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Empirical Studies on Social Capital as a Catalyst for Green Innovation

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ABSTRACT

Lack of social capital is among the numerous barriers impeding Pakistan's industrial sector's adoption of green innovation. The aim of this methodological study is to investigate how social capital can promote green innovation in Pakistan's industrial sector. This study reviews and summarizes the relevant literature and empirical data. First, there is a quick rundown of how Pakistan's industrial sector innovates environmental sustainability through social capital. Second, the articles will be indexed using ideas and theoretical positions from the published literature. This article addresses the theoretical underpinnings of these processes as well as how and why they operate. Third, this study suggests three item for consumption category for further examination. This study contributes to Pakistan's industrial sector by critically analyzing and synthesizing current theories and research on green innovation and the environment. These findings suggest that enhanced social networks, trust, and collaboration among industrial stakeholders can facilitate resource access, information exchange, and collective action, all of which are essential for advancing green innovation. This research also reveals significant management and policy implications to support the adoption of green innovation in Pakistan's industrial sector and foster social capital.

Keywords: *Green Innovation, Social Capital, Environment, Industrial Sector, Social Network, Sustainability.*

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Introduction

Social capital has been defined in a number of interconnected ways. A thorough framework for social capital was put forth, which divided social capital into three categories: relational, structural, and cognitive. Configurations and patterns of human relationships are referred to as the structural dimension, which addresses attributes including network density, connectedness, and hierarchy. Network size are the four main sub-constructs that identified in the structural dimension. The economically motivated tradition of social capital is intimately linked to the structural dimension. According to certain authors who take an economically motivated stance, social capital is an investment in interpersonal relationships that should yield financial gains. Social relations, which rely on the anticipation of benefits from preferential treatment and collaboration between individuals and groups, provide social capital. This method may not adequately take into account how entrenched individuals are in their social setting because it is mostly based on rational choice theory (Zheng, 2010).

The concept of social networks and the sociological tradition are the primary sources of the relational dimension of social capital. According to a sociological perspective, the degree of reciprocity and trust within a group or between people can be used to gauge social capital. These "social organization features, like trust, norms, and networks, can improve the effectiveness of society by enabling concerted efforts " are referred to as capital. They concentrated on the value of all social networks taken together as well as the tendencies that emerge from them to help one another. The majority of research on social capital and creativity has been on norms and trust (ZHENG, 2010). The composite metric used in this study to quantify social capital is mostly derived from the sociological tradition and takes into account both passive and active group membership as well as trust. Shared language, codes, narratives, and interpretations are implied by the cognitive component of social capital. claimed that this aspect of social capital has received the least attention and is primarily confined to the strategy area (Echebarria and Barrutia, 2013).

Figure 1: *Source(s) author's own creation.*

The world economy is expanding rapidly; however, this increase is accompanied by significant environmental damage and massive energy consumption. Energy use and environmental deterioration are elements that endanger the safety of human existence. The creation of a green economy is essential, as environmental concerns have become a significant factor in global economic and social development (Li et al., 2022). Businesses have a social duty to protect the environment, as a key component of excellent economic development. Economic progress is fueled and derived from innovation. Green innovation has boosted the

growth potential of the green economy and emerged as a crucial means for businesses to consider both financial and environmental advantages. Companies' capacity and willingness to implement green innovation are frequently constrained by their long cycle, high level of uncertainty, high investment requirements, high risk, and dual externalities (He et al., 2021). Thus, we must actively investigate the forces behind companies' green innovation and encourage businesses to follow the path of sustainable development (Zhang and Chen, 2023).

In light of the growing concern over global warming, stakeholders are more aware of environmental issues than they were in the past. More than ever, stakeholders are inclined to support environmentally conscious business. Simultaneously, businesses aim to expand their social networks in a way that will boost their green innovation. Green social capital plays an important role in green innovation. Network variety had no effect on green social capital. This shows the value of social capital in promoting green projects, and implies that building robust social networks can improve a business's capacity for environmental innovation. To meet stakeholders' green claims, a new green attitude is becoming increasingly common in corporate operations, including green supply chain management, production, marketing, design, and R&D.

According to Chen et al. (2019), environmental management is becoming more and more important for regular business operations, in addition to becoming a new business function in organizations. Green innovation requires social capital because it enables entrepreneurs to overcome challenges including obtaining funding, overcoming technical problems, and gaining clients. Social capital facilitates access to resources and assistance, which is essential for environmental initiatives. Through effective network management, trust-building, and strategic cooperation, it achieves this. Apart from being crucial in addressing the issues of environmental entrepreneurship, social capital is also necessary for the advancement and spread of green technologies. social networks can provide new ideas and provide frameworks for assessing and improving them (Carniet al.,2024).

The connection between green technological innovation (GTI) and corporate social responsibility (CSR) is reinforced by social capital, which Green Innovation depends on. Gaining resources, exchanging information, and building confidence with suppliers, customers, and governments are all made simpler by it. This partnership helps the GTI expand, raises the bar for CSR, and makes it easier to collaborate internally and spot business prospects. Accordingly, social capital reduces the positive effects of CSR on the GTI, hence fostering innovation and sustained business development (Wang, 2024). Green innovation benefits from social capital because it fosters collaborative networks and stakeholder trust, which enhance knowledge sharing and resource mobilization. Social capital encourages green innovation efforts in companies, which ultimately increases Green Total Factor Productivity (GTFP), according to this study. However, the effect varies according to the type of organization, indicating that social capital supports green innovation in a significant but context-dependent way, with corporate ownership and financial constraints having a particularly significant impact (Sun et al., 2022).

Social capital is essential for small manufacturing businesses to innovate, particularly when it comes to environmental performance. This facilitates access to the networks, data, and assets required to advance technological and process innovations. The environmental performance of businesses has improved as a result of these developments. Social capital is important for promoting green innovation, which helps manufacturing SMEs grow sustainably, according to research (Ooi et al., 2023). Social capital is created by bonding, bridging, and linking. Strong bonds between homogeneous groups and exchanges between communities are known as "bonding ties." Intimacy, informality, and likeness within a group, including classmates, families, and relatives, are informally linked to these strong relationships. On the other hand, bridging links are associated with heterogeneous groupings and extra-local networks, where interpersonal mutuality varies. This alludes to both official and informal horizontal relationships and standards between people from different backgrounds (Chang, 2019; Cofré-Bravo et al., 2019). According to Cofré-Bravo et al. (2019),

connecting relationships, on the other hand, refer to official associations with institutionalized power, including government agencies.

Through cooperative efforts, such as cooperative innovation initiatives, reciprocal education, problem-solving, sharing of technology, green knowledge, and growing organizational green capability, as well as social capital acquired through interpersonal relationships assists businesses in enhancing green product and process innovation (Huang and Li, 2017). Nevertheless, social connections are becoming increasingly important in improving business performance (Wang et al., 2020). In the context of green innovation, social ties are still mostly ignored in the literature. Based on social capital theory, we propose that social connections can help businesses acquire new information and important resources needed to implement green innovation. This study emphasizes how social capital, particularly through political and business connections, is crucial for promoting the uptake of green innovation in developing nations. Compared with political ties, business links have a greater impact on adoption. Additionally, the adoption of green innovation and social bonds are positively correlated when absorptive ability is present., indicating that companies with strong social networks and the ability to take in new information are more likely to implement eco-friendly practices (Ali et al., 2023).

An important and favorable factor in the adoption of green manufacturing technology is social capital. The most important of its numerous aspects is social participation. This study suggests that social capital, especially for younger and part-time rice producers, facilitates the adoption of green technologies. In order to boost social capital and accelerate the transition to low-carbon and environmentally friendly farming practices, it is crucial to encourage group activities and organizational support (Liu and Liao, 2024).

Green innovation benefits from social capital because it facilitates access to the data and materials needed for environmental innovation initiatives. The study found that whereas structural and relational capital had a significant impact on environmental innovation, cognitive capital did not. Additionally, the positive benefits of relational and structural capital on environmental innovation are reinforced by environmental scanning, indicating that companies with high social capital are better able to find and implement innovative environmental technologies. Companies can use their social capital to promote environmental innovation initiatives and find the resources needed for environmental innovation. Because environmental innovation includes the full process of idea collection, research and development, testing, and launching new goods or services onto the market, it entails a substantial amount of physical resources and labor that may be beyond the capability of small enterprises. Strong social capital thus makes it possible for companies to access data and resources that might spur the expansion of environmental innovation (Lao, 2018).

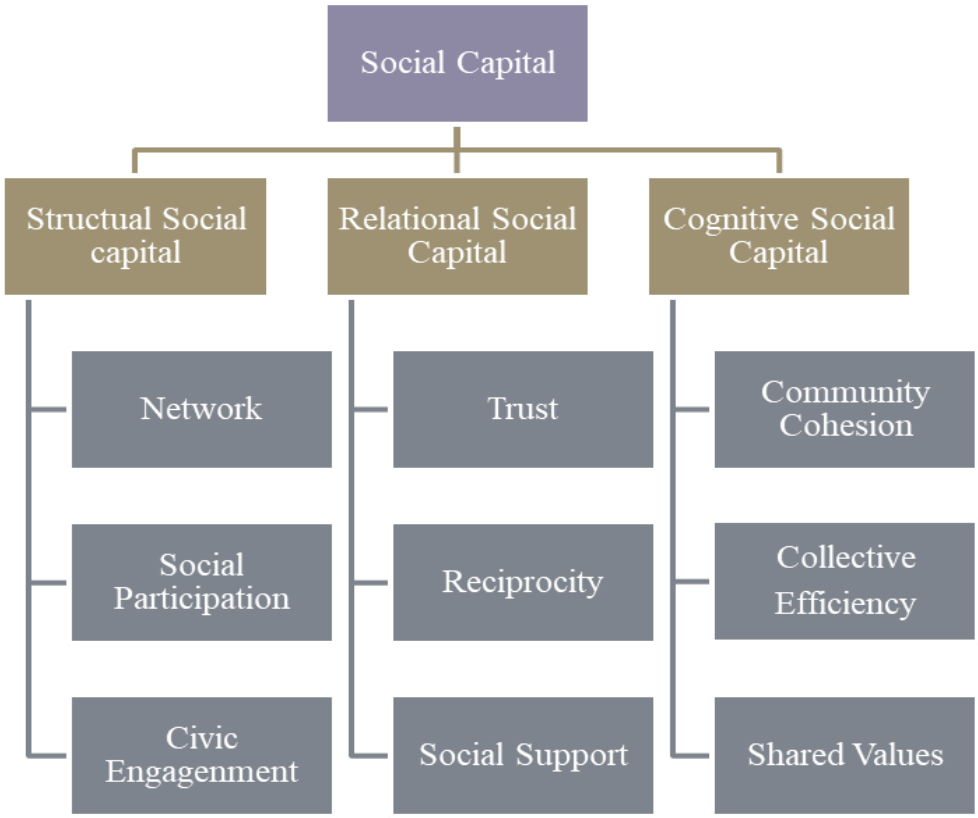

Figure 2: *Source(s) author's own creation*

Research objectives:

1. To give an overview of green innovations and their impact on Pakistan's industrial sector's ec ological and environmental efficiency.
2. To review and synthesize the body of research and empirical information on the topic of social capital as a catalyst for green innovation.

Review of Literature

According to Akram (2020), the transition to a more environmentally friendly and sustainable manufacturing sector is the main issue facing many emerging countries, including Pakistan. One significant factor that has garnered much attention in this context is the role of social capital in fostering green innovation. This systematic review aims to gather literature on the application of social capital to promote green innovation in Pakistan's manufacturing sector. Additionally, studies have shown that consumer awareness and preferences for environmentally friendly products may encourage companies to innovate to adapt to their customers' evolving needs.

According to Arundel and Kemp (2009), green innovation is the intentional or unintentional creation or major enhancement of a company's operational processes, (including goods and services) that reduce environmental risk and pollutant emissions, as well as the negative effects of energy and resource usage. The Organization for Economic Cooperation and Development in Pakistan (2010) offers this description. Because of the increasing pollution problem, environmental safety testing has become a focus of the global economy. The international community also implemented environmental safety measures and made significant efforts to prevent environmental contamination. Between 2022 and 2023, Pakistan's manufacturing GDP decreased from 4864350 PKR million to 4606868 PKR million. The State Bank of Pakistan reports that between 2000 and 2023, Pakistan's manufacturing GDP averaged 3113545.02 PKR million, reaching an all-time high of 4864350.00 PKR million in 2022 and a record low of 1405601.92 PKR million in 2000. According to the Framework for Economic Growth (2011), the main goals of Pakistan's economic growth plan include boosting exports and revitalizing the manufacturing sector. Over the previous three decades, there has been little change in the nation's industrial structure. The main reason for Pakistan's industrial sectors' poor export performance is their inadequate industrial environmental performance.

The 14,001 company replies gathered for this Non Lending Technical Assistance (NLTA) are compiled with the empirically demonstrated links between environmental performance and export competitiveness. (World Bank Group, 2012). Manufacturing activity started to improve in FY2024, although it was still below potential due to a heavy reliance on imports, disruptions in global supply, and unfavorable market sentiment. A failing textile industry, rising input costs, a decline in government spending, excessive inflation, and high policy rates further exacerbated the issue. The political and economic uncertainty surrounding the reelection and the global slowdown in demand made this more challenging. The Pakistan Economic Survey, 20234, reports that Large Scale Manufacturing (LSM) decreased by 0.1 percent between July and March of FY2024 after declining by 7.0 percent the year before.

Reficco et al., (2018) studied that the variety of factors, including stakeholder views, corporate environmental ethics, and consumer demand for green products, have been studied in relation to the acceptance and success of green innovation. According to their findings, there has been a growing interest in the literature about the function of social capital in encouraging green innovation in many industries. In order to promote sustainable innovation, it has been found that social and economic partnership frameworks are crucial. Through these techniques, social and environmental considerations may be easier to integrate into the business models of green innovators. The study has looked at the connections between these social, economic, and environmental cooperation mechanisms and the supportive environments in the focus businesses.

El-Kassar and Singh's (2018) study, for instance, found that organizational performance can be improved by implementing green product and process innovations. As drivers of green innovation, the authors stressed the importance of considering stakeholder perspectives, corporate environmental ethics, and customer demand for environmentally friendly products. One significant element that has emerged is the importance of collaboration and knowledge sharing inside and across organizations. Additionally, environmental management strategies and the ability to exploit large-scale data can help overcome technological barriers.

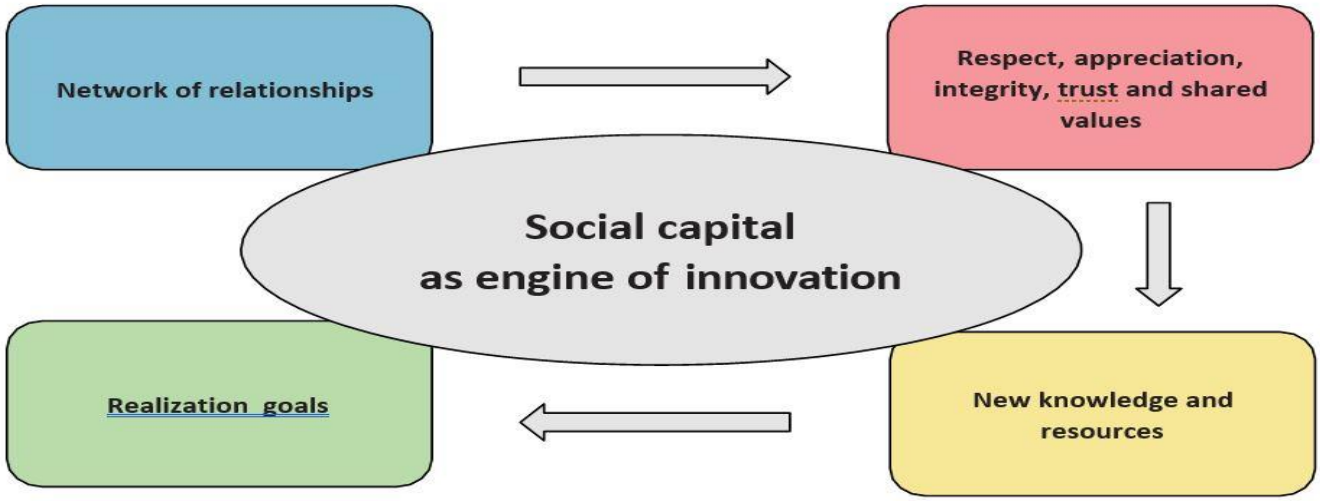

Figure 3: *Source(s) author's own create*

Table 1: *Empirical Studies on Social capital as a catalyst for green innovation:*

Author	Topic/Focus/Question	Findings
Xin, (2020)	The aim of the research was to examine the positive relationship between social capital and product innovation.	According to the findings, social capital is highly related with the innovation of new products and is entirely mediated by both marketing and capacity to absorb.
Chen et al., (2014)	The rationale of this study is to investigate, from the view point of social capital, how collaboration regarding the environment across organizational borders.	According to the research findings, relational capital has been positively influenced by structural and cognitive capital, and it plays an important role for green management, which develops higher innovation. Businesses should use their social capital to generate more in order to achieve sustainable green innovation.
Ali et al., (2023)	The purpose of this study is to explore how social connections and the implementation of green innovation are affected by absorptive capacity.	The study's findings show that absorptive capacity promotes both the favorable relationships between the two types of social contacts and the adoption adoption.
Zhao et al., (2021)	Assessing how second-order social capital Correlates to green innovation is the goal of the study. The moderating role of the ambidextrous. governing body	Studies indicate that second-order social capital from suppliers and customers promotes green Exploitative
Xie et al., (2022)	The aim of the study is to examine the connections between customers 'inferred green needs and green social capital.	This study presents a deeper knowledge of the Contingent variables behind green needs and green social capital and how firms' engagement Innovative green processes can have significant impacts on their finances performance.
Dalgado et al., (2014)	The main objective of the study is to find out how green social capital operates as a bridge among environmental product innovation And green intellectual capital.	The empirical findings show that green social capital plays a key role in mediating the relationship between environmental product innovation and green organizational structure capital. They also emphasize the significance of social ties in improving the environmental sustainability of the company.
Huang et al., (2017)	This study explores the relationships between performance, green innovation, and influencing factors as well as the variables that impact green innovation.	The study's findings demonstrate that social reciprocity, coordination ability, and dynamic capability are key drivers of green innovation, which includes the development of green processes and green products. Green product and process innovation improves both organizational and environmental performance.

Laužikas and Dailydaitė, (2013)	The study highlights social capital as a motivating element for businesses pursuing innovation.	The study, which is based on the Global Entrepreneurship Monitor (GEM) methodology, primarily focuses on three aspects of social capital: trust, norms, and networks in Lithuanian companies. These aspects are consistent with the elements of social capital that are identified as the driving factors in the literature review.
Pashazadeh & Teymoriazar, (2024).	The present study aims to examine how governance ambidexterity in the focus companies plays a moderating role.	The results show that supplier and consumer indirect social capital, also known as second-order social capital, significantly influences
Muafi, (2015)	This study examines how Green IT empowers SMEs and how creativity and innovation are social capital.	According to the study's findings, social capital influences innovation, and the empowerment of green IT plays a big role in both creativity and innovation as well as social capital simultaneously.
Tran et al., (2023)	This study constructed a model that incorporates learning outcomes, environmental knowledge, green social behavior, green intellectual capital, and green innovation.	The results offer a greater understanding of how businesses can maximize the advantages of their green resources and competencies, such as green innovation and intellectual capital.
Wang and Juo, 2021	This study examines the connection between green intellectual capital (GIC) and economic and green performance through green innovation.	According to a survey of 138 high-tech companies, these three GIC structures have a favorable impact on green performance, economic performance, and green innovation.
Anik, & Sulistyo (2021).	This study evaluated SMEs' competitive advantage holistically by looking at concepts.	This study demonstrates that SMEs in Indonesia can gain a competitive edge by utilizing green innovation, environmental ethics, and intellectual capital.
Hung et al., (2014)	The green management practices of 160 Taiwanese companies were examined using a partial least squares approach.	According to the findings, supply chain social media is crucial for putting the rationale behind introducing green practices into practice and for helping network members access the information that they need on an individual basis.
Zhang et al., (2022)	Three facets of social capital accumulation supplier integration, which in turn affects environmental and economic results.	The findings show that the inclusion of green suppliers has a major impact on the accumulation of social capital. Relational and structural capital accumulation has a positive effect on environmental and economic performance.
Ooi et al., (202	The purpose of this study is to clarify how social capital supports innovation in small manufacturing companies and how innovations improve environmental performance.	The relationship between environmental performance and social capital is mediated by both process and digital innovation, with digital innovation having the greatest impact.
Lee, (2015)	This study investigates how green supply chain management affects operational and environmental outcomes from the standpoint of supply chain social capital accumulation.	According to this study, social capital accumulation through green supply chain management enhances the supply chain's operational performance and environmental impact.
Liao, (2018)	This study examines the causes of the environmental improvements made by businesses.	Environmental scanning acts as a beneficial moderator in the connections between structural capital, relational capital, and environmental innovation.
Liu et al., (2022)	This study uses the green supply chain integration (GSCI) perspective to investigate how green intellectual capital (GIC) affects GI.	The findings show that GI benefits from three aspects of green intellectual capital. Both internal and external green supply chain integration mediate the interaction between GIC and GI.

Petrou, & Daskalopoulou, (2013).	Overall, our findings show that a company's knowledge base supports innovation. However, when the underlying mechanisms of social capital formation are considered, the explanatory value of knowledge-based variables decreases.	This study uses cross-sectional tourist data for Greece to quantify social capital through intentional and active participation in network alliances and calculates multiple profit models to test for the impact of social capital on innovation activity.
Chen, (2024)	This study examines the relationship between equity finance and green innovation (GI) in BRICS economies.	This study emphasizes how adopting green innovation can improve businesses' financial status in a practical sense and emphasizes the growing significance of sustainability in influencing investment choices and promoting a greener economy in a social sense**.**
Dost, & Badir, (2019	This study aims to determine whether human capital moderation improves or degrades the relationship between social capital and the generation and adoption of process innovation.	This study concludes that social capital has an ambidextrous effect on the adoption and generation of process innovation. However, this relationship becomes stronger when human capital interacts.
Susyanti, &Fikriana, (2024).	The purpose of this study is to examine how top management support affects green social capital and ecological behavior among employees.	The findings showed that green social capital was significantly affected by top management support. Additionally, the ecological behavior of employees is significantly impacted by the support of the upper management.

It is thought that the economies' creative activitie s are boosted by the favorable dynamics ofmarke t size (GDP) expansion.Industrial growth, which mostly results in economies of scale, isone potent ial explanation for this expansion.However, the t heory is still unclear about the directimpact of ma rket size in innovations, including whether it cont ributes to more R&D, lower taxes, the availabilit y of other incentives, etc.We are duplicating the green growth phenomenon incontrast to the tradit ional economic growth phenomenon.Green R&D , green taxation, andindustrylevel structural chan ges may be influenced by the size of the green m arkets and the demand forgreen products.This ma y ultimately result in environmental advancement s and the automatic rise of green technologies (PIDE,2023).

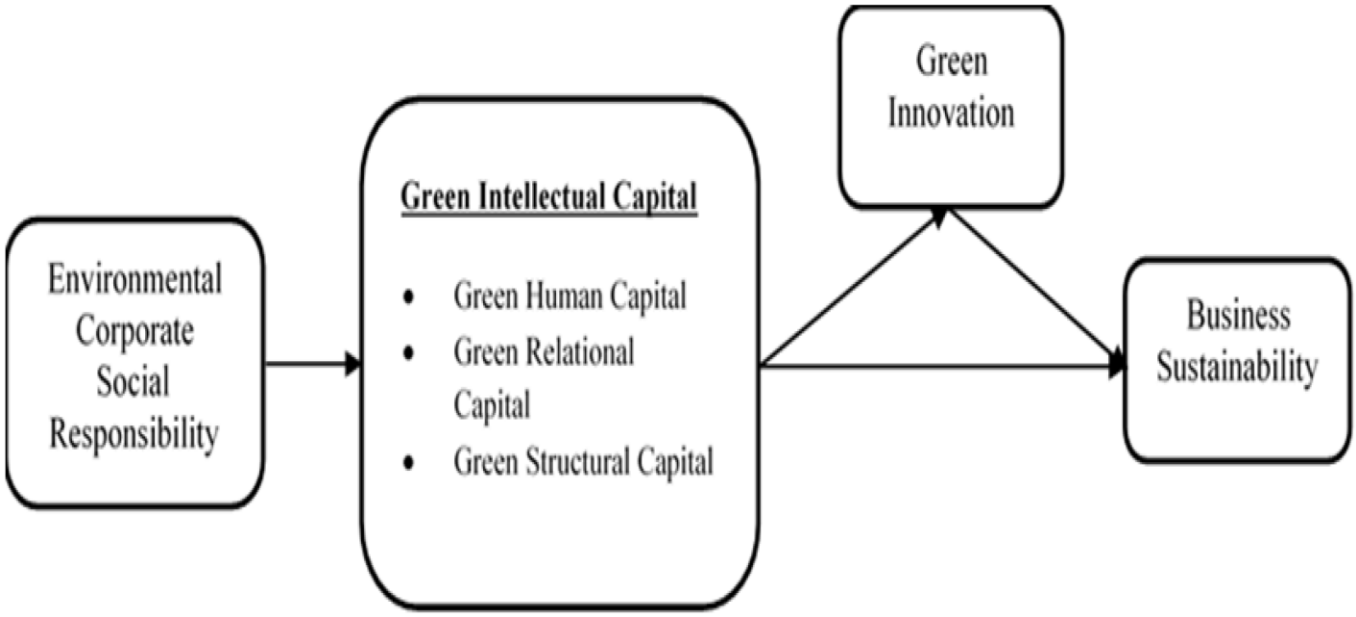

Figure 3: *Conceptual Model.*

Previous research suggests that companies that prioritize environmental responsibility are more inclined to invest in green intellectual capital because it could help them discover and adopt more sustainable practices. Furthermore, a company's obligations to its internal shareholders, upper management, staff, clients are referred to as environmental corporate social responsibility, or ECSR. Businesses that prioritize their external stakeholders, such as eco-aware consumers, will typically spend more on green innovation and GIC, among other eco-friendly projects. Additionally, companies as corporate sustainability activities grow. ECSR incorporates plans and policies such as innovative product design and personnel development programs to guarantee business sustainability.

Research Methodology

The author developed a serious and critical review form in order to perform a thorough and critical analysis. The research focus, bibliographic information, applied theory and model when appropriate, research philosophy (Zikmund, Babin, Carr, & Griffin, 2000), the definition and methodology of green innovation, key findings, green growth, environmental performance, research context, study setting, and theoretical analysis are just a few of the important components of previous research that are searched. The author looked at the empirical literature review in order to evaluate this work critically. After articles were identified, a comprehensive search was carried out to find the most pertinent papers on green innovation. In order to accomplish this, they evaluated the relevant literature that was downloaded from two sources: (1) extensive datasets (Scopus); and (2) economics journals that were part of Clarivate Analytics, such as the Master Journal List 2017 and the JCR report 2016. (3) Google Scholar; (4) MDPI. The following characteristics were used by the author to develop the selection criteria for the literature: books, executive abstracts, abstracts with keywords, editorials, literature reviews, articles, newspapers, magazines, and commentaries were all disqualified because they were conceptually or empirically unrelated to green innovation through social capital and environmental performance.

Conclusion

In conclusion, foster green innovation in several ways Firstly, social capital can make it easier for people to share their knowledge and information, enabling firms to better understand environmental challenges and identify opportunities for green innovation. Second, social capital can encourage collaboration and trust, which can encourage businesses to make long-term, sustainable investments in socially beneficial ideas. The success and beneficial effects of green innovation are largely driven by social capital. Strong social networks that are based on cooperation, trust, and common values give people a place to freely exchange ideas, resources, and information,

which encourages innovation and speeds up the creation of long-term solutions. These networks allow communities and businesses to share knowledge, lower adoption obstacles, and improve group efforts to achieve environmental objectives. Green innovation is therefore accelerated by social capital, which facilitates more fruitful collaborations, improved problem-solving, and a larger long-term influence on sustainability. Finally, the incorporation of social capital into green innovation initiatives not only improves the effectiveness of environmentally friendly solutions but also helps to solve environmental issues in a more comprehensive and inclusive manner.

Conflict of Interest

The authors showed no conflict of interest.

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