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Research article

Green banking policies and sustainable performance: unraveling the mediating role of GC and EP

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Abstract: Green banking and its sustainability are equally important in responsible banking, and are recognized as key drivers of operational success. It is considered extremely important that financial institutions develop a sustainable working space that can contribute to their operational performance (OP). In this context, we explored the complex relationship between Green Banking Policies (GBPs) and the OP of the banks in Pakistan, shedding light on the mediating roles played by Green Culture (GC) and Environmental Performance (EP). Employing Structural Equation Modeling (SEM) in AMOS SPSS 2022 and Binary Logistic Regression (BLR), we highlight the connected impact of green banking strategies, the integration of GC, and EP on operational outcomes. We conclude that the GBPs can indirectly impact the OP of the banks through only a mediating role of the GC and EP, thus providing insights into the causal relationships within this multifaceted framework. Its practical inferences resonate with financial institutions and policymakers, advocating for a comprehensive approach to green banking. In the ear of environmental consciousness being paramount, this research offers a timely and invaluable contribution to the ongoing dialogue on the role of green banking and sustainable finance. The research also extends its novelty in terms of addressing the debate on sustainable banking practices, especially in the case of developing countries, along with a quantitative methodological implication, thus enabling more capable and innovative research in the context.

Keywords: green banking; sustainability; GC; EP; SEM; binary logistic regression

1. Introduction

The Triple Bottom Line approach has been promoted by the UN's sustainable development agenda as a means to achieve profitable growth [1]. Similarly, multinational firms have established sustainable development programs in line with UN's objective [2]. In such cases, to encourage energy conservation and achieve economic, environmental, and social efficiency, businesses that prioritize sustainability have switched from traditional to creative business models [2].

Approaching greener sustainability, the term Green Banking (GB) is a new paradigm that considers various approaches to sustainable development. It implies strategies for the development of community members, consumers, and other stakeholders [3]. The operational approach to green banking revolves around operation-related and employee-related practices daily. Employee-related practices promote employee participation in growing and sustaining the green banking idea in use [4]. Operation-related practices include optimizing daily banking operations to be more environmentally friendly by implementing green practices. This means that by supporting sustainable projects, the customers can depict that despite the banks being financially demanding, they can also prove to be a perfect force for environmental good, thus highlighting the importance of the industry being sustainable [5]. For instance, by maximizing resource use and minimizing waste, sustainable banking can result in cost savings and long-term profitability [6]. In this context, it can be safely stated that GBPs are increasingly acknowledged by policymakers in advocating sustainability, social responsibility, and long-term economic strength. The policies are essential for addressing global environmental crises as banks are urged to invest in environmentally friendly initiatives.

Furthermore, it exhibits a strong relationship with various SDGs, like SDG 7, aiming at Affordable and Clean Energy, and SDG 13, centered on Climate Action. Major financial institutions that associate with these SDGs play an integral role in tackling critical environmental issues, and this alignment highlights the profound interconnection between financial association and environmental welfare, leading to a better corporate reputation [7]. Similarly, GBPs also help to create cultural congruence with sustainable objectives, impacting employee behaviors and decisions [8]. A culture that deeply resonates with long-term goals encourages employees to include environmental considerations in their work habits, which resonates with Green Culture (GC). The concept promotes common environmental beliefs inside the institution, where this synchronized effort sets the foundation for enhanced environmental awareness and dedication [9]. Environmental Performance (EP), in turn, has a practical effect not only on the operational excellence of financial institutions but also on benefits such as cost reduction and enhanced resource efficacy as well [10]. Similarly, the advancement of GC, influenced by GBP, is pivotal in nurturing environmental liability within financial institutions. This culture, characterized by shared values and practices, has a direct impact on EP, and these interconnected elements feature a holistic approach to sustainability, where GBP serves as a catalyst for transformative change within financial institutions [11].

We employ a novel approach that addresses various aspects of Green Banking and its impact on the connected entities. Developing countries such as Pakistan require such approaches to ensure that the sustainable aspects of the society are met, and since banking plays a greater role in the overall economy, society, and the environment as a whole, the impact of its policies needs proper assessment, thus adding to the novelty of the research. We aim to discuss the findings to investigate the nature of the association between GBP and the sustainable performance of the banking industry. For empirical analysis, we employ Structural Equation Modeling (SEM) and Binary Logistic Regression through the utilization of AMOS SPSS 22. Moreover, we seek to evaluate the importance of fostering GC to enhance the OP of banks in a developing economy like Pakistan. The practical contribution entails

furnishing the policy-makers with quantitative empirical evidence to transform the banking industry into a more sustainable business.

We seek to fill the gap by employing a rigorous empirical approach to provide insights into the synergies and causal relationships within this multifaceted framework by investigating the following research questions:

A. Does GBP have a significant direct impact on the Operational Performance (OP) of the banks?

B. Does GBP indirectly affect the OP of banks, considering the mediation of GC and subsequent enhancements in EP?

The rest of the manuscript is divided into a literature review, followed by methodology, results, discussion, and the conclusion.

2. Literature review

The escalating planetary crises of climate change and resource depletion have irrevocably shifted the global discourse, placing unprecedented pressure on industries to demonstrate genuine environmental stewardship [12]. Within this imperative, the financial sector, particularly banking, occupies a uniquely influential position, capable of directing capital flows toward sustainable practices or perpetuating ecological harm [13]. Consequently, understanding how banking institutions translate environmental commitments, specifically through GBPs, into tangible sustainable performance has become a critical research frontier, necessitating deeper exploration of the underlying mechanisms, such as GC and EP, that may mediate this crucial relationship [14]. Based on such a discussion, we formulate the assessment of various linkages based on the hypothesis to see the impact of GBPs.

2.1 GBP and GC

Green Banking is an activity where financial institutions perform their daily activities with consciousness about society, and when coupled with the GC in banks, it refers to a culture that prioritizes environmental and social responsibility. This type of arrangement encourages a workplace where employees are invigorated to be environmentally mindful, sustainable, and socially responsible in their daily activities and decision-making processes [15]. Previous research suggests that GBP requires employee training on environmental issues [16], thus promoting ecological awareness and a sense of accountability that aligns employees with the values of GC. Similarly, other research suggests that it leads to improved productivity in improving environmental green performance within the bank's operations [17]. Another study highlights the impact of green banking on green behavior, and the researchers consider the mediating role of the GC [18], but they fail to consider the OP of the banks, especially in the case of a developing country. Similarly, other researchers address the theoretical aspect of green banking and green economy and discuss the environmental policy [19], again failing to address how GBP can impact the GC directly and via a quantitative assessment. Therefore, based on the aforementioned discussion, we propose the following as a hypothesis in the case of a developing country's context.

