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Does Green Innovation Linked between Environmental Governance and Firm Performance? A System of Generalised Method of Moments in Pakistan

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Abstract

This study investigates the relationship between environmental governance's quadruple bottom line dimensions (economic, environmental, social, and governance) and firm performance. It therefore ascertains whether green innovation can mediate the nexus of ecological governance's quadruple bottom line dimensions and firm performance. Particularly using the generalized method of moments techniques to analyze a comprehensive dataset of 110 non-financial firms listed at the Pakistan Stock Exchange from 2015 to 2022 (880 firm-year observations), our findings first suggest that environmental governance's dimensions positively affect firm performance. Second, the desired ecological governance can be achieved by adopting comprehensive green innovation. Third, environmental governance has a significant impact on shaping green innovation that affects firm performance. These results are in line with Porter's theory assumptions. The results have substantial implications for stakeholders i.e. researchers, financiers, managers, legislators, and regulators.

Keywords: *Environmental Governance, Green Innovation, Firm Performance, Pakistan Stock Exchange, Generalised method of moments*

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1. INTRODUCTION

In the last few decades many developing nations like Pakistan, have accomplished quick economic growth (Mujtaba *et al.*, 2024). However, the progress made by these developing countries has coincided with the environment's increasing degradation (Murshed *et al.*, 2022). The term "environmental governance" (EG) describes the institutions, procedures, and systems put in place to support environmentally friendly growth and preservation. To minimize pollution, support renewable energy sources, and address the climate issue, rules, laws, and regulations must be implemented in addition to managing natural resources (Protocol, 1997; Anser *et al.*, 2024). Thereafter, with environmental degradation becoming an increasingly pressing global issue, many companies are forced to implement green innovation (GI) practices to achieve financial gains (Asadi *et al.*, 2020; Farooq *et al.*, 2023). Therefore, EG has attracted the attention of governments,

corporate executives, and academics (Arvidsson *et al.*, 2022). One of the main topics covered by the EG discourse (Huang *et al.*, 2016) and firm performance (FP) (Arvidsson *et al.*, 2022; Naeem *et al.*, 2023) is the role of the environment in fostering innovation capacity. The innovation of an organization that supports environmental responsibility and sustainability is known as its GI. While FP refers to the process of improving a company's entire performance through strategic initiatives that boost profitability and competitiveness, these can be attained through effective risk management, operational excellence, product innovation, and efficient resource allocation (Bai *et al.*, 2019; Naeem *et al.*, 2025a,b). As a result, GI effectively reduces environmental deterioration and the negative effects of resource consumption practices, leading to the growth of the environment (Salihi *et al.*, 2024). It is possible to address environmental issues and promote green growth when these innovations are used to their fullest potential (Abid *et al.*, 2022). The government of Pakistan established a Ministry tasked with educating public and private entities about the importance of properly managing environmental concerns to promote environmental protection. This is a result of growing environmental consciousness in society and the rapid shift in consumer preferences toward greener products. As a result, GI plays a vital role in enhancing the green environment.

Businesses must have a thorough understanding of the factors that drive GI to establish this position. (Triguero *et al.*, 2022; Naeem, 2023; Naeem *et al.*, 2024a,b). Because of this, businesses need to create new EGs that highlight the benefits of using GI. (Zhang *et al.*, 2022). Previous research (Hasbullah *et al.*, 2022; Shahzad *et al.*, 2021) has demonstrated that factors including environmental devotion facilitate GI. Xie *et al.* (2022) examined the factors that drive and encourage GI, primarily concerning developed economies, Pakistani markets are overlooked, particularly when it comes to EG. However, earlier research on the effect of EG on the FP mediating role of GI has not shown final results. Two schools of thought are the main topic of research. First, according to the "neoclassical notion," EG suppresses GI by increasing business expenses and lowering FP. (Zhong *et al.*, 2022). According to Shen *et al.* (2020), the "Porter theory" holds that EG continues to have a motivational effect on GI and enhances FP. Thus, it is unclear how much of an impact EG has in Pakistan. Thus, comprehending the origins of GI can help decision-makers create financial tools for sustainable growth. (Sanni & Change, 2018).

Moreover, FP depends on EG, which benefits shareholders. (Ching *et al.*, 2017). The limitation of this study is lessened because it is recognized as a requirement for FP. (Chouaibi *et al.*, 2022). Enhancing FP in relationship to corporate strategy is the main goal of EG, a new transparency concept that fosters increased communication between the business and its stakeholders. (Buallay, 2019). Consequently, it lessens the stakeholders' agency problem. (Taiwo *et al.*, 2022). There is still disagreement over whether an FP and an EG are related, despite the importance of sustainability in predicting future business performance. Although this topic has been the subject of research (Nwaigwe *et al.*, 2022), the question of whether EG increases FP and GI mediate this link is left unanswered. Therefore, the mediating role of GI between FP and EG and its dimensions is examined in this work.

Thus, in the context of Pakistan, it is crucial to investigate EG as a source of FP and the mediating role of GI between these variables. Pakistan has numerous environmental problems that call for long-term

solutions as an evolving country with a developing economy. Growing GI is useful for EG, and GI can then boost FP for businesses by reducing costs, boosting productivity, and enhancing reputation. Although the economic circumstances in Pakistan differ from those in other nations, Baron *et al.* (1986) A study on the impact of EG on GI and business value creation was done in an African environment, emphasizing the beneficial association between EG and GI and firm value development. Therefore, knowing how EG might improve the FP mediating role of GI can assist Pakistani businesses become more long-term competitive and sustainable. Thus, in the context of Pakistan, it is essential to conduct a thorough investigation on the mediating role of GI between EG and FP. Therefore, this study's main goal is to look at how EG affects FP and how GI acts as a mediator between the two.

This study has some contributions. First, by determining the optimal dimension that resulted in the enhancement of GI's FP mediating role, this inquiry contributes to the EG research. Thus, by demonstrating the motivating influence of EG on FP and the mediating role of GI, the study contributes to the EG research on the Porter theory. Secondly, the investigation advances current research by offering a thorough model of distinct EG dimensions that drive the FP and GI. Third, by highlighting the conflicting effects of EG dimensions on FP those that lead to the enhancement of FP and those that do not the study contributes to the body of current research. As a result, it increases openness between the business and other stakeholders, which decreases agency conflicts between them. Stakeholders like shareholders, investors, regulators, policymakers, and academics will benefit from this since it will increase their understanding of EG's responsibilities in FP and how to establish regulations regarding EG concerning businesses' future success. Finally, the investigation advances EG research by providing a thorough model of the distinct EG scope that drives FP.

The arrangement of this study is as follows: an introduction is given in the first section, and the theoretical foundation is covered in the second. A survey of the literature review is included in the third section. The study methodology is described in the fourth section. Study findings and analysis are presented in the fifth section. The conclusion, research implications, and limitations are presented in last section six.

2. THEORETICAL BACKGROUND

The "Porter theory" is one idea that clarifies how EG drives GI and FP and how either GI mediates the link between EG and FP. The theory, which was formulated by Michael Porter (1991), contends that environmental laws boost businesses' inventiveness and competitiveness. Michael Porter (1991) claims that companies obliged to follow environmental regulations will have to come up with further provident and effective ways to achieve those conditions. This may goad invention and affect the development of eco-friendly technology. A business's performance and competitive edge may be enhanced by innovation.

Businesses that executed environmental guidelines had more FP than those that couldn't follow these guidelines has lower performance (Darnall *et al.*, 2008; Kim *et al.*, 2014). This study is based on the "Porter proposition," which contends that environmental laws can foster invention and better FP. This idea has

been supported empirically in several studies, showing that businesses that apply more eco-friendly practices can gain a competitive edge in the market.

3. LITERATURE REVIEW

The review of existing research on the relationship between EG and businesses' capacity for environmentally sustainable innovation and how this can impact performance is done in the context of EG as a driver of GI and FP.

3.1. Environmental Governance

The processes, laws, and associations that societies use to decide how stylish to manage and cover the landscape are inclusively appertained to as EG. It encompasses a range of strategies, including laws, request-ground impulses, community-grounded operation, and the involvement of multiple actors, including individualities, the marketable sector, government institutions, and civil society associations. Natural resource operation and mortal commerce with the terrain are governed by a system of institutions, rules, procedures, and conventions. It's the process by which all situations of public and marketable actors in the environmental sector carry out their duties and exercise their authority (Henseler *et al.*, 2015).

Commercial image operation is done with the help of EG. Businesses employ it to manage stakeholder responses and assure them that they're acting following their prospects. (Boiral, 2016). The creative tools to be employed to negotiate this, are the terrain, frugality, society, government, and inventions. (Moussa *et al.*, 2022). Environmental, social, and governance, or ESG, is a component of EG that is significant in the assessment of well-managed businesses, environmentally conscious businesses, and socially responsible businesses by shareholders. The application of these elements in the process of envisioning the prospects for sustainable development has become popular among ethically conscious investors, both individual and institutional.

Therefore, to bridge the gap of merging economics and governance concurrently, sustainability is proxied with the quadruple bottom line (QBL) in the current inquiry. The body of research on the subject examines the impact of EG with a particular emphasis on the triple bottom line (TBL) dimensions. However, some studies (Buallay & Management, 2020; Buallay, 2019; Nguyen & Accounting, 2022) ignore the concurrent existence of economic and governance factors, which are significant in developing nations such as Pakistan, where the following characteristics are prevalent: (1) Low standard of living, as economic environments serve as indicators of societal well-being. Sheth *et al.* (2011); (2) Weak governance structure (Giurca Vasilescu, 2008). While concerns about social cohesion, ecological awareness, financial development, and governance are not novel, it is crucial to combine these issues into a single investigation (Hernández *et al.*, 2020). As a result, the QBL that addresses the integration of the economic, environmental, social, and governance dimensions forms the basis of this investigation.

3.2. Green Innovation

GI can be defined as a nation's or an association's capability to develop and apply environmentally friendly and sustainable technologies and practices. This capability can lead to further competitiveness in the global market, more effective use of resources, and lower environmental impact. According to Asadi *et al.* (2020),

GI is one of the most important environmental programs. It involves changing product styles to reduce resource consumption, reduce pollution, and incorporate environmental administration measures into business operations. GI promotes the development and operation of green technologies that cover, record, supervise, and lessen environmental detriment at the source of emigration while also ensuring that the entire process of producing and consuming finished goods has a negligible environmental impact. (Bai *et al.*, 2019).

3.3. Firm Performance

The term "FP" has multiple aspects and is subject to various impacts. Return on assets, return on equity, earnings per share, and market value to book value are a few of the significant variables that have been identified to have an emotional impact on FP. Ali *et al.* (2022) and Farooq and Ahmad (2023) explain the high return on assets and profitability.

3.4. Hypotheses Development

3.4.1. Environmental Governance and Green Innovation

3.4.1.1. Economic Dimension and Green Innovation

The primary interest of GI is cost savings (Hojnik *et al.*, 2016). It lessens the influence of production and depletion on the environment. GI is prejudiced by the economic structure (Shen *et al.*, 2020). Thus, it is worthwhile to establish the association between resources, the environment, and the economy. A collective amount of research backs up the theory that economic variables have a substantial role in GI (Triguero *et al.*, 2022; Rehman *et al.*, 2022). According to this research, financial incentives, consumer demand, and regulatory frameworks all have a substantial role in motivating businesses to engage in GI. Financial incentives, such as tax credits and subsidies, encourage businesses to use environmentally friendly methods and technologies. The market's need for sustainable goods and services can also spur modernization in these fields, and laws can level the playing field for businesses and entice them to spend money on sustainable technologies. In general, the body of research reverses the theory that GI is mostly caused by economic issues. Existing research suggests that businesses will harvest more innovative products if they take into account investing in the economic constituent of sustainability while creating their products, especially in the context of the economy's post-pandemic retrieval (Pichlak *et al.*, 2021; Sarkar *et al.*, 2022).

3.4.1.2 Environmental Dimension and Green Innovation

For long-term sustainability, the environmental constituent of sustainability seeks to diminish environmental footprints and human-environment struggles (Pan *et al.*, 2021). Through natural preservation, it is increasingly supplementary to the building of a sustainable ecosystem. Authorities have applied significant pressure on businesses to comply with environmental regulations to uphold the sustainability of the environment (Shahzad *et al.*, 2020). EG directs and excites GI strategies (Asadi *et al.*, 2020). Several studies have recognized the existence of a theoretical association between sustainability reporting and innovation (McWilliams & Siegel, 2000). The influence of environmental strategy on innovation has not been acknowledged by much empirical attention (Kraus *et al.*, 2020; Rehman *et al.*, 2022). In developing

Asian countries, researchers have not measured the impression of environmental strategy as a driver of GI (Orji *et al.*, 2019; Sanni & Change, 2018).

The association between environmental factors and GI has been the subject of a few studies. Eco-friendly activities that restrict environmental issues influence firms' GI (Li *et al.*, 2020). Environmental issues (e.g. resource depletion and climate change) encourage businesses to produce sustainable goods and services, which can enhance their innovation potential (Bos-Brouwers 2010). Sun *et al.* (2022) companies with robust environmental management systems had higher predispositions to engage in GI activities. Nwaigwe *et al.* (2022) GI also found that environmental commitment and awareness were essential for GI. Those firms that work on eco-friendly activities are working on higher levels of innovation to protect their environment (Asadi *et al.*, 2020). This research provides evidence in favor of the theory that environmental factors have a significant role in GI in organizations.

3.4.1.3 Social Dimension and Green Innovation

Graafland *et al.* (2003) identified social mechanisms of sustainability that include worker participation, committing environmental standards, enhancing resource awareness, and enhancing employees' administrative and technical capabilities for employing such EG. The internal growth and capabilities of businesses have a substantial influence on GI (Huang *et al.*, 2016). The essence of research suggests that including social fears in a company's product development process increases innovation (Awan *et al.*, 2021; Chouaibi *et al.*, 2021; Shahzad *et al.*, 2020).

The body of research indicates that the link between social dimensions and GI is expanding. GI was found to be prejudiced by stakeholder participation in a study controlled by Ullah *et al.* (2023). Comparable findings were made by Zhang *et al.* (2022), who observed that awareness and social norms were important forecasters of GI. More recently, (Graafland *et al.*, 2003) discovered that employee information sharing and social networks were substantial factors manipulating GI in New Zealand businesses. Ahmed *et al.* (2022) discovered in another study that GI in Vietnamese initiatives was favorably influenced by social capital, which is defined as the resources inherent in social networks. All things measured, these findings point to the importance of social factors in GI inside establishments. Establishments can improve their capability for GI and provision sustainable development by involving stakeholders, advancing social norms and awareness, hopeful social networks and knowledge exchange, and developing social capital.

3.4.1.4 Governance Dimension and Green Innovation

By contributing the required incentives, legal frameworks, and financial channels to upkeep sustainable growth, effective governance can significantly influence a nation's Gross Domestic Product (GDP). Yuan and Cao (2022) assert that GI is directly impacted by sustainable governance attributes such as competency, approach, size, and environmental administration. Consequently, businesses that take sustainability governance into account generate a robust network of stakeholders and support the expansion of novel green technology. According to the Porter theory, innovation and sustainable governance are correlated (Shen *et al.*, 2020). Besides, the literature indicates that eco-friendly governance

fosters corporate creativity and innovation, supportive of the Porter theory (Jiang *et al.*, 2018; Li *et al.*, 2022).

Thus, based on the above literature on EG and GI we hypothesized it as follows:

H1: Environmental Governance has a significant effect on green innovation.

3.4.2 Green Innovation and Firm Performance

According to a large body of prior research, innovation is fundamentally associated with improved performance (Bos-Brouwers & environment, 2010). In today's competitive markets, GI is thought to be one of the major variables influencing a company's long-term success (Kwakwa, 2021). GI has the potential to differentiate goods and services through reduced prices, improved quality, or giving businesses a competitive edge in the marketplace, all of which can improve FP. High-level innovative firms can sustain steady market competitiveness and adapt flexibly to the constantly changing market, resulting in continuous improvement of FP. According to Doran *et al.* (2016), GI is an effective strategy that both new businesses can utilize to challenge more established businesses and more established businesses who need to keep their competitive edge in fast-paced industries. In a fiercely competitive and global market contend that GI is widely recognized as the ultimate success factor; an innovative viewpoint paints a clear picture of the prospects that lay ahead. As a result, we made the following hypothesis.

H2: Green innovation has a significant effect on firm performance.

3.4.3 Environmental Governance and Firm Performance

3.4.3.1 Economic Dimension and Firm Performance

Strong evidence from the literature supports the idea that economic issues significantly affect FP. According to Shen *et al.* (2020), FP was positively correlated with economic variables such as GDP growth, interest rates, and inflation. Alam and Tariq (2023) Demonstrated that economic variables including stock market indices, oil prices, and exchange rates were significant FP drivers in the context of emerging economies. Zhang *et al.* (2022) Examined the association between business value and economic factors in the context of the Chinese stock market in an additional study. They discovered that FP is significantly affected by variables. Aslam *et al.* (2020) Also examined how economic conditions impeded the performance. Ghardallou, (2022) and Behl *et al.* (2022) claimed that businesses that follow sustainability have higher FP and suggest that investing in sustainable governance will result in higher performance.

3.4.3.2 Environmental Dimension and Firm Performance

Many studies indicate that firms improve their FP by focusing on environmental sustainability activities. Li *et al.* (2020), Wang *et al.* (2014) and Kraus *et al.* (2020) examined the impact of environmental responsibility on FP. The study concluded that firms that invest in environmental sustainability efforts can enhance FP. However, businesses can accomplish better when they adopt environmental sustainability happenings (Sabherwal *et al.*, 2019). Environmental involvement is a useful tool to reduce the negative effects of agency costs and insufficient governance on performance. Research suggests that making investments in environmental sustainability will advance output (Jiang *et al.*, 2018; Li *et al.*, 2020). This exploration demonstrates the belief that FP is assisting environmental sustainability events.

3.4.3.3 Social Dimension and Firm Performance

According to Devie *et al.* (2020), social sustainability attends as a tool for businesses to include social issues into their operations and stakeholder association. It escalates the profits of companies. According to Chouaibi *et al.* (2021), businesses that engage in social activities stand to gain recovering positioning because of their astrophysical reputation for doing good deeds for society, even at the expenditure of some earnings. According to current research, spending on environmental sustainability increases FP (Gillan *et al.*, 2021).

