

# **Green Intellectual Capital and Corporate Economic Sