand, a well-functioning bureaucracy is essential for the effective administration and enforcement of environmental regulations [26]. On the other hand, bureaucratic inefficiencies and corruption can severely hamper policy implementation, leading to suboptimal environmental outcomes [38].

Research suggests that in countries where bureaucracy is characterized by high levels of red tape and corruption, the implementation of environmental policies is often slow and ineffective [19]. Corrupt bureaucracies are more likely to engage in rent-seeking behaviours, prioritize personal gains over public goods, and resist changes that threaten established interests [32]. This significantly undermines the state's ability to enforce environmental regulations and achieve sustainability goals.

Case Studies: The Impact of Corruption on Environmental Governance in Different Regions

The impact of corruption on environmental governance varies significantly across regions, reflecting differences in political, economic, and social contexts. In developing countries, for instance, corruption often manifests in the form of bribery and embezzlement, diverting resources away from environmental protection and towards personal enrichment [31]. In contrast, in developed countries, corruption may take more subtle forms, such as regulatory capture, where powerful interest groups influence policy decisions to their advantage [43].

Studies have shown that in Sub-Saharan Africa, high levels of corruption have led to widespread environmental degradation, including deforestation, soil erosion, and loss of biodiversity [40]. Similarly, in Latin America, corruption has been linked to ineffective environmental policies and high rates of pollution [29]. In Eastern Europe and Central Asia, corruption has been identified as a significant barrier to the implementation of EU environmental standards [6, 85].

Mitigating the Impact of Corruption on Sustainable Development

To mitigate the impact of corruption on sustainable development, several strategies have been proposed. Strengthening institutional frameworks and enhancing transparency in governance are crucial steps towards reducing corruption [23]. This includes implementing robust anti-corruption laws, promoting open government practices, and fostering civic engagement to hold public officials accountable [20].

Moreover, international cooperation and the involvement of civil society organizations are essential in combating corruption and promoting sustainable development [37]. By fostering a culture of integrity and accountability, countries can create an enabling environment for the successful implementation of green transition policies and achieve their sustainability goals [22].

Conclusion

The transition to a sustainable economy is inherently linked to the effectiveness of environmental policies and governance. This literature review highlights the significant impact of corruption on the green transition process, particularly in terms of environmental policy implementation, international cooperation, and greenhouse gas emissions. Corruption undermines the effectiveness of sustainability initiatives, leading to poorer environmental outcomes and hindering progress towards sustainable development goals.

Future research should focus on developing more sophisticated methods for measuring corruption and its impact on environmental governance. Additionally, there is a need for more empirical studies that examine the interplay between corruption, bureaucracy, and environmental policy in different regional contexts. By addressing these gaps, scholars and policymakers can better understand the complex dynamics between corruption and sustainability and develop more effective strategies for promoting a green transition.

Hypotheses

After reviewing the literature, the authors formulated the following research questions:

Q1: Based on the literature, how can the examined sample be characterized based on the environmental sustainability indicators selected in this research?

Q2: What effect do the selected indicators have on the development of corruption perception?

3 Methodology

The researchers addressed the research questions using statistical methods. They us~~tiliz~~ed the 2022 Sustainable Governance Indicators (SGI) database from Bertelsmann Stiftung, which covers 41 EU and OECD countries and is publicly accessible online (https://www.sgi-network.org/2022/). This database includes an index that measures the effectiveness of anti-corruption efforts, as well as several sustainability-related indices (such as environmental policy, greenhouse gas emissions, waste generation, air pollution, etc.). The authors selected specific indicators from the entire database that are associated with corruption (including illegal waste disposal, the trading of emission quotas, and environmental policy decisions). According to the BS methodology, these indices are primarily composed of statistical indicators and are assigned a score from 1 to 10, with higher scores being more favourable. In the BS scoring system (ranging from 1 to 10 points), the theoretical average (rounded down) is set at 5 points.

The authors selected the following indices of the SGI for their study (Table 1):

Table 1 Indicators used by authors

Index name	Definition
Corruption Prevention	This question addresses how the state and society prevent public servants and politicians from accepting bribes by applying mechanisms to guarantee the integrity of officeholders
Environmental Policy	This question deals with government activities aimed at protecting natural resources and limiting or minimizing pollutants. It examines three questions: is the government's environmental policy ambitious enough, are its effects tangible, are environmental aspects properly integrated into the policies.
Energy Productivity	It measures how much the economic benefit comes from using primary energy. This value is calculated by taking the ratio of GDP (the total money made in a country) to total primary energy use (TPES) (all of the primary fuels and primary flows that a country uses to get energy)
Gross Greenhouse Gas Emissions	in per capita
Particulate Matter (PM)	What share of population is exposed to more than 15 micrograms/m3 PM

Biocapacity	The capacity of ecosystems to regenerate what people demand from those surfaces. Life, including human life, competes for space. The biocapacity of a particular surface represents its ability to regenerate what people demand [52].
Waste Generation	Municipal waste produced per capita
Material Recycling	Recovered percentage of municipal waste

Source: authors' own

The indicators selected for the study (e.g. environmental policy, greenhouse gas emissions, energy efficiency, waste generation, material recycling, etc.) represent aspects of sustainability that, based on the literature, can be most closely linked to institutional quality and corruption risks. During the selection, we took into account theoretical relevance (literature), empirical accessibility and reliability, as well as comparability (uniform methodology, standardized indicators). The aim of the selected indicators is to create a complex, but manageable model structure that provides an adequate empirical basis for examining the relationships between corruption and environmental performance.

The authors used the time series data from SGI Corruption Prevention Index to model the extent of corruption. To avoid confusion with the Transparency International CPI index, the Bertelsmann CPI index will be abbreviated as BCPI from now on.

The SGI reports all variables transformed to a value between 1 and 10, so no further transformation was performed on the variables. We did not apply weighting based on country size, GDP or regional grouping, as our goal was for the regression model to treat perceived corruption risks and environmental indicators with the same weight across countries. These factors should be addressed by expanding the model (e.g. dummy variables, interaction effects). This could be part of a later, extended analysis. The aim of the present model is to explore comprehensive and structurally simple relationships, in order to establish the basis for further stratified studies.

The initial step involved generating descriptive statistics was, ~~.~~ s~~S~~imultaneously, assessing the normality of the sample ~~was assessed~~ using the Shapiro-Wilk test [30], and the assumption of homoscedasticity was evaluated with Levene's test (Levene et al., 1960). These two tests are crucial in determining the appropriate statistical methods for subsequent analysis. Following this, the focus shifted to investigating the extent and direction in which environmental indices impact corruption prevention. To explore this relationship, the authors developed a regression model where the BCPI was the dependent variable, while the environmental indices served as independent variables. The model equation:

$$CORRUPT_{it} = \beta_0 + \beta_1 GHG_{it} + \beta 2\ WASTE_{it} + \beta 3\ RECYCLE_{it} + \beta 4\ ENERGY_{it} + \beta 5\ ENV\_POLICY_{it} + \varepsilon_{it}$$

,

where:

$CORRUPT_{it}$ is Corruption Prevention Index (BCPI) in country i, year t,

GHG_{it} is Greenhouse gas emissions per capita in country i, year t,

$WASTE_{it}$ is Municipal waste per capita in country i, year t,

$RECYCLE_{it}$ is Recycling rate in country i, year t,

$ENERGY_{it}$ is Energy efficiency in country i, year t,

ENV_POLICY_{it} is Quality of environmental regulation in country i, year t,

ε_{it} is error term.

4 Results and discussion

Q1: How can the sample examined be characterized based on the environmental sustainability indicators selected for the research?

Complete data was available for all years in the study covering 41 countries. Based on descriptive statistics, most of the indicators examined meet the conditions of normality, with the exception of the Multilateral Environmental Agreements and Particulate Matter variables, for which the Shapiro–Wilk test indicated a significant deviation. For this reason, only non-parametric methods can be applied to these indicators.

Overall, the countries in the sample performed better than the theoretical average in terms of corruption prevention. However, the values for Waste Generation and Particulate Matter are unfavourable: the region is characterized by above-average waste generation and high population exposure to airborne dust concentrations. The level of participation in international environmental agreements is also above-average, indicating a strong commitment to environmental cooperation.

In contrast, the values for Material Recycling and Renewable Energy remained below the theoretical average, suggesting that further development is needed to achieve more sustainable management, particularly in the areas of renewable energy and material circulation.

Overall, research question Q1 revealed that the environmental sustainability patterns of the countries examined are mixed: despite strong environmental policy engagement, there are persistent challenges in terms of material emissions and energy awareness.

Table 2 shows the results of the descriptive statistics.

Table 2
Descriptive statistics of sample

	2014	2015	2016	2017	2018	2019	2020	2021	2022	S-W p
Corruption_ Prevention – MEAN	6.41	6.39	6.51	6.56	6.54	6.44	6.32	6.24	6.34	0.958
Waste_Ge-neration – MEAN	5.71	5.74	5.71	5.64	5.41	5.33	5.24	5.25	5.20	0.184
Material_ Recycling – MEAN	4.48	4.48	4.62	4.80	4.86	4.86	4.94	4.93	5.00	0.191
Renewable_ Energy – MEAN	4.14	4.28	4.42	4.51	4.56	4.59	4.61	4.67	4.80	0.002
Multilateral_ Environ-mental_ Agreements – MEAN	7.33	7.33	6.66	6.46	6.88	6.71	6.79	6.81	6.93	<0.001
Particulate_ Matter – MEAN	5.42	6.20	6.40	6.62	6.61	7.19	7.10	7.13	7.10	<0.001
Material_Foo tprint – MEAN	5.82	5.88	5.93	5.91	5.98	5.91	5.88	5.91	5.95	0.028
Environment al_Policy – MEAN	5.98	6.07	6.07	6.15	6.05	6.12	6.17	6.17	6.22	0.051
N	41	41	41	41	41	41	41	41	41	------
Missing	0	0	0	0	0	0	0	0	0	------

Note: S-W p = Shapiro-Wilk's p Source: authors' own

A total of 41 countries were examined, with no missing data. The Shapiro-Wilk test (1965) indicated that most of the analysed indices exhibit normality. However, there are exceptions ($p<0.001$): 'Multilateral Environmental Agreements' and 'Particulate Matter' (PM). The former measures participation in international agreements, while the latter reflects the proportion of the population exposed to more than 15 micrograms/m3 of PM. Consequently, only non-parametric statistical methods can be applied.

Overall, the countries in the sample performed better than the theoretical average in terms of Corruption Prevention. This confirms earlier findings that EU and OECD countries generally exhibit relatively strong institutional frameworks and anti-corruption mechanisms compared to the global average [61], [64], [67]. At the same time, the picture is not uniformly positive on the environmental side. The values for Waste Generation and Particulate Matter are unfavourable: the region is characterized by above-average waste generation and high population exposure to airborne dust concentrations. This result is consistent with previous evidence showing that higher income and more advanced institutional settings do not automatically lead to lower environmental pressures, especially in terms of material throughput and urban air pollution [69], [72], [47].

The level of participation in Multilateral Environmental Agreements is also above -average, indicating a strong commitment to international environmental cooperation. This aligns with the literature which highlights that EU and OECD members are typically embedded in dense "regime complexes" of climate and environmental agreements [66], [41]. However, our findings suggest that formal participation is not sufficient on its own to guarantee favourable outcomes in all environmental dimensions, echoing critiques that emphasize enforcement gaps and implementation deficits even in highly institutionalized settings [63], [68].

In contrast, the values for Material Recycling and Renewable Energy remained below the theoretical average, suggesting that further development is needed to achieve more sustainable management, particularly in the areas of renewable energy deployment and material circulation. This is in line with studies that point to a slow and uneven transition towards circular economy practices and renewable energy, even in countries with relatively strong governance and environmental policy frameworks [55], [59], [73].

Overall, research question Q1 revealed that the environmental sustainability patterns of the countries examined are mixed: despite strong environmental policy engagement and comparatively robust anti-corruption institutions, there are persistent challenges in terms of material emissions, waste generation, and energy awareness. This duality supports the argument that improvements in governance and corruption control are necessary but not sufficient conditions for comprehensive green transition; structural change in production and consumption patterns are~~is~~ also required [9], [34], [47].

Table 2 shows the results of the descriptive statistics.

Q2: How do the selected environmental indicators affect the perception of corruption?

The regression model explains 69.4% of the variation in the prevention of corruption (BCPI), indicating a strong relationship between environmental indicators and the effectiveness of corruption prevention. The model fit is significant and there is no multicollinearity.

The most significant factors are:

- Environmental Policy (positive, $p < 0.001$): Stronger environmental policy is closely linked to the prevention of corruption. This can be explained by the fact that more transparent operations and fewer legal loopholes leave less room for corruption. The result empirically supports prior findings that better environmental governance and stricter, well-enforced regulations are associated with lower levels of corruption and better environmental performance [9], [21], [35], [41]. Our results thus extend this literature by showing that not only does corruption affect environmental outcomes, but environmental policy quality itself feeds back into the perceived effectiveness of corruption prevention.
- Particulate Matter (positive, $p < 0.001$): High air pollution increases public pressure, which leads to stricter environmental measures – and this can have a strong anti-corruption effect. The effect is delayed. This mechanism complements earlier studies that primarily document the opposite causal direction, i.e. that higher corruption tends to worsen environmental quality and air pollution [49], [50], [34], [47]. In contrast, our findings suggest a possible feedback loop: once pollution becomes salient to citizens and institutions, it may trigger stronger regulatory responses and improved oversight, which in turn enhance corruption control.
- Gross Greenhouse Gas Emissions (negative, $p < 0.001$): Increasing greenhouse gas emissions worsen the BCPI value. Higher emission data are signs of an inefficient regulatory environment. This is consistent with previous research that links higher emissions and environmental degradation to poorer governance and more pervasive corruption [50], [9], [34], [47]. Our model confirms this negative association even after controlling for multiple environmental indicators, reinforcing the view that decarbonisation and anti-corruption efforts are closely intertwined.

Additional factors significant at the 5% level:

- Energy Productivity (positive, $p = 0.006$): Efficient energy management is of strategic importance, so decision-makers are less tolerant of corruption in this area. This finding resonates with the literature on eco-efficiency and governance, which argues that higher energy and resource productivity often coincide with more coherent policy frameworks and lower levels of rent-seeking [33], [42]. Our results add to this by showing that energy productivity is not only an economic or environmental indicator but also a proxy for the quality of institutions that manage strategic resources.
- Material Recycling (positive, $p = 0.014$): The circular economy is an important element of CSR, requiring more transparent corporate operations and stricter controls. The positive link between recycling and corruption prevention supports studies that emphasize the role of CSR and environmental transparency in strengthening institutional trust and reducing room for illicit practices [11], [60], [22].

Although Waste Generation and Biocapacity also show a negative trend, their impact is not significant.

Based on the interpretation of research question Q2, the results suggest that sustainability indicators—particularly environmental policy, air pollution, and emissions data—are closely related to corruption prevention and the development of corruption risks. A stronger green transition and transparent operating practices reduce the potential for corruption, while poor environmental performance is associated with an increase in corruption risks.

All the countries analysed perform better than the theoretical average for the Corruption Prevention indicator, which itself is slightly above-average. Both Waste Generation and Particulate Matter are above the theoretical average, indicating that more waste is produced than average and a larger proportion of people are exposed to polluted air in these countries. The Multilateral Environmental Agreements also score above the theoretical average, suggesting adequate participation in international environmental protection agreements. However, the values for Material Recycling and Renewable Energy are below the theoretical average, highlighting the need for further development in these areas (Figure 1). This pattern underscores the central message of the literature: governance and anti-corruption frameworks are necessary foundations, but substantial investments and structural reforms are required to translate them into tangible environmental improvements [5], [68], [41], [42], [86].

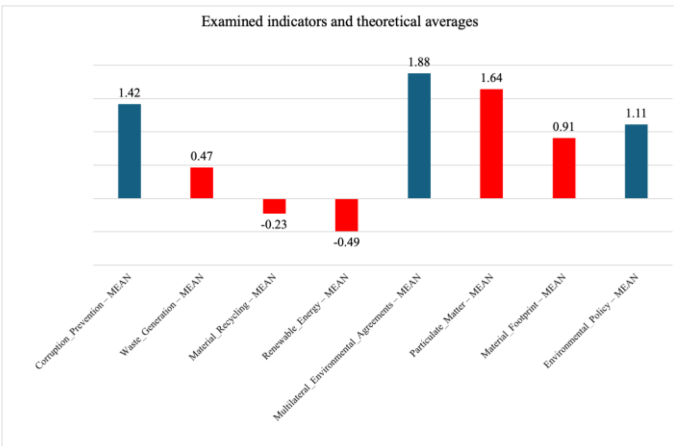

Figure 1
Favourable (dark teal) and unfavourable (red) indicator averages
(Source: authors' own)

The regression model is described in Table 3 and Table 4.