3.4.3.4 Governance Dimension and Firm Performance

Strong evidence from the literature demonstrates that higher FP is correlated with excellent governance practices. Several investigations were carried out in this area. These investigations offer proof in favor of this theory. A study conducted by Boiral (2016) examined the relationship between FP and governance and discovered favorable correlations between the two. Another study by (Ali *et al.*, 2022) examined Pakistani businesses and discovered that FP benefited from excellent governance procedures. Similar findings were made by Vieira *et al.* (2019), who investigated the relationship between governance and performance in Portuguese businesses.

Thus, FP is directly impacted by sustainable governance traits including expertise, method, scale, and environmental administration system. According to Yuan and Cao (2022), companies that prioritize sustainability and governance establish strong relationships with their shareholders, which helps them acquire the knowledge that they need for financial reporting. As a result, the strengths of governance outweigh the limitations of the system (Fatemi *et al.*, 2018).

Thus, based on the above literature we hypothesized it as follows:

H3. Environmental Governance has significant effects on firm performance.

3.5. Environmental Governance, Green Innovation and Firm Performance

It appears from earlier research that little is known about how EG activities could enhance FP through GI. Based on a thorough review of the literature, Aguinis *et al.* (2013) Conclude that there is a glaring void in the adoption of various approaches to investigating EG and factors that may influence the relationship between EG and FP. As a result, we must comprehend the processes tying EG and FP together. GI is a crucial tool that helps businesses meet EG and enhance FP.

Provasnek *et al.* (2017) State that EG requires businesses to create win-win relationships with suppliers and customers, offer high-quality products and services to consumers and produce more environmentally friendly products through GI in light of the advancement of information technology and user demand complexity. Examining GI as a mediator in the association between EG engagement and FP will enhance the accuracy of the data and understanding of this relationship because GI not only affects FP but is also thought to be an essential component in achieving EG. So, we hypothesized it as follows:

H4: Green innovation mediates the relationship between environmental and firm performance.

3.6. Conceptual Framework

Based on the literature we formulate the following conceptual framework.

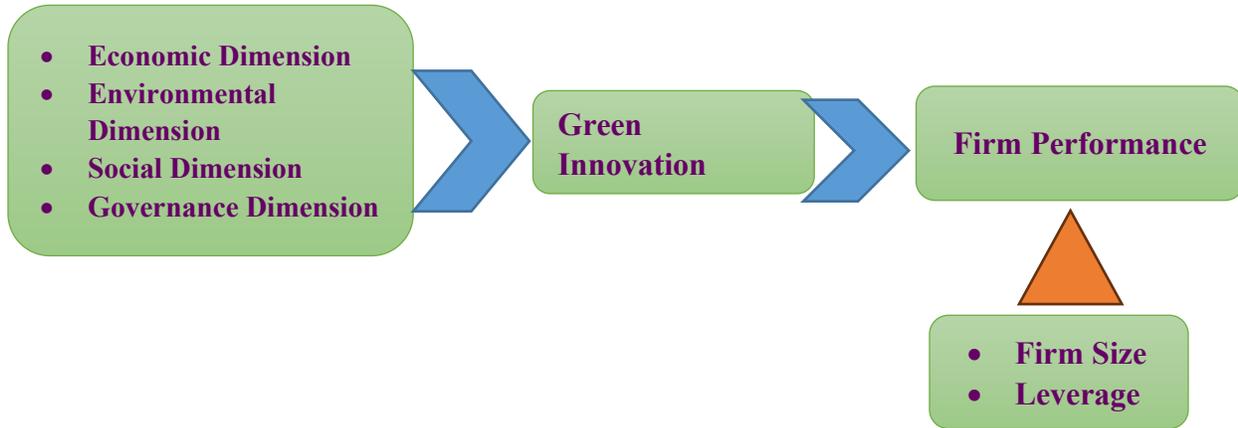


Figure 1. Conceptual Framework

4. METHODOLOGY

4.1 Sample

The sample of the study was selected based on the availability of data and consisted of 110 firms from seven sectors period from (2015 to 2022). Data was obtained from annual reports which were available on PSX. This study takes a positivist research philosophy approach in its methodology, gathering quantitative data to investigate the mediating role of GI between EG and FP. To investigate hypotheses, the study uses quantitative techniques such as statistical analysis. Financial statements and content analysis for EG and GI, as well as FP. Furthermore, STATA is utilized to analyze the data using the GMM model.

4.2 Econometric Model

Endogeneity is a potential issue that may develop when discussing the relationship between EG practices, GI, and FP, raising issues about the findings' validity and reliability. The system GMM model is an excellent statistical tool for dealing with heterogeneity, endogeneity, and estimate bias. (Ullah *et al.*, 2018). To address these endogeneity issues, the system GMM technique includes internal instruments that are derived from the dependent variables' lagged values (Ullah *et al.*, 2018; Blundell & Bond, 2000). Furthermore, the GMM model offers a method of minimizing excessive data losses. We used the system GMM model to check our models for endogeneity and reverse causality concerns.