H1: GBP positively influences GC

2.2. GC and EP

Banks with a stronger GC that actively promotes green products and processes significantly minimize the carbon footprint on the environment [20]. Similarly, GC has strengthened its overall

commitment to sustainability, and banks have become dedicated to aligning their practices with carbon reduction goals [21]. Banks with GC prioritize sustainable procurement practices, which include sourcing green products and facilities, thereby reducing the ecological impact of their supply chain [22]. Moreover, green bank policies incentivize clients to use these credit lines by offering favorable terms or interest rates [23]. The previous research also suggests that green innovation, along with GC, plays a mediating role between green human resource management and EP, thus contributing to a sustainable work culture [24]. Similarly, green HRM is also impacted positively in terms of EP via the mediation of GC to gain endorsements from GC [25]. However, the adoption of GC within banks emphasizes responsible lending practices, stringent environmental criteria, and a commitment to promoting sustainability, thereby improving the EP. Therefore, we suggest that the role of GC on the EP must also be verified directly so that the impact of the overall GBP on the OP of the banks in a developing country can be demonstrated, and to do so, we suggest the following hypothesis:

H2: GC positively influences EP

2.3. EP and OP

The evaluation of an organization's impact on the environment in terms of its sustainability, resource utilization, and overall ecological footprint is termed EP. The International Organization for Standardization (ISO) highlights that EP should align with broader sustainability goals and "consider the wants and expectations of stakeholders" [26]. In the context of green banking, the improved EP of banks has a positive impact on the OP, as it enhances sustainability, reduces risks, and aligns with changing market expectations [27]. A strong commitment to environmental sustainability enhances a bank's reputation and stakeholder relationships and extends its ability to a fully working and sustainable environment. Since the GBPs are expected to have a better performance on the OP of the banks, a mediating role of having EP on the OP can drive it. As per previous research, only the positive impact of the GBPs has been observed on the green financing and EP of the banks in China [28]. Similarly, it must also be noted that in a developing country such as Pakistan, the researchers cover only the aspect of GBPs on the EP of the banks and not the EP's impact on the OP of the banks [29], which demands further investigation as these actions can contribute to the overall OP and long-term sustainability of banks. Thus, we suggest the following research hypothesis:

H3: The EP influences the OP of banks

2.4. GBP and OP

GBPs encourage banks to integrate social considerations into their operations, risk assessments, and investment strategies, which requires the banks to review and control environmental and social risks in their lending and investment choices [30]. GBPs can also help with fostering the adoption of energy-efficient technologies, such as paperless banking, electronic communication, and green building standards [31]. Similarly, by reducing energy consumption and resource wastage, banks can minimize their operational costs and improve overall efficiency [32]. The literature suggests that by diversifying their product portfolios to include green financing options like sustainable bonds and green loans, the banks can tap into new market opportunities and generate additional revenue streams [33]. Furthermore, studies also highlight that GBPs can positively impact Corporate Social Responsibility (CSR) and make their financial activities sustainable, especially in the case of Bangladesh [34]. Similarly, Indonesian banks also have a suggestion: That the GBPs can improve financial performance [35], though a profound study has yet to address the ultimate direct impact of

the GBPs on the OP of the banks positively. Hence, in view of the aforesaid argument, the following research hypothesis is proposed:

H4: GBP directly and positively influences the OP of banks

2.5. Mediating the role of GC and EP

GBP incorporates a set of procedures that encourage banks to affiliate their operations with environmentally responsible principles. Reducing carbon emissions, promoting sustainable investments, and adopting eco-friendly technologies help to improve a bank's operational efficiency and cost-effectiveness [36]. These policies emphasize eco-conscious decision-making and socially responsible behavior [37]. A strong GC promotes environmental awareness, leading to better resource management, reduced waste, and lower energy consumption [38]. GC transformation can influence the bank's EP by encouraging the implementation of eco-friendly practices and support for sustainable projects [39]. Similarly, a strong dedication to EP aligns with well-developed operational efficacy, and banks with a reduced environmental footprint experience lower operating costs, increased resource utilization, and improved overall financial performance [40]. Here, a point must be noted whether GC and EP can both be mediators that can contribute to the OP, so that the GBPs are proven effective. The recent literature depicts that EP with GC positively impacts green human resource management but hardly covers any impact on the overall OP [41]. Similarly, the mediating role of EP has also been observed in the case of organizational performance in collaboration with the culture [42], yet the overall OP remains unanswered. Keeping this discussion in mind, the following research hypothesis is proposed:

H5: GBP indirectly influences OP through the influence of GC and subsequent improvement in EP

In previous research, many authors have discussed the correlation between green banking activities and the sustainable performance of banks. In this study, we address a notable research gap in green banking, based on the previous discussion, by examining the influence of GBP on the expansion of GC within financial institutions, with a specific focus on their combined impact on OP. We employ a quantitative assessment based on Binary Logistic Regression (BLR) and Structural Equation Modeling (SEM) together, since SEM can test the overall theoretical aspects of a model with latent variables, while BLR can analyze the concrete and final impact on operational outcomes that are required in the form of binary results. The rationale for using these two major aspects of the methodologies is that SEM can express the research model that involves complex relationships with latent constructs and mediation paths, and BLR can explicitly state that some of the dependent variables are binary with a high or low efficiency or a yes or no outcome. Using them both can be justified by the fact that, along with the addition of BLR, it becomes more directly robust and interpretable, while using the SEM solely can generate the generalized outcomes. The additional insight that BLR can give is that it provides marginal effects and odd ratios and is more flexible when dealing with variable selection techniques and model diagnostics. The other models are outperformed by these two models because BRL can predict binary outcomes because of its effectiveness with resource-constrained data. Similarly, the SEM can analyze complex relationships that can be differentiated among the latent variables and the observed variables, and combining these two offers a wide range of applications that most models fail to fulfill. The choice of these two models can also be justified via some of the recent applications in the literature, where one of the studies analyzed the trajectories of the suicides following violent victimization by the partners using SEM [43]. Similarly,

another application involved the application of the BLR and SEM to analyze the impact of the pricing on the policy changes for the street parking demand [44]. Analyzing the transportation for university commuters in Jordan is also another example of SEM and BLR [45]. A developing country like Pakistan, regularly facing climate-induced hazards, is also a subject of the BLR and SEM assessment [46]. An assessment of student retention for online MOOCs is also one of the core examples of the SEM [47]. Last, a consumer's willingness to subscribe to a millet-based product proves to be another recent example of research that has employed BLR and SEM to evaluate various theories and demographic factors [48].

Connecting the aforementioned discussion, while progressions in banking technology have shown promise in fostering eco-friendly practices, there exists a significant dearth of research exploring the intricate relationships between GBP, GC, and their collective effect on the OP of banks, and, therefore, requires an in-depth modeling based on BLR and SEM. The conceptual model developed according to the proposed hypotheses is illustrated in Figure 1. In the model, GBPs represents Green Banking Policies, GC denotes Green Culture, EP is Environmental Performance, and OP represents OP. GC serves as a mediator between GBP and EP. EP serves as a mediator between GC and OP. GC and EP serially mediate to explain the indirect influence of GBP on OP.

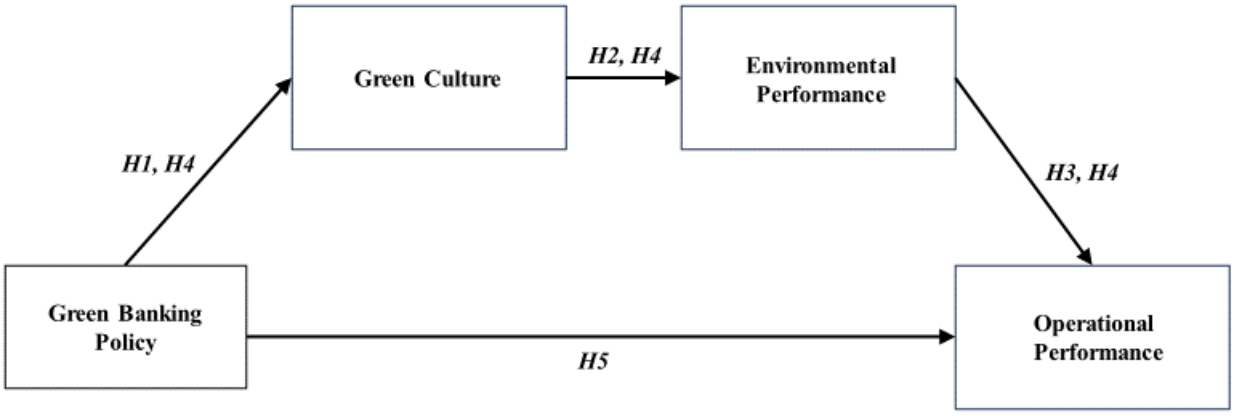


Figure 1. Conceptual research model

3. Methodology

3.1. Context, sample size, and procedure

We focus on the banking industry of Pakistan where we approached the banking industry for the collection of data. We utilized a quantitative and explanatory approach to establish a definitive correlation between the exogenous latent variable, i.e., GBP, and the endogenous latent variable, i.e., OP of banks in Pakistan. Procedures recommended by Brace [49] were followed to design the questionnaire. Three academic specialists analyzed the items and scales used in the questionnaire. The questionnaire was pretested with the help of management professionals, eliminating unnecessary items using suggestions from the practitioners, as the validity of the constructs. Similarly, the scales were also reviewed by the two industry experts for relevance and coverage, thus the content validity. After modeling the questionnaire, it was divided into five sections, with one section featuring demographic information and the rest of the sections including questions about each of the four constructs. The primary data was attained mainly from the workforce at selected commercial banks in Pakistan. To

validate the sample size computation, Soper's insights were incorporated into the study (Soper, 2021). The optimal sample size was recommended to be 137, with an effect of 0.3, a statistical power of 0.80, total variables of 4, and observed variables of 23. A total of 300 structured questionnaires were distributed for data collection between June and October 2023, of which 248 were received, demonstrating a recovery rate of 82.66%. From the data analysis perspective, a 200-sample size was deemed sufficient for the study. However, in total, 248 full-time professionals from the commercial banking sector across numerous regions of Pakistan participated in the study. The demographic statistics of the surveyed bankers are presented in Table 1, which depicts their work experiences and educational background as a proper demographic picture. The bank types were collected based on consultation with the relevant bankers and according to the responding banks' profiles, 41% of them were private, 25% of them were public, and 34% of them were cooperative banks. The research applied structural equation modeling and binary logistic regression analysis to test the model.

3.2. Measures

The survey responses were evaluated using a five-point Likert scale, wherein the first point represents "Strongly Disagree" and the fifth point represents "Strongly Agree". The official language in Pakistan is English and is taught as an obligatory subject in educational institutes and thus, the survey has been administered in English.

3.3. GBP

We measure GBP by asking questions over a five-point Likert scale, where the GBP is measured using eight items adapted from Shaumya K, et al.[50] and Rehman A, et al [51]. A sample item is: "In my bank, the top management involves environmental protection-related planning and implementation." The construct has an internal reliability of 0.940.

3.4. GC

Based on prior research of Wang C H [52] and Fraj E, et al [53], GC is measured using 6 items via five-point Likert scale. A sample item for GC is: "My bank links environmental objectives with its corporate goals." The construct has an internal reliability of 0.880.

3.5. EP

Research studies such as Chen J, et al [50,54,55,] are used as benchmarks to measure EP via a five-point Likert scale. A sample item from the construct is "Green banking practices improve banks' compliance to environmental standards." The construct has an internal reliability of 0.881.

3.6. OP

In this case, Chen J, et al [54] used five-point Likert scale to measure OP. A sample item from the construct is "Green banking practices significantly improve resource management efficiency in our bank." The construct has an internal reliability of 0.917.

4. Results

4.1. Data analysis approach

We employ IBM SPSS (v22) and AMOS SPSS (v23) to examine the obtained primary data. Tools like Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Structural Equation Modeling (SEM), and Binary Logistic Regression Analysis (BLRA) were utilized to assess the data. EFA is a data-driven technique used to analyze the correlation between variables. Performing an EFA involves preparing and probing the data, observing eigenvalues, determining the factor count, adjusting factors for clarity, and providing an explanation for the results [56]. CFA is conducted to determine the measurement model of the study, evaluating various critical ratios and the values of standardized coefficients [57]. Performing the SEM analysis includes choosing the model, gathering and filtering suitable data, evaluating the model's parameters, assessing how well the model fits the data, interpreting the model's parameters, and evaluating the credibility of competing models [58]. To test the proposed model, we employed a two-step statistical approach following Hair J F, et al. [59,60]. In the first step, we examined the CFA measurement model, and in the second step, the SEM approach was applied to recognize the structural associations among the latent constructs. To evaluate the reliability of the study variables, Cronbach's alpha (CA) and composite reliability (CR) values were considered [61]. Additionally, we studied the convergent validity of the dataset by calculating the average variance extracted (AVE) and standardized factor loading values [59]. To recognize the discriminant validity, we applied both the Fornell–Larcker [62] and Heterotrait–Monotrait ratio (HTMT) approaches [63]. Finally, the measurement and structural model fit were measured using various model fit indices, namely chi-square/degrees of freedom (X2/df), goodness-of-fit index (GFI), normed fit index (NFI), comparative fit index (CFI), incremental fit index (IFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standard root-mean-square residual (SRMR), which was in line with past studies [60,64–66], Moreover, we also employed Binary Logistic Regression for the statistical analysis of our research model. This statistical tool helps in finding significant predictors and measuring their impact on the binary outcome, making it a versatile and powerful tool for decision-making [67,68]. Figure 2 shows the analytical research model of the study.

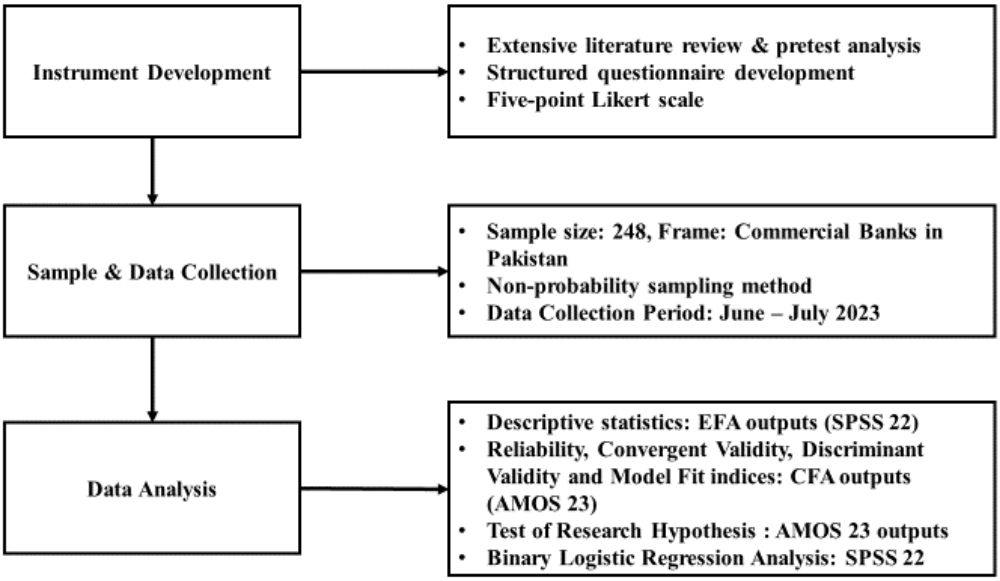


Figure 2. Analytical research model.

4.2. Demographic information

Here, Table 1 particularizes the data of respondents, which is diversely spread out in terms of gender, age, education, and years of experience in the banking industry. It further indicates that most of the respondents were male (90.7%), which is a common occurrence in the banking culture of Pakistan, while 9.3% were female. The number of respondents with a bachelor's level of qualification composed the major portion (57%), while 61% had postgraduate qualifications. The findings revealed that 55.90% of the respondents had work experience of 1–4 years; 32.60%, less than a year; and 11.50% more than 4 years.

Table 1. Demographic data.

VARIABLES	ITEMS	FREQUENCY (N)	PERCENTAGE (%)
Gender	Male	225	90.7
	Female	23	9.3
Age	18–23	16	6.5
	24–29	90	36.3
	30–35	80	32.3
	35+	62	25
Educational Qualification	Bachelors	69	27.8
	Masters	171	69
	Ph.D.	4	1.6
	Others	4	1.6
Work Experience	1–3	64	25.8
	4–6	51	20.6
	7–10	48	19.4
	10+	85	34.3

4.3. Common method bias

To obtain the responses, we used a time-lag approach to prevent common method bias. Furthermore, the degree of multicollinearity between the independent variables was calculated through both variance (VIF) and values of tolerance [69]. The scores of VIF were between 1.90 and 3.23, and the value of tolerance was more than the suggested cut-off level of 0.10, which indicated that multicollinearity was not a problem in the dataset.

4.4. Measurement model

We ensured the validity of the measurement model by examining the convergent validity, reliability, and discriminant validity of the constructs under consideration. CFA was performed to check the appropriateness of the measurement model. The measurement model is depicted in Figure 3 below.

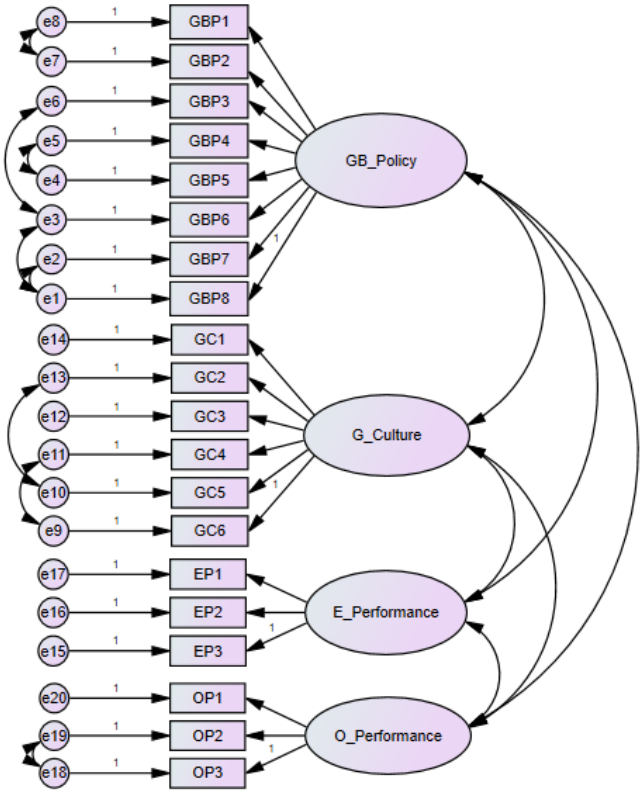


Figure 3. Measurement Model of the study.

4.5. Model fit

The measures of model fit were used to assess the overall goodness of fit (CMIN/df, GFI, FLI, TLI, RFI, NFI, RMSEA, and SRMS), and all values were within their respective common acceptance levels [59,70–73]. The four-factor model (GBP, GC, EP, OP) yielded a good field (Table 2) for the data.

Table 2. Model Fit Indices.

FIT INDICES	RECOMMENDED VALUE	OBTAINED VALUE
CMIN (CHI-SQUARE/DF)	3-5	2.149
GFI	>0.90	0.890
CFI	>0.90	0.956
TLI	>0.90	0.946
RFI	>0.90	0.906
NRI	>0.90	0.921
RMSEA	<0.08	0.068
SRMR	<0.08	0.042

4.6. Exploratory factor analysis

Table 3. EFA results.

Factor Loadings	
GC1	.723
GC2	.710
GC3	.568
GC4	.785
GC5	.577
GC6	.750
GBP1	.683
GBP2	.670
GBP3	.749
GBP4	.802
GBP5	.678
GBP6	.668
GBP7	.811
GBP8	.765
EP1	.649
EP2	.731
EP3	.824
OP1	.787
OP2	.881
OP3	.847

An Exploratory Factor Analysis (EFA) was performed using the varimax rotation and principal component analysis. The factor loading criteria were set to a minimum of 0.50. The commonality of the scale was also evaluated to guarantee acceptable explanation levels, indicating the amount of variance in all dimensions. According to the results, all commonalities were over 0.50, and an imperative step involved evaluating the overall significance of the correlation matrix through Bartlett's Test of Sphericity. This test provides a degree of statistical probability that the correlation matrix has substantial correlations among its components. The results were significant, $x2 = 4134.914$ ($p < 0.001$), which indicated its suitability for factor analysis. The Kaiser–Meyer–Olkin measure of sampling

adequacy (MSA), which indicates the appropriateness of the data for factor analysis, was 0.944. In this regard, data with MSA values above 0.800 were considered appropriate for factor analysis. Finally, the factor solution derived from this testing yielded three factors for the scale, which accounted for 70.753% of the variation in the data. Factor Loadings are depicted in Table 3.

4.7. Convergent validity

Convergent validity is the degree to which different attempts to measure the same concept are in agreement. The concept states that two or more measures of the same thing must be highly covary if they are valid measures of the concept [73]. Cronbach's alpha and composite reliability values were evaluated for construct reliability. Cronbach's alpha and composite reliability of all variables were greater than 0.7, which confirmed the reliability of the constructs [74,75]. The average variance extracted (AVE) test was used to determine the measurement model's convergent validity; all AVE values observed were higher than 0.5, which achieved convergent validity [76]. Table 4 shows the summarized results of the measurement model analysis.

Table 4. Properties of the final measurement model.

ITEMS	FACTOR LOADINGS	CRONBACH'S ALPHA	COMPOSITE RELIABILITY(RHO_A)	AVERAGE VARIANCE EXTRACTED (AVE)
Green Banking Policy		0.940	0.939	0.658
GBP1	0.791			
GBP2	0.812			
GBP3	0.865			
GBP4	0.879			
GBP5	0.829			
GBP6	0.810			
GBP7	0.747			
GBP8	0.747			
Green Culture		0.880	0.882	0.556
GC1	0.768			
GC2	0.845			
GC3	0.737			
GC4	0.707			
GC5	0.725			
GC6	0.684			
Environmental Performance		0.881	0.881	0.712
EP1	0.796			
EP2	0.885			
EP3	0.849			
Operational Performance		0.917	0.894	0.737
OP1	0.901			
OP2	0.831			
OP3	0.843			

4.8. Discriminant validity

Discriminant Validity in this study was assessed using the Fornell and Larcker (FL) Criterion and the Heterotrait-Monotrait (HTMT) Ratio. According to the FL criterion, discriminant validity is established when the square root of AVE for a construct is more than its correlation with the other constructs in the study. However, the FL criterion has been disparaged, and a new method to evaluate the discriminant validity, i.e., HTMT ratio, is increasingly employed. In this study, discriminant validity was established using the FL criterion and the HTMT ratio. When assessed through the HTMT ratio, all ratios were less than the required limit of 0.85 [63]. Hence, the discriminant validity of the study was established. The results of discriminant validity are presented in Tables 5 and 6 below.

Table 5. Heterotrait-Monotrait criterion.

	GBP	GC	EP	OP
GBP	0.969			
GC	0.849	0.948		
EP	0.752	0.647	0.938	
OP	0.678	0.621	0.898	0.9455

Table 6. Fornell-Larcker criterion.

	GBP	GC	EP	OP
GBP				
GC	0.710			
EP	0.645	0.531		
OP	0.615	0.540	0.791	

4.9. Structural model

To analyze the structural model, AMOS was utilized. It was concluded that GBP had a positive, indirect effect on the OP of commercial banks in Pakistan. A good fitting model was accepted if the value of the CMIN/df, the goodness-of-fit (GFI) indices [59], the Tucker and Lewis (TLI) index, and the confirmatory-fit (CFI) index [71] was greater than 0.90 [59]. In addition, an adequate-fitting model was accepted if the AMOS computed value of the standardized root mean square residual (SRMR) was less than 0.05, and the root mean square error approximation (RMSEA) was between 0.05 and 0.08 [59]. The squared multiple correlation for GC was 0.77, showing that 77% variance in GC was accounted for by GBP. The squared multiple correlation for EP was 0.50, showing that a 50% variance in EP was accounted for by GBP. The squared multiple correlation for OP was 0.81, showing that 81% variance in OP was accounted for by GBP. The structural model is represented in Figure 4 below.

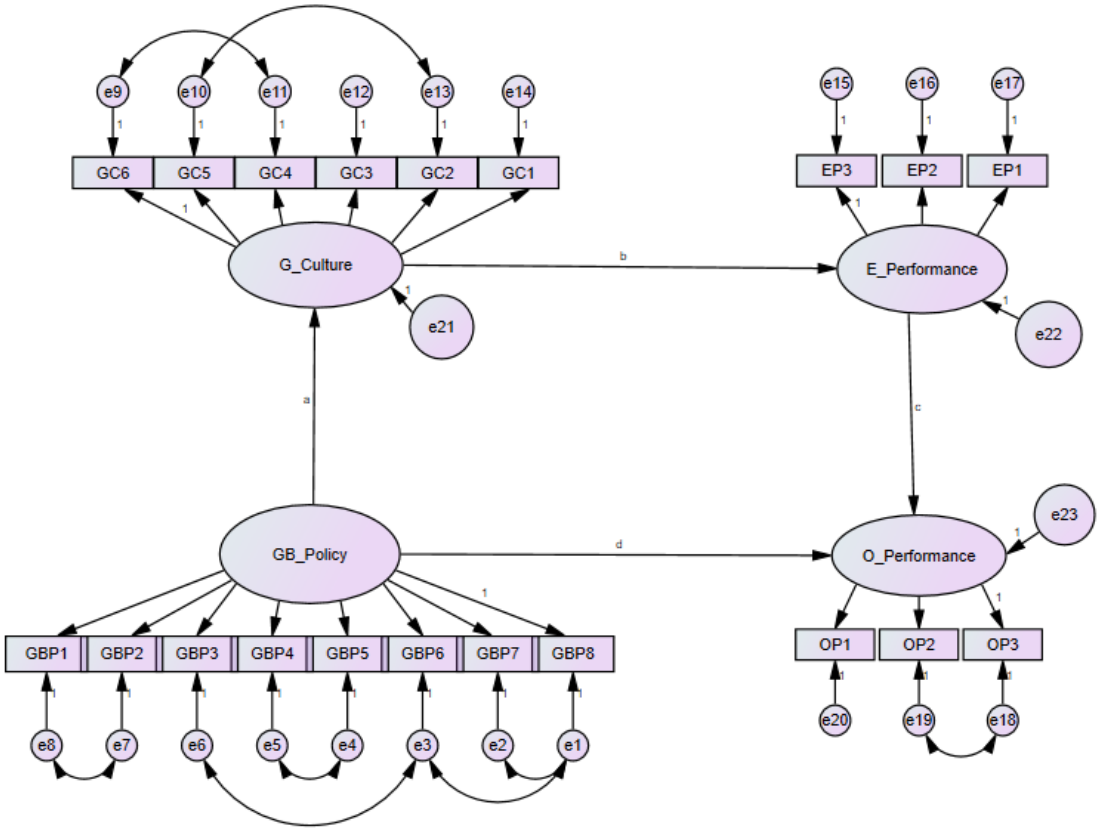


Figure 4. Structural model.

We assessed the relationship between GBP on the OP of banks through the serial mediation of GC and the EP of banks. The impact of GBP on GC was positive and significant ($\beta = 0.620$, $t = 9.99$, $p < 0.005$), supporting H1, which posits that "GBP has a positive impact on GC". Hypothesis H2, which states that "GC has a positive impact on EP of banks", was deemed acceptable based on the statistical results ($\beta = 0.895$, $t = 9.15$, $p < 0.005$). Hypothesis H3, which postulates that "EP has a positive impact on the operational of banks", was validated by the positivity and significance of statistical results ($\beta = 0.861$, $t = 11.57$, $p < 0.005$). However, the statistical analysis of H4 ($\beta = 0.05$, $t = 1.00$, $p = 0.317$) revealed that there was no significance and direct correlation between the GBP and the OP of banks. This lack of direct relation can be connected to the time-lagged nature of sustainability investments because in one case, the green policies can incur costs in terms of staff training or technological upgrades, and their operational benefits such as reduced regulatory fines or energy savings are materializing over the multi-year horizons. Similarly, the data collected over the past months might be insufficient for the operational gains to offset the short-term expenditures.

Model fit indices and hypothesis results are presented in Table 7, and Direct and Indirect effects are depicted in Table 8. Here, the table depicts that the GBP is significantly affecting the GC in terms of direct effects and depicts strong evidence that the GBP can implement GC properly in a bank. Similarly, GC can drive EP as well with a medium to large positive effect, and we found that GC can improve the EP of the bank. EP driving OP is another significant impact, with a 0.864 unit increase in OP. Last, GBP does not directly impact OP and is not significant, but it drives it positively via the mediators. It can be justified by the fact that a one-unit increase in GBP can drive a 0.533-unit increase

in OP indirectly via its positive effect on the GC and the EP. Similarly, the magnitude and relevance can also be justified by the fact that the large indirect effect is over half a standard deviation change in OP that results from GBP, which accounts for high relevance and practice. It depicts that GBPs are extremely powerful tools that drive and improve OP, but only if they can efficiently cultivate GC that can, in turn, also drive EP, thus yielding substantial OP benefits.

Table 7. Results of the structural model.

Hypothesis	Hypothesized Relationship	Path Coefficient (β)	t-value	p-value	Decision
H1	GC ← GBP	0.620	9.99	0.000	Accepted
H2	EP ← GC	0.895	9.15	0.000	Accepted
H3	OP ← EP	0.861	11.57	0.000	Accepted
H4	OP ← GBP	0.05	1.001	0.317	Rejected
Model Fit					
CMIN/df = 2.28, GFI = 0.88, CFI = 0.950, TLI = 0.940, RMSEA = 0.07, SRMR = 0.05					

Table 8. Direct and indirect effect.

Parameter			Estimate	Lower	Upper	P
GC	←	GBP	0.875	0.817	0.936	0.004
EP	←	GC	0.705	0.555	0.828	0.010
OP	←	EP	0.864	0.689	1.038	0.007
OP	←	GBP	0.058	-0.107	0.256	0.410

4.10. Serial mediation analysis

We assessed the serial mediating role of GC and EP on the association between GBP and OP. The outcomes revealed a significant indirect effect of GBP on OP through GC and EP (β = 0.477, p = 0.007), supporting H5. Here, β = 0.477 means that being a standardized path coefficient and one SD increase in GBP will account for a 0.477 SD increase in OP indirectly. Additionally, the direct effect of GBP on OP in the presence of the mediators was insignificant (β = 0.05, p = 0.317). Hence, GC and EP fully mediate the relationship between GBP and OP. The mediation analysis summary is presented in Table 9.

Table 9. Results of serial mediation.

Relationship	Direct Effect	Indirect Effect	Confidence Interval Lower Bound Upper Bound	P-value	Conclusion
GBPolicy --> GCulture --> EPerformance --> Operformance	0.052 (0.317)	0.477	0.323 0.645	0.007	Full Mediation

4.11. Binary Logistic Regression Analysis

Binary Logistic Regression Analysis (BLRA) associates a response variable and one or more explanatory variables. It is often a situation in which the outcome variable is discrete, assuming two or more potential values [77]. BLRA represents a special condition of linear regression analysis when the response is binary, not continuous, and the explanatory variables are quantitative or qualitative [56]. In this study, we assessed the odds of the OP of banks being positively influenced by various independent variables (GBP, GC, EP). We hypothesized that the implementation of green banking practices, fostering GC, and improved EP leads to improved OP of banks.

4.12. Goodness of Model Fit

The classification consists of predicting whether a bank's OP would be positively affected or not. The data was labeled, such that we put 1 for positive OP and 0 for negative OP. To test the model fit, Omnibus Tests of Model Coefficients were used. If the model was significant, there was a significant improvement in fit compared to the null model. Table 10 gives the information of model fitting, showing the statistical significance of the final x2. The Hosmer-Lemeshow test is also a test of Model fit. The Hosmer-Lemeshow statistic indicates a poor fit if the significance value is less than 0.05. Here, the model adequately fits the data. Hence, there is no difference between the observed and predicted model. Table 11 gives information on model fitting through the Hosmer- Lemeshow test.

Table 10. Omnibus Test of Model Coefficients.

		Chi-square	Df	Sig.
Step 1	Step	76.572	3	.000
	Block	76.572	3	.000
	Model	76.572	3	.000

Table 11. Hosmer and Lemeshow Test.

Step	Chi-square	Df	Sig.
1	6.114	4	.191

The model summary in Table 12 represents the two pseudo-R values. A total of 26% of the variance is defined according to the Cox & Snell R2 value and 40% according to the Nagelkerke R2 value, the modified form of the Cox & Snell coefficient. In this case, a 40% change in the criterion variable can be reported to the predictor variables in the model.

Table 12. Model summary.

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	185.884[a]	.266	.407

4.13. Evaluation of the Logistic Regression Model

The specificity for this model was 50.9%, which implies that the percentage of cases falling into the non-target category (Y=0; Negative OP) was correctly predicted by the model. The sensitivity for the model was 93.3% meaning that the percentage of cases falling in the target group (Y=1; Positive

OP) was correctly predicted by the model. In totality, the accuracy rate was very good, at 83.9%. The model exhibited good sensitivity since the probability of positive OP of banks that accounted for 93.3% accuracy, was correctly predicted based on the model. Table 13 depicts the aforementioned results.

Table 13. Classification Table.

Observed			Predicted		
			Operational_Performance		Percentage Correct
			Negative OP	Positive OP	
Step 1	Operational_Performance	Negative OP	28	27	50.9
		Positive OP	13	180	93.3
	Overall Percentage				83.9

Table 14 shows the relationship between the predictors and the outcome. B (Beta) is the predicted change in Log Odds: For a 1-unit change in the predictor, there is Exp(B) change in the probability of the outcome. The beta coefficients can be negative or positive, and have a t-value and significance of the t-value associated with each variable. If the beta coefficient is negative, the interpretation is that for every 1-unit increase in the predictor variable, the outcome variable will decrease by the beta coefficient value.

Table 14. Variables in the equation.

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Green_Culture	1.011	.420	5.805	1	.016	2.749	1.208	6.258
Green_Banking_Policy	1.250	.420	8.871	1	.003	3.489	1.533	7.939
Environmental_Performance	1.888	.391	23.322	1	.000	6.607	3.071	14.217
Constant	-1.302	.371	12.319	1	.000	.272		

The results indicated that banks with a GC were 2.749 times more likely to exhibit improved OP compared to those without such a culture, with a 95% confidence interval ranging from 1.208 to 6.258. Similarly, the odds of a bank's OP improving with the implementation of GBPs were 3.489 times higher than those with no GBPs, with a 95% CI of 1.533 to 7.939. Last, according to the binary logistic regression analysis, the odds of a bank's OP improving with a bank's EP were 6.607 times higher than the case reversed, with a 95% CI of 3.071 to 14.217. The values greater than 1 meant that as the predictor variables (GC, GBP, EP) increased, so do the odds of positive and improved OP of the banks.

5. Discussion

We attempt to examine the impact of GBPs on the OP of banks using the context of Pakistani commercial banks. Data was collected from bank employees and analyzed using SEM and BLRA with AMOS-SPSS. Researchers have inspected the direct relationship of green practices with banks' EP [51] and financial performance [78]. However, we uniquely examine the relationship between a bank's GBPs and their impact on its OP. Furthermore, we also tested the mediating roles of GC and EP on the operational efficiency of banks. We successfully achieved our primary research objective by analyzing the indirect effects of GC and EP on the OP of banks. Interestingly, our findings failed to support the hypothesis that "GBP has a direct and positive impact on the OP of banks (H4)". The absence of a direct link between GBP and OP can be justified by the fact that sometimes the policies

rarely translate into operational outcomes [79]. This means that GBP can establish structures, but its impact relies on the costs, efficiency, or quality of the service that requires GC, EP, and time for its maturity. Similarly, symbolically, the GBP can be adopted by the banks to signal legitimacy without integrating them into daily operations, and only when the GBP results in driving actual behavioral change via GC or EP [80]. It can also be mentioned that GBP requires resources such as capital and time, and may result in negating the direct benefits of the reduction in the errors by GC or the efficiencies being generated by EP. Therefore, for banks to succeed in Pakistan, culture-building must accompany policy rollout, as GBP is merely empty acquiescence without GC and EP. The stakeholders and the policymakers must ensure that they enable time for the mediation pathways to mature and not just keep on adopting policies. It is not a failure but it highlights in real-time how a real change works in complicated companies, economies, or organizations. Culture and processes must be permeated via policies to have an impact on performance [81].

