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Impact of Green Intellectual Capital on Sustainable Green Banking: Empirical Evidence of Commercial Banks

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Abstract: *This research endeavors to evaluate the impact of green intellectual capital on sustainable green banking. A survey was administered to gather data from the employees of commercial banks in Sindh by using convenient sampling techniques, and data were subsequently analyzed using statistical software like SPSS. The validation of hypotheses was conducted using reliability tests, correlation analyses, and regression analyses. The study's findings reveal a positive direct impact of green intellectual capital on sustainable green banking. This suggests that banks should place a greater emphasis on leveraging green intellectual capital, including green human capital, green structural capital, and green relational capital, to enhance their ability to achieve sustainable green banking. Green human capital plays a crucial role in promoting sustainable green the banking. Therefore, it is imperative for banks to formulate transparent, unambiguous, straightforward, and universally communicated sustainability policies for their entire workforce. Furthermore, green structural capital serves as a significant predictor of sustainable green banking practices. Hence, banks should strive to enhance the adaptability of their organizational structures, reducing environmental waste, such as paper, and fostering a greater focus on eco-friendly activities.*

Keywords: Green Intellectual Capital, Sustainable Green Banking, Commercial banks

Introduction

In recent decades, there has been a growing global emphasis on environmental issues, leading to increased awareness and importance placed on these concerns by governments, advocacy groups, businesses, and the general public (Banerjee, 2002). Initially, environmental protection efforts were mainly focused on households and communities, but now they have become mandatory for commercial enterprises (Gunathilaka, Gunawardana, & Pushpakumari, 2015).While environmental issues were not initially considered highly relevant to the financial sector, this perspective has changed. Banks now acknowledge the influence of environmental issues on their operations (Kiernan, 2001; McKenzie & Wolfe, 2004). As major financiers, banks have a responsibility to ensure strong verification measures are in place to assess the negative environmental impact of businesses they fund. Negligence in this regard could indirectly contribute to environmental pollution. Therefore, it is crucial for banks to prioritize environmentally responsible investments and lending practices (Thombre,

2011).

In developing countries heavily reliant on natural resources, environmental issues have become critical. The focus on environmental concerns has pressured all industries, including banks, to adopt environmentally friendly practices. This study aims to find factors that promote both profitability and environmental protection. Companies can gain a competitive edge by implementing strategies that prioritize both.Green banking is becoming increasingly vital for financial institutions to infuse principles of environmental sustainability into their operations, investments, and financing strategies (Sahoo & Nayak, 2007; Bihari & Pradhan, 2011)

Green banking entails financial institutions adopting sustainable banking practices, which encompass the inclusion of "environmental, social and governance (ESG) factors into their decision-making processes". These practices encompass responsible lending, the development of eco-friendly products, impact investments, and the support of projects aimed at environmental preservation and climate change mitigation (Dias, J. F., Cerdeira Bento, J. P., & Matos, F. J. F., 2021). According to Sharma, Sarkar, & Rishi (2022), Green banking, or sustainable banking, involves the integration of environmental sustainability principles into the fundamental operations and procedures of financial institutions to promote sustainable development and mitigate environmental risks. This entails financial institutions adopting practices that incorporate environmental considerations into their decision-making processes and operations, which includes initiatives like offering environmentally friendly loans, investing in renewable energy projects, and implementing frameworks for assessing environmental risks (Brown & Jones, 2022).

In essence, Green banking denotes the practice of financial institutions embracing principles of environmental and social responsibility within their operations, products, and services. This involves championing sustainable financing alternatives, supporting clean energy ventures, and integrating assessments of environmental risks into lending decisions, all aimed at facilitating the shift toward a more sustainable and low-carbon economy (Chen & Lee, 2023). Green intellectual capital plays a pivotal role in boosting a company's market share by effectively harnessing human, foundational, and societal resources. Existing literature underscores the importance of intangible assets, such as human capital, the dissemination of knowledge, and the efficient utilization of structural resources, in achieving long-term sustainability (Allameh, 2018).

The term "green intellectual capital" encompasses intangible assets, knowledge, and competencies found within an organization or society, with a specific focus on the development and implementation of environmentally sustainable practices, technologies, and policies (Marimon, 2017). It signifies the amalgamation of knowledge, expertise, skills, and intangible resources that contribute to the advancement, diffusion, and application of eco-friendly practices, technologies, and strategies within both organizations and society at large (Ren, Yuan, & Qian, 2018). Green intellectual capital encapsulates the knowledge, competencies, and capacities possessed by individuals and entities, which play a vital role in devising and implementing environmentally conscious technologies, policies, and practices, thereby advancing sustainability and mitigating environmental hazards (Peng, 2020).

Numerous researchers have explored into the relationship between green intellectual capital knowledge sharing, organizational performance, social capital, productivity and sustainability in various contexts. They found that green intellectual capital positively impacts on business sustainability Jabbour, and Nagano, 2018) across various sectors such as manufacturing firms and the hotel industry. However, there is a dearth of studies exploring how green intellectual capital influences sustainable green banking practices within the banking industry (Elberdin, 2017; Allameh , 2018 and Yusliza, 2020) . Green intellectual capital has positive influence on green banking, with particular attention to the moderating impact of competitive pressure (Huma Ayub and Abdullah, 2022). This knowledge gap is

underscored by the limited research on the moderating role of variables that affect the relationship between intellectual capital and sustainability. Consequently, the aim of this study is to fill the gap by contributing to the existing body of knowledge by examining the "impact of green intellectual capital on sustainable green banking practices", evidence from commercial banks of Sindh.

The primary focus of this study is to address the deficiency in our comprehensive understanding of how "green intellectual capital" influences sustainable green banking practices, particularly within the context of commercial banks operating in the province of Sindh. Green intellectual capital denotes the knowledge and expertise associated with environmentally responsible practices and sustainable development. Despite the global acknowledgment of the importance of sustainable green banking, there is a noticeable absence of empirical study that explicitly investigates the role of green intellectual capital within the commercial banks of Sindh. This knowledge gap impedes the formulation of effective policies and strategies aimed at promoting sustainable banking practices in the region. Consequently, the objective of this study is to examine the influence green intellectual capital on sustainable green banking within Sindh's commercial banks, offering evidence-based insights for policymakers and bank executives. These insights will contribute to the enhancement of sustainable banking practices and the advancement of environmental well-being within the region.

Research Objectives

The aim of this study Impact of Green Intellectual Capital on Sustainable Green Banking within Commercial Banks Operating in Sindh" would typically be to investigate and understand the impact of 'green intellectual capital' dimensions ('green human capital, green structural capital, and green relational capital') on sustainable green banking practices in commercial banks operating in the Sindh region. This study would likely seek to achieve the following specific objectives:

1. To evaluate the positive and direct impact of green human capital on sustainable green banking.
2. To evaluate the positive and direct impact of green structural capital on sustainable green banking practices.
3. To evaluate the positive and direct impact of green relational capital on sustainable green banking practices.

Research Questions

The research aims to investigate the research question in the following manner.

1. Is there positive and direct "impact of green human capital on sustainable green banking"?
2. Is there positive and direct "impact of green structural capital on sustainable green banking'?
3. Is there positive and direct "impact of green relational capital on sustainable green banking"?

Literature Review

This study's theoretical framework draws upon the 'intellectual capital based'view (ICV) presented by Sveiby in 1997 and the resource-based view (RBV) formulated by Barney in 1991. The RBV theory offers a conceptual foundation for comprehending the connection between intellectual capital and the establishment of environmentally sustainable banking practices. According to RBV, a company's competitive edge and performance can be ascribed to its distinct resources and abilities. In the context of sustainable green banking, green intellectual capital emerges as a valuable asset, empowering banks to devise and execute eco-friendly initiatives.

Green banking practices have been shown to exhibit superior environmental performance (Martinez-Camilo, 2022). As noted by Smith, Johnson, and Brown (2020), the role of green banking is pivotal in advancing the cause of sustainable development. Wang (2021) proposes that incorporating environmental factors into banking operations can prove to be economically sound. The acceptance of green

banking, heightened awareness of environmental concerns, and a preference for sustainable financial products have been emphasized in the research conducted by Nguyen (2023).

Green banking has gained significant global attention, prompting banks to proactively address environmental degradation through the implementation of eco-friendly practices and sustainable practices (Amran, Hashim and,Bukhari 2019). This trend is also making strides in emerging economies like Pakistan. The State Bank of Pakistan, in line with PEPA (Act-1997) recommendations, introduced guidelines for Green Banking in 2017. The objective is to establish Green Banking initiatives aimed at promoting sustainability (Siddiqui, Aisha, & Rasheed, 2019).

Green intellectual capital plays a pivotal role in attaining environmental sustainability and gaining a competitive edge. Alzubaidi, Basah, and Latiff (2019) underscore the significance of amalgamating environmental knowledge with intellectual capital to ensure the prosperity of organizations in the context of the green economy. Tseng and Lin (2018) contend that a firm's capacity to generate, oversee, and harness green intellectual capital can significantly bolster its sustainable competitive advantage. Li, Wang, and Zhang (2016) propose that nurturing green intellectual capital can augment a firm's environmental management practices and contribute substantively to sustainable development.

The positive impact of green intellectual capital on eco-innovation and firm performance has been highlighted by Hamidizadeh, Nejati, and Dasgupta (2021). Sieber and Delgado (2022) suggested that green intellectual capital green intellectual capital equips a firm with the capability to discern and exploit environmental opportunities, offering insights into the mechanisms through which it contributes to sustainable business performance. Lastly, Iannuzzi and Veneroso (2023) stress the importance of seamlessly integrating environmental and intellectual capital to uphold sustainability.

Dimensions of Green Intellectual Capital

Green Human Capital: as defined by Buendía-Martínez (2019), pertains to the incorporation of environmental considerations into human resource management (HRM) strategies and policies with the objective of cultivating a workforce characterized by expertise, proficiency, and a strong environmental consciousness. Yang (2018) contends that Green Human Capital, encompassing employees' knowledge, competencies, and environmental awareness, serves as a pivotal catalyst in propelling green innovation performance and nurturing sustainable corporate growth. Additionally, D'Amato (2020) posits that Green Human Capital involves the capability to comprehend, oversee, and implement eco-friendly practices and technologies within organizational settings.

Green Structural Capital: refers to the organizational frameworks, procedures, and systems that underpin efforts in sustainable banking. The incorporation of economic assessment into decision-making processes can facilitate the identification and prioritization of investments and policies aimed at fostering the sustainable utilization and preservation of green structural capital (Pinto, 2020). Martinez-Lopez (2021) highlights the significance of green structural capital in bolstering resilience, productivity, and the long-term sustainability of a company's operations while mitigating adverse environmental impacts. The report from the United Nations Environment Programmed (UNEP, 2018) underscores the imperative of integrating green structural capital into national development strategies to ensure the enduring sustainability of ecosystem services.

Green Relational Capital: The literature underscores the significance of green relational capital in the context of banks or organizations establishing connections with their customers, supplier partners, and network members to gain a competitive edge (Chen, 2008). According to Jabbour (2019) the Green relationship with suppliers in supply chain management emphasizes the importance of environmental considerations within the supply chain, highlighting its crucial role in promoting

sustainability. Firmansyah's (2017) found relationship between green relational capital and gaining a competitive edge. Likewise, Huang and Kungs (2011) demonstrated the favorable impact of green relational capital on environmental proficiency and dedication to related activities. Akhtar (2015) asserted that green relational capital is a key factor to attain sustainability.

Green Human Capital and Sustainable Green Banking

Green human capital is increasingly vital for organizations seeking a competitive edge, especially in light of growing environmental degradation concerns. To address this imperative, banks and other entities must swiftly implement 'protective measures for the environment' (Fernando and Albassam, 2019).

The 'Resource-Based View'Theory underscores that banks, like all organizations, possess tangible and intangible assets, with human resources playing a pivotal role in achieving optimal performance (Malik, 2020). As stated by Ramesh, Ravishankar, and Ramya (2020), Green human capital contains the skills, knowledge and expertise related to sustainable banking, enabling the development and adoption of environmentally responsible policies, products, and services within organizational contexts.

Scarpellini and Aranda Uson (2017) propose that green human capital encompasses practices aimed at enhancing employees' capabilities through training and education, thereby elevating their skills, expertise, and knowledge. This ultimately leads to increased employee satisfaction and an overall enhancement of a bank's operations. Such individuals adeptly integrate sustainability considerations into their decision-making processes, thereby contributing to the adoption of green banking practices (Kumar & Sharma, 2021).

Green Structural Capital and Sustainable Green Banking:

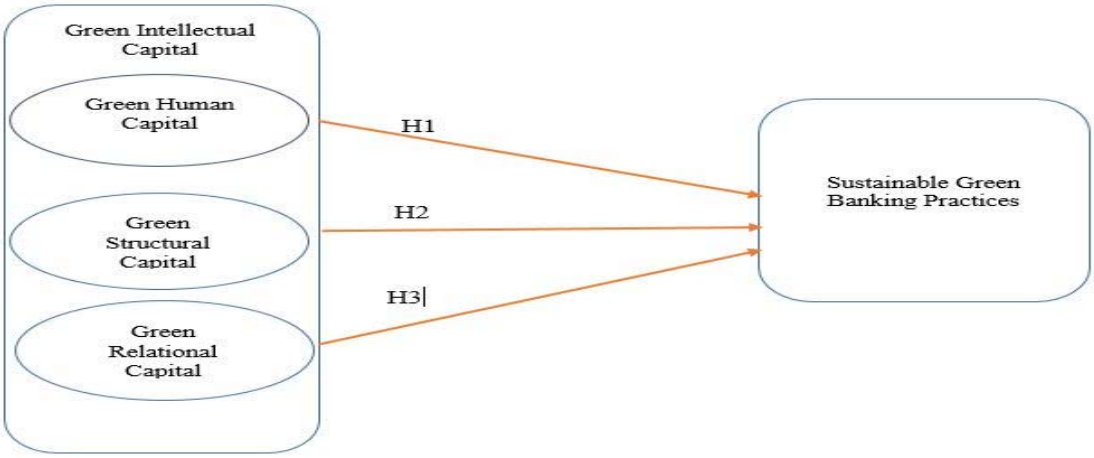
Previous research has recognized structural capital as the knowledge ingrained within an organization's methods, framework, and tenet, as exemplified by databases, technology, and other concrete assets (Carlos & Martos, 2012). These intangible assets possess substantial worth for financial institutions and are often denoted as organizational capital, which endures even in the absence of staff members (Cavicchi & Vagnoni, 2017). As per Smith and Johnson (2022), the existence of green structural capital exerts a noteworthy influence on the sustainability of green banking practices. Lee and Choi (2023) have illustrated that the efficient utilization of green structural capital favorably affects the sustainability of green banking activities. Johnson (2023) has also underscored that the incorporation of green structural capital of green structural capital into sustainable green banking approaches results in enhanced ecological and financial performance.

Green Relational Capital and Sustainable Green Banking

Literature emphasizes the significance of green relational capital whereby banks industry establish connections with their partners, suppliers, customers and network members in order to gain a competitive edge Chen (2008). Based on the stakeholder theory proposed by Donaldson and Preston (1995) the interrelationships between an organization's employees, investors, customers, and suppliers are instrumental in creating competitive advantages. According to Smith and Johnson (2022). "Green relational capital plays" a crucial role in the success of sustainable green banking initiatives. Green relational capital, which encompasses trust, reputation, and stakeholder relationships, is an essential element in promoting sustainable green banking practices (Davis and Lee, 2023). Green "relational capital, defined as the "network of relationships between a bank and its stakeholders, is a valuable intangible asset that enables sustainable green banking practices (Johnson, 2023). Chen and Li (2022) highlights the importance "of green relational capital in" enhancing the sustainability performance of green "banks"' and fostering long-term relationships with stakeholders. According Johnson and Smith (2021), green relational capital is a critical factor in driving sustainable

green banking practices, facilitating collaboration with stakeholders and enhancing the bank's reputation.

Research Model



Research Hypothesis

As a result of the preceding discussion, the following hypothesis has been developed:

1. H1: “There is positive” and direct “impact of green human capital on sustainable green banking”.
2. H2: “There is positive and direct” “impact of green structural capital on sustainable green banking”.
3. H3: “There is positive’ and direct “impact of green relational capital on sustainable green banking”.