To examine the impact of EG on GI, we estimate our first GMM regression model as below:

$$GI_{it} = \beta_0 + \beta_1 GI_{it-1} + \beta_2 ECD_{it} + \beta_3 END_{it} + \beta_4 SD_{it} + \beta_5 GD_{it} + \beta_6 FS_{it} + \beta_7 Lev_{it} + \epsilon_{it} \dots \dots \dots (1)$$

To test our second hypothesis (impact of EG on FP), we estimate the following equation model:

$$FP_{it} = \beta_0 + \beta_1 FP_{it-1} + \beta_2 ECD_{it} + \beta_3 END_{it} + \beta_4 SD_{it} + \beta_5 GS_{it} + \beta_6 FS_{it} + \beta_7 Lev_{it} + \epsilon_{it} \dots \dots \dots (2)$$

Further, we estimated the following regression model to examine the impact of GI on FP:

$$FP_{it} = \beta_0 + \beta_1 FP_{it-1} + \beta_2 GI_{it} + \beta_3 FS_{it} + \beta_4 Lev_{it} + \epsilon_{it} \dots \dots \dots (3)$$

Ultimately, to examine the mediating role of GI between EG and FP, we estimate the following empirical model:

$$FP_{it} = \beta_0 + \beta_1 FP_{it-1} + \beta_2 ECD_{it} + \beta_3 END_{it} + \beta_4 SD_{it} + \beta_5 GD_{it} + \beta_6 GI_{it} + \beta_7 FS_{it} + \beta_8 Lev_{it} + \epsilon_{it} \dots \dots \dots (4)$$

Where;

FP_{it} = Financial Performance of firm i at time t

FP_{it-1} = Lagged Financial Performance of firm i at time t

ECD_{it} = Economic dimension of firm i at time t

END_{it} = Environmental dimension of firm i at time t

SD_{it} = Social dimension of firm i at time t

GD_{it} = Governance dimension of firm i at time t

GI_{it} = Green innovation of firm i at time t

GI_{it-1} = Lagged of Green innovation of firm i at time t

FS_{it} = Size of firm i at time t

$R\&D_{it}$ = Research and Development of firm i at time t

$TDTA_{it}$ = Total debt to total assets of firm i at time t

ϵ_{it} = error term

4.3 Measurement of variables

The measurement of variables is given below.

4.3.1 Measurement of Dependent Variable

We measure FP through this formula. The market value of total shares outstanding + total liabilities divided by total assets (Aslam *et al.*, 2020).

4.3.2 Measurement of Independent Variable

We measure EG through content analysis of annual reports of economic, environmental, social, and governance dimensions. For this analysis, global reporting initiatives (GRI) are used. These are measured in binary form. If the indicator is mentioned then assign 1 otherwise 0 after this, we created the index of these indicators by using this formula:

Index = No of items disclosed / Total item on an indicator

This measurement is also used by Alam and Tariq (2023).

4.3.3 Measurement of Mediator

The mediator GI is measured through this method. The natural logarithm of the sum spent by the firm on research and development is used to compute it (Salihi *et al.*, 2024).

4.3.4 Measurement of Control Variable

The regression model has added some control variables to increase its quality. The model contained FS as a control variable, calculated as the natural logarithm of total assets. According to this viewpoint, businesses with higher log or assets are anticipated to produce higher performance than firms with lower assets. Lev is calculated by dividing total debt by total assets (Ali *et al.*, 2022).

The data analysis, which includes descriptive analysis, correlation, and regression is presented in the section that follows as a conclusion to the findings.

5. RESULTS

The results of this analysis are given below.

5.1 Descriptive Result

The descriptive statistics for every variable under examination are shown in Table II. In contrast to GI, which has a mean value of 9.10 and a standard deviation of 2.91, FP is widely distributed, with a range of 0.36 to 5.79, a mean value of 1.31, and a standard deviation of 0.39. It shows that firms adopt more GI in Pakistan. EG mean values from all proxies: economic dimension (ECD), environmental dimension (END), social dimension (SD), and governance dimension (GD) are 0.59, 0.42, 0.19, and 0.70, respectively, with a standard deviation of 0.49, 0.26, 0.00, and 0.51, indicating that EG data tend to be less spread (more clustered) around the mean. FS mean value is 5.32 and standard deviation is 0.49. Ultimately, Lev's mean value of 0.51 indicates that over half of the company's funding came from loans that had an impact on the dependent variables.