Furthermore, the analysis also suggests that the findings for (H1) and (H2) are from previous studies, which suggest that GBPs are fundamental to adopting green banking practices, which have a positive impact on the GC and EP of banks. Furthermore, our findings suggest that improved EP has a positive impact on the OP of the banks. Hence, according to the statistical analyses, it has been determined that the impact of GBP on OP is not directly significant, but GC and EP play a full mediation role in the interaction between GBP and OP. Moreover, GBP has a strong positive relationship with GC, which has a significant positive relationship with EP, showing that GC and EP fully mediate the association between GBP and OP. In light of these findings, it is evident that the integration of GBPs and the development of a GC can be a win-win strategy for banks. Not only does it contribute to environmental sustainability and the fulfillment of SDGs, but it also yields operational advantages that can boost the overall financial performance of banking institutions.

5.1. Research implications

The study helps to navigate the mediating effects of the GC and EP so that the impact of the GBPs on the OP of the banks can be analyzed. The study can advance the mediation models in the case of the Pakistani banking sector by demonstrating GC's role as a critical gateway.

The research provides significant insight within the context of Pakistani commercial banks, offering a blueprint for fostering sustainable practices through the adoption of GBPs. It further adds value to the banking sector by suggesting that the prioritization of the stakeholders must be beyond the GC compliance and programs such as "Green Champions" that can be launched to link the banking staff's KPIs to the EP targets of the banks [82]. One such example can be taken in the case of the Muslim Commercial Bank (MCB)'s "Green Tellers" program to reduce the cost of transactions by 18% [83]. Similarly, the study adds that measurement and benchmarking must be the key factors with localized staff training hours and branch-level energy use [84]. It can also help with overcoming the bottlenecks by partnering with educational institutions such as LUMS and to implement cloud-based auditing so that data credibility issues are handled [85]. It must also be added that within the specific context of the Pakistani banking sector, it is imperative for banks to strategically embrace GBPs as an integral component of their corporate strategies. In doing so, banks can align their operations with environmental and social considerations, thereby enhancing their long-term sustainability [86]. Similarly, cultivating a GC within banking institutions is a pivotal managerial implication, and this involves raising awareness among employees and nurturing a sense of responsibility toward environmental goals. Management should consider initiating training programs, workshops, and internal communication campaigns to instill a commitment to green practices at all levels of the

organization [87]. Furthermore, resource optimization and energy efficiency form another critical managerial implication. Pakistani commercial banks should prioritize investments in energy-efficient technologies and adopt green building standards for their premises [88]. By minimizing waste generation and optimizing resource use, banks not only reduce operational costs but also minimize their environmental footprint [89]. The establishment of robust environmental reporting and transparent mechanisms is imperative for banks to build credibility among stakeholders. This can also be made possible via the mandating of the GC disclosure in annual reports by the State Bank of Pakistan (SBP) and also to link the banking licensing to the EP thresholds, along with restructuring of the incentives and fixing the judicial administration issues that might lead to delaying the GBP enforcements [90].

In a broader context, the implications of this study extend beyond Pakistani banks and resonate with the global banking industry. The transformative potential of integrating GBPs and nurturing a green corporate culture is relevant not only to banks in Pakistan but also to financial institutions worldwide. The adoption of sustainability practices can augment banks' reputation and financial performance while contributing to global sustainability endeavors. The study calls for regulatory authorities worldwide to acknowledge the positive outcomes of GBPs and consider revising and strengthening regulatory frameworks to promote sustainable banking practices. Clear guidelines for compliance can incentivize more banks to adopt green policies, catalyzing the industry's sustainable transformation. Based on this study, investors and analysts will have a better understanding of adopting sustainable green banking practices and their effect on the performance of banks in general. This may be used in future assessments of the bank's green policy adoption and OP in Pakistan.

Furthermore, comparative research across multiple countries could shed light on how regulatory, cultural, and economic differences influence the effectiveness of GBPs. This approach would offer a more inclusive understanding of the global applicability of these policies. A comprehensive analysis of the regulatory frameworks in different countries and its impact on the adoption of green policies requires exploration, thus adding to the future recommendations and extensions of this research.

6. Conclusion

Amidst the global initiatives for sustainability and fulfilling the SDGs, we target the Pakistani banking sector by identifying fostering GC through the implementation of GBPs and their impact on the EP and their ultimate effect on the OP of banks. Unique in several aspects, we focus on the role of GC and environment-related activities to derive a link between GBPs and operational efficiency. In a world marked by soaring concerns about environmental sustainability and the pressing need to meet the SDGs, the current research deems to be a timely study.

We use the SEM and Binary Logistic Regression technique to assess the impact of GBP on the OP of Pakistani commercial banks. The data have been collected from 248 banking professionals and analyzed using SPSS-22 and AMOS-23 software. The findings emphasize that banks can improve their OP not merely by formulating GBPs, but by implementing them to foster GC, consequently enhancing the EP in the process. This enhanced EP can improve the OP of banks. Hence, banks' green policies indirectly support OP through the combined impact of GC and enhanced EP.

The cultivation of a GC within banking institutions is pivotal in the successful implementation of green policies. It not only fosters a sense of responsibility and accountability among employees but also ensures the seamless integration of these policies into the bank's day-to-day operations. Moreover, positive EP brought about by GC can subsequently result in tangible benefits for the operational efficiency of Pakistani banks. The research delivers evidence to support the view that the adoption of

GBPs by banks significantly impacts their OP. Similarly, the unique methodological aspects of this research extend toward the formal stakeholders and the policymakers to ensure that a certain narrative is being built by the governing bodies that improve the culture as the foundation and help with overcoming the bottlenecks. They can also help with proper training and benchmarking so that it can lead to more effective green idea submissions. Moreover, regulatory upgrades and the fixing of the pending cases along with the restructuring of the incentives, such as in the case of implementing green credit guarantee schemes for the SMEs, can lead to EP-linked banking and reduced water waste.

7. Limitations and future recommendations

Despite its substantial contribution to the literature, we acknowledge limitations in this study. Our findings are primarily based on a specific context, that is, the Pakistani banking sector. Moreover, the causality claims are limited by the single-wave data, as collected a limited amount of data, spanning a limited timeline. Similarly, the scope remains sector-specific, reflecting Pakistani banking's high state ownership. Last, our focus remains at a regional level. Future research studies can help overcome the regional focus by extending the data sets to the country or a global scale, with a data limit spanning more than three years of the timeline. This will help cover various uncovered norms and bridge more gaps.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Conflict of interest

The authors declare no conflict of interest.

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