Research Methods

To formulate the research objectives, an extensive literature review was undertaken. The primary aim of this literature review was to gain insights into the influence of “green intellectual capital’’ on the sustainability of green banking. Subsequently, a deductive research approach was employed to develop hypotheses. To collect primary data for this research, a descriptive research methodology was employed. The targeted population consisted of employees working in commercial banks located in Sindh. Self-administered questionnaires were utilized as the data collection instrument. 12 items related to dimensions of green intellectual capital (GHC, GSC, and GRC) were adopted from Huang and Kung (2011). 10 items related to sustainable green banking were adopted from Shaumya and Arulraja (2011) and assessed using a 5-point Likert scale, with options ranging from 1, indicating strongly disagreement, to 5, representing strongly agreement, with a total of 100 questionnaires distributed to participants using convenient sampling techniques. Of the distributed questionnaires, 95 were returned with responses. After removing unusable questionnaires, the final dataset used for analysis consisted of 90 appropriately completed questionnaires. Consequently, the sample size for the current study is denoted as N = 9.

Data Analysis

Table 1: Demographics of Respondents

Sr. No	Demographics	Characteristics	Frequency	Percentage
1	Age	21-30	43	47.8
		31-40	39	43.3
		41-50	8	8.9
		Total	90	100.0
2	Gender	Male	71	78.9
		Female	19	21.1
		Total	90	100.0
3	Education	Bechlors	19	21.1
		Masters	63	70.0
		M.Phil	8	8.9
		Total	90	100.0
4	Designation	Manager	20	22.2
		Officer	26	28.9
		Banking Assistant	22	24.9
		Banking Trainee	22	24.9
		Total	90	100.0
5	Income	10000-20000	12	13.3
		21000-30000	21	23.3
		31000-40000	24	26.7
		41000-50000	14	15.6
		50+	19	21.1
		Total	90	100.0

A sample profile was collected, consisting of 90 respondents from various categories. Among these, 71 were male respondents, yielding a response rate of 78.9%, while 19 were female respondents with a response rate of 21.1%. Within this sample profile, 43 respondents fell within the age group of 21-30 years, with a response rate of 47.8%. In the age group of 31-40 years, there were 39 respondents with a response rate of 43.3%, and 8 respondents belonged to the age group of 41-50 years, with a response rate of 8.9%.

Regarding educational qualifications, 19 had Bachelor's degrees, resulting in a response rate of 21.1%. The majority, 63 respondents, held Master's degrees with a response rate of 70%, and 8 respondent's possessed M.Phil degrees with a response rate of 8.9%.

When considering income ranges, 12 respondents reported incomes between 10,000 and 20,000, accounting for 13.3% of the sample. There were 21 respondents with incomes between 21,000 and 30,000, with a response rate of 23.3%. In the income range of 31,000 to 40,000, 24 respondents were found with a response rate of 26.7%. Additionally, 14 respondents had incomes ranging from 41,000 to 50,000, resulting in a response rate of 15.6%. There were 19 respondents with an income of 50+.

In terms of job positions, 20 were Managers, with a response rate of 22.2. %. Additionally, there were 26 Officers with a response rate of 28.9%, 22 respondents in the role of Banking Assistants with a response rate of 24.9%, and 22 respondents working as Banking Trainees, yielding a response rate of 24.9%

Reliability Analysis:

Table 2: Reliability Test

S .No	Variables	Chronbach's Alpha	No. of items
1	GHC(Green Intellectual Capital)	.856	4
2	GSC(Green Structural Capital)	.758	4
3	GRC(Green Relational Capital)	.745	4
4	SGB (Sustainable Green Banking Practices)	.889	10

A reliability analysis was performed to assess the internal consistency of each item, with a focus on the analysis of Cronbach's Alpha coefficients. As suggested by Malhotra (2004), an ideal scale typically exhibits a value greater than 0.7. The reliability statistics table presented that Cronbach's Alpha falls within the range of 0.758 to 0.889. This range indicates a strong level of consistency among the items comprising the construct. All the items are valuable and reliable to evaluating scales.