Table 1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent Variable					
FP	880	1.31	0.39	0.36	5.79
Mediator Variables					
GI	880	9.10	2.91	0.00	16.70
Independent Variables					
ECD	880	0.59	0.11	0.49	0.74
END	880	0.42	0.13	0.26	0.51
SD	880	0.19	0.10	0.00	0.26
GD	880	0.70	0.23	0.51	0.97
Control Variables					
FS	880	5.32	0.49	4.32	7.49
Lev	880	0.51	0.19	0.15	0.78

5.2 Correlation Result

Since the correlation coefficients between the model variables are less than 0.70, Table III's correlation values for the remaining variables demonstrate that there is no sign of multicollinearity in the data. Consequently, the data lack multicollinearity. Moreover, we use the variance inflation factor (VIF) to study multicollinearity. While a VIF of less than 10 is acceptable, a VIF of more than 10 indicates significant multicollinearity. Nonetheless, the maximum level for the VIF is 5, according to Henseler *et al.* (2015) and (Ullah *et al.*, 2018; Ullah *et al.*, 2023). Table IV's VIF results show that no value is more than 5. The research variables do not exhibit multicollinearity as a consequence.

Table 2 Matrix of correlations

Variables	FP	GI	ECD	END	SD	GD	FS	Lev
FP	1.000							
GI	0.07	1.000						

ECD	0.21	0.39	1.000					
END	-0.07	-0.42	-0.57	1.000				
SD	-0.03	-0.46	-0.51	0.32	1.000			
GD	0.01	0.41	0.42	0.16	-0.16	1.000		
FS	0.03	0.06	0.14	-0.02	0.14	0.05	1.000	
Lev	0.29	-0.020	-0.19	-0.39	0.42	-0.03	0.26	1.000

Table 3 Variance inflation factor

Variables	VIF	1/VIF
END	1.49	0.67
GD	1.39	0.71
FS	1.31	0.76
SD	1.21	0.82
FP	1.18	0.84
ECD	1.12	0.89
GI	1.08	0.92
Lev	1.06	0.94
Mean VIF	1.23	

5.3 Regression Result

We use hierarchical regression analysis to evaluate the mediation effect of GI in the association between EG and FP, adhering to the mediation guidelines of Baron *et al.* (1986). Table V presents Model 1 which illustrates how EG affects GI. We investigated EG's impact on FP in the second model. Model 3 shows the effect of GI on FP. In Model 4, the combined effect of EG and GI on FP is examined after meeting the three mediation requirements outlined earlier. Results of this regression are shown in Table V. An important and favorable correlation is shown by the outcome.

Model 1's regression results demonstrate a strong positive link between a firm's involvement in EG-related practices and GI, suggesting that EG proxies ECD, END, SD, and GD have a significant effect on the GI. Innovation increases with a company's EG activity investment. It's interesting to note that 69% of the GI may be explained by the variables listed. This implies that a corporation will be more likely to have GI capacities when it values environmental, social, and governance initiatives. This indicates that there is a greater likelihood of GI capacities in an organization that values EG activities. Interestingly, according to this study, GD is the biggest component that causes GI. These findings are aligned with (Peng *et al.*, 2023; Padilla-Lozano & Collazzo, 2021).

The regression result regarding the effect of EG on FP is shown in Table V model 2. The outcome demonstrates a strong and favorable correlation. The outcome demonstrates that FP has a positive connection with ECD, END, and SD. This demonstrates that there is a greater likelihood of improved

business success when a company places a high priority on economic governance. Similar to ECD, environmental initiatives inside a business increase FP. It's interesting to note that this outcome implies that a business has more opportunities to improve FP when social activities are prioritized. These results align with the findings of these researchers (*Li et al., 2022; Cho et al., 2019*). The outcome demonstrates that GD is negligible, proving that the governance activities' priorities have no bearing on the FP. Probably because of the way the Pakistani capital market is structured with a focus on ownership concentration leading to bad governance. This is aligned with (*Safitri et al., 2020*).

Regression model 3 shows the result of the impact of GI on FP. The result shows that GI has a positive significant effect on FP. This indicates that those firms who are focusing on innovation enhancing their performance. PSX sample firms focusing on it. In this FS has also a positive significant effect on FP. Because those firms that have more assets work more on innovation and enhance their performance. Lev has a negative significant effect on FP. It shows that when firms rely on debt those firms performances reduces.