Table 3
Overall test results of regression model

	Overall Model Test					
Model	R	R²	F	df1	df2	p
1	0.833	0.694	90.6	9	359	< .001

Source: authors' own

The model explains 69.4% of the evolution of Corruption prevention under the influence of environmental indicators (R2=0.694). The fit of the model is adequate, the effect found cannot be attributed to chance alone (p<0.001). The VIF value for each variable is between 1.12-5.33 (a value below 10 is appropriate), i.e. there is no multicollinearity between the variables. This relatively high explanatory power is comparable to or higher than that reported in earlier cross-country studies linking environmental indicators and corruption or governance quality [35], [9], [35], [47].

Table 4 Regression model coefficients

Model Coefficients - Corruption_Prevention

Predictor	Estimate	SE	t	p
Intercept	2.7554	0.6307	4.369	< .001
Environmental_Policy	0.4928	0.0536	9.199	< .001
Particulate_Matter	0.1767	0.0247	7.162	< .001
Energy_Productivity	0.1626	0.0588	2.767	0.006
Gross_Greenhouse_Gas_Emissions	-0.2809	0.0654	-4.298	< .001
Biocapacity	0.0626	0.0443	1.412	0.159
Waste_Generation	-0.0649	0.0538	-1.205	0.229
Material_Recycling	0.0951	0.0384	2.479	0.014
Biodiversity	-0.0791	0.0552	-1.431	0.153
Renewable_Energy	0.0504	0.0546	0.923	0.356

Source: authors' own

"According to Table 4, corruption prevention is notably impacted by environmental policy, particulate matter, and gross greenhouse gas emissions, with the latter having a negative effect. Adherence to environmental policy can greatly enhance the effectiveness of corruption prevention, primarily by closing legal loopholes. Although not included in the model, global environmental policies and associated multilateral environmental agreements likely contribute to the strong impact of environmental policy. The positive relationship between increased population exposure to particulate matter and corruption control warrants further explanation. Higher air pollution levels pose significant health risks, leading to increased incidences and mortality rates from emerging diseases. Furthermore, deteriorating air quality becomes noticeable to the human senses, prompting government action to prevent air pollution. Thus, such preventive measures are not compatible with tolerating corruption. Consequently, higher levels of air pollution, with a certain delay, result in stronger corruption control and a reduced perception of corruption. The adverse effect of gross greenhouse gas emissions can be attributed to the fact that a formally acknowledged rise in emissions decreases the BCPI, indicating a negative shift in corruption levels, i.e., an increase.

If the significance level (α) is set at 5%, then energy productivity and material recycling also positively influence corruption prevention. The positive impact of energy productivity can be explained by the goal of increasing GDP with minimal primary energy consumption, which is crucial for the future. Therefore, no responsible public or economic leadership would tolerate corruption in this sector. An increase in waste generation also lowers the BCPI, thereby heightening the perception of corruption; however, this effect was not found to be significant. Additionally, recycling is a key marketing element of Corporate Social Responsibility (CSR) strategies and, in some respects, holds more value than money."

5 Policy Implications

The relationships revealed may be underpinned by institutional mechanisms that structurally shape the relationship between environmental policy quality and perceptions of corruption. More waste, poor recycling rates or low energy efficiency may be indicators of systemic failures that point to shortcomings in institutional functioning (weak controls, lack of accountability and circumvention of regulatory procedures).

This can lead to an erosion of trust in public institutions, which can also reduce the effectiveness of corruption control. At the same time, the presence of corruption – for example in licensing procedures or waste management systems – can weaken the effectiveness of policy interventions. This creates a negative feedback mechanism in which institutional weakness and environmental degradation reinforce each other.

Deterioration of environmental indicators can potentially be an early indicator of a decline in institutional integrity, and therefore their monitoring is crucial not only from an ecological perspective but also from a corruption prevention perspective. From a policy perspective, this means that an integrated approach is needed when developing sustainability strategies, encompassing not only environmental but also governance reforms. Transparency and accountability of implementation can play a key role in reducing corruption risks.

Through these experiences, the study not only presents data-driven correlations, but can also contribute to a deeper policy understanding of the relationship between green transition and anti-corruption governance.

6 Conclusion

State institutions are crucial in promoting environmental sustainability, particularly through their ability to legislate and enforce laws effectively. In many instances, substantial financial incentives are provided to support the green transition, which can also attract corrupt practices. This study found a strong link between environmental sustainability indicators and the perceived level of corruption, with the authors' model accounting for nearly 70% of this relationship. The perceived corruption level is heavily influenced by the effectiveness of environmental policies, which are often bolstered by participation in international green initiatives. Moreover, international coordination and collaboration play a key role in combating corruption, thereby lowering the perceived level of corruption.

Anti-corruption efforts result in a stricter regulatory landscape for companies, increasing the costs associated with violations and reducing the potential for profit through corrupt means. As these anti-corruption measures become more effective, firms lose privileges that were once secured through political connections. Consequently, companies may focus more on social initiatives to build their reputation and secure resources or to divert attention from past misconduct. Enhancing the fight against corruption leads to improved external oversight and greater scrutiny from stakeholders, pushing companies to achieve better corporate social responsibility (CSR) performance. Additionally, anti-corruption actions release previously restricted resources, which are essential for companies to engage in social activities.

7 Limitations of the Study

Despite its comprehensive approach and the strong explanatory power of the regression model, this study is subject to several limitations that must be taken into account when interpreting the results.

Reliance on Perception-based Measures

The central dependent variable, the Corruption Prevention Index (BCPI), is based on expert assessments rather than direct observation. While widely used, perception indices may introduce subjective bias, measurement noise, or cultural differences in reporting standards. Consequently, actual corruption levels may differ from perceived corruption, potentially affecting the robustness of the results.

Restricted Sample of Countries (EU and OECD)

The analysis covers 41 EU and OECD countries, which are generally characterized by higher governance quality, stronger institutions, and more consistent environmental reporting systems. As a result, the findings may not be generalizable to developing regions, where corruption dynamics and environmental pressures differ substantially. The limited cross-regional variation may also attenuate the strength of certain effects.

Limitations of Secondary Data and Index-Based Indicators

The study relies exclusively on indicators from the SGI database, which aggregates data from multiple sources using composite scoring systems. Such indices inevitably involve methodological choices that may affect comparability across countries. Additionally, some SGI indicators (e.g., Environmental Policy) integrate qualitative expert assessments, reducing measurement precision.

Potential Endogeneity between Governance and Environmental Quality

Although the regression model controls for multiple environmental indicators, causal direction remains difficult to establish. Environmental performance may influence corruption perception, but corruption may simultaneously shape environmental outcomes. Without explicit instruments or longitudinal causal modelling, reverse causality cannot be ruled out.

Exclusion of Certain Relevant Variables

The model does not incorporate several contextual factors known to affect corruption, such as political stability, regulatory quality, judicial effectiveness, income inequality, or digitalization of public administration. Omission of these variables may bias coefficient estimates or overstate the effect of environmental indicators.

Use of Annual Time-Series Data Without Accounting for Structural Breaks

Although 9 years of data provide a meaningful time horizon, the period includes major events (e.g., the 2020 COVID-19 pandemic) that may have affected both environmental indicators and corruption perception. The model does not explicitly control for global shocks or structural breaks, which may introduce unexplained variance.

Limited Availability of Normal Distributions for Certain Variables

As shown by the Shapiro–Wilk test, two indicators (Multilateral Environmental Agreements and Particulate Matter) significantly deviated from normality. Although non-parametric considerations were applied, the use of ordinary least squares regression may still introduce small distortions for variables with highly skewed distributions.

Absence of behavioural or survey-level analysis

The study focuses on macro-level indices but does not incorporate micro-level data (household surveys, firm-level corruption experiences, behavioural experiments, etc.). As a result, the findings cannot reveal individual-level corruption mechanisms, motivations, or organizational practices.

Summary

This study provides meaningful evidence on the link between environmental sustainability and corruption perception; however, the aforementioned limitations should be acknowledged when interpreting the results. Future research could strengthen causal inference through panel-data techniques, instrumental variables, structural equation modelling, or the integration of micro-level datasets.

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