Correlation Analysis

Table3: Correlation between GHC, GSC, GRC and SGB

	GHC	GSC	GRC	SGB
GHC	1			
GSC	.740**	1		
GRC	.815**	.847**	1	
SGB	.799**	.869**	.743**	1

The correlation analysis evaluates the strength of direct relations between variables. The table shows, a diagonal value of 1 represents a perfect correlation between variables. The correlation between "GHC" and "SGB" is 0.740**, significant at the 0.01 level, with a significance value of 0.000, implying a significant relationship (r=0.740**, p<0.01).

Similarly, the correlation between "GSC" and "SGB" is 0.815, with a significance value of 0.000, indicating a significant positive correlation (r=0.815**, p<0.01). The correlation between "GRC" and "SGB"is 0.799, and the significance value remains 0.000, again suggesting a positive correlation (r=0.799**, p<0.01). Furthermore, the collinearity statistics confirm the absence of multicollinearity issues in the data.

Regression Analysis

Table 4: Regression Analysis

Independent Variables	Coefficients	t statics	P value
GHC	.375	3 .887	.005
GSC	.412	4.110	.000
GRC	.346	3.490	.000
R-square .728	Adjusted R-square .511	F statistics 66.037	……. .
Dependent Variable:	Sustainable Green Banking		

provided regression table shows that the R-square value stands at 0.728, indicating that the independent variables ("GHC,GSC and GRC") collectively account for 72% of the variance in SGB (as denoted by R Square). The R value signifies the predictive accuracy of the dependent variable and represents the multiple correlation coefficients. A higher R value implies a stronger relationship between the independent variables and the dependent variable. In this specific case, the R value was observed to be 72.6%, and it is associated with an F-value of 66.037. The p-value is less than 0.01as suggested threshold, highlighting the

overall significance of the model, as illustrated in the table.

Furthermore, it is notable that the variable "GSC" exhibited the highest beta value of 0.412, along with a significance P value of 0.005. A higher score on this scale suggests a more substantial impact on SGB. The "GHS" variable displayed a beta value of 0.375 with a P value of 0.000. Conversely, the "GRC" variable showed a beta value of 0.346, with a P value of 0.000, signifying its statistically significant impact on SGB. All the independent variables demonstrate a significant positive impact on SGB. Findings

Table: "Testing Hypothesis"

NO	Hypothesis	Sign	T statistic	Significance (P) level	Verification
H1	GHC →SGB	+	3 .887	0.005	Accepted
H2	GSC → SGB	+	4.110S	0.000	Accepted
H3	GRC → SGB	+	3.490	0.000	Accepted

Findings:

The research findings also indicate that a higher level of green human capital (GHC) within environmentally responsible banks can contribute to the sustainability of green banking. This observation aligns with existing literature that highlights the beneficial influence of the independent variable on the dependent variable (Malik, 2020). Furthermore, the results lend support to the considerable impact of green structural capital (GSC) on the sustainability of green banking, consistent with the research conducted by Yusof, and Samad (2019), who emphasize the positive role of green structural capital within the context of green intellectual capital in the manufacturing sector's performance. The significant and positive correlation between green relational capital, a component of green intellectual capital, and sustainable green banking is also corroborated by the work of Omar and Zaman, (2019).

Conclusion:

The research findings indicate a significant impact of green intellectual capital on sustainable green banking. Based on the findings, it can be concluded that green human capital emerges as the most influential factor in promoting sustainable green banking. This implies that an increased presence of individuals with a strong environmental commitment and green mind set would likely improve the prospects of achieving sustainable green banking. Subsequently, green structural capital is also as most influential determinant of sustainable green banking. A banking infrastructure that is adaptable to technology and supports green banking activities involved in enhancing both efficiency and effectiveness while contributing to environmental preservation. Furthermore, the results emphasize the significance of green relational capital, particularly in fostering strong relations between banks and all their stakeholders, including employees increased knowledge sharing and creates an environment to the free exchange of ideas. The study's results indicate that banks operating in Sindh should prioritize the development of green human capital, adapt their structures to facilitate green initiatives, and nurture strong relationships with all employees, particularly to foster greater sustainability in their green banking activities.

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