Finally, by including CSR in the regression equation, we investigate the mediating role of GI on the relationship between EG (ECD, END, SD, and GD) and FP. The findings are shown in Model 4 of Table V. As mentioned earlier, we evaluated GI's mediating function in the EG–FP relationship using the methodology described by Baron *et al.* (1986). According to these writers, the mediation criteria can only be satisfied under three circumstances. It is necessary to first establish a meaningful relationship between the independent variable (EG) and the mediating variable (GI). A significant relationship between the independent variable (EG) and the dependent variable (FP) is the second requirement. The third requirement is that there must be a significant relationship between the dependent variable (FP) and the mediating variable (GI). Every variable satisfied these requirements based on these three requirements. Table V demonstrates that the degree of significance is still strong and that GI, ECD, END, and SD are significantly positively linked with FP. Full mediation is demonstrated when the equation contains both independent and mediating factors and the correlation between the independent and dependent variables is statistically high (Galbreath, 2018). Thus, we deduce that the link between EG and FP is mediated by GI. The result shows that ECD, END, SD, and GD have a positive significant effect on FP. It indicates that GI positively mediates this relationship and those firms who are more concerned about the environment more work for GI to enhance their FP because they know that stakeholders giving more importance to the environment.

Table 4 Regression results

Dependent Variables					
Variables	GI (Model 1)	FP (Model 2)	FP (Model 3)	FP (Model 4)	(Model 4)
Lagged of Dependent	0.283***	0.382***	0.280***	0.274***	
	-0.0151	-0.0163	-0.015	-0.0151	
GI			0.550***	0.521***	

			-0.0349	-0.035
ECD	0.292***	0.386***		0.372***
	-0.015	-0.0161		-0.0452
END	0.284***	0.276***		0.413***
	-0.0152	-0.015		-0.0552
SD	0.104***	0.270***		0.0860***
	-0.011	-0.015		-0.0109
GD	0.0143*	0.0498		-0.0331***
	-0.00802	-0.00663		-0.00805
FS	-0.207***	-0.0507	0.201***	-0.141***
	-0.0422	-0.0347	-0.0423	-0.0421
Lev	0.0856***	0.260***	-0.113***	0.0868***
	-0.0264	-0.0215	-0.0263	-0.0262
Constant	0.979***	0.909***	1.033***	0.861***
	-0.264	-0.216	-0.264	-0.262
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
Observations	880	880	880	880
Wald Chi2	56.44	668.24	617.87	462.11
Hansen's test	0.517	0.44	0.45	0.88
AR(1)	0.03	0.017	0.003	0.002
AR(2)	0.69	0.52	0.41	0.62
No. of companies	110	110	110	110

Note: The figures in parentheses are the standard errors.

*** p<0.01, ** p<0.05, * p<0.1

6. CONCLUSION

The growing global importance of GI adoption has spurred businesses to keep improving their green capacities and putting new green techniques into practice for environmental preservation and conservation as well as the rising FP. The purpose of this work is to examine GI's mediating function between EG and FP. The study provides an additional understanding of how EG drives GI in terms of its theoretical implications. There are five (5) main conclusions of the inquiry. First, it was shown that a company's propensity to have capacities in GI increases with its recognition of the significance of governance, environment, and economic governance. Second, a greater focus on END and GD increases GI's propensity for capacity. Third, it was found that organizations are more likely to increase their FP when they acknowledge the significance of SD, END, and ECD. Fourth, a greater focus on SD and END increases the propensity to raise FP. Fifth, GD does not affect an organization's capacity to improve FP.

As a result, PSX-listed companies must recognize the value of environmental conservation, which will undoubtedly benefit them as well. Finally, each of these dimensions significantly affects GI, and GI also affects FP. The results of this investigation also suggest that GI mediates the relationship between FP and EG. Therefore, understanding how EG might flourish towards driving GI and FP in the context of Pakistan depends on the findings obtained here. We investigated the mediating role of GI between relationships of EG and FP in Pakistan using the Porter theory. The investigation's findings point to several consequences for theory and practice. Since the GI is still in its early stages of evolution, no study has yet been able to identify a relationship between EG, GI, and FP in the context of Pakistan. From a theoretical standpoint, the current study's identification of GI and FP driving variables can help regulators and business leaders identify the elements that lead to increased investment in EG in Pakistan.

Three (3) important outcomes from the study have practical implications. Initially, Pakistani businesses are encouraging the development of novel concepts to improve EG and sustainability. So, leaders who adhere to innovation strategies can gain investors' trust for their GI efforts. Second, the study advances our understanding of non-financial companies' motivations for building GI skills within the Pakistani context. Thus, this provides more information regarding the main causes of GI. Thirdly, the study adds to our understanding of non-financial organizations' sources of inspiration for improving FP. Hence, managers can implement performance drivers.

The study had certain limitations, but it also suggested areas for further research. First, the current investigation looks into the role that GI plays as a mediator between EG and FP using non-financial firms; this presents a chance to use new domains, such as the financial sector. The inquiry used investment in research and development as a single metric to examine the GI of Pakistani companies. Subsequent studies may use different metrics, including the quantity of patents, to assess GI potential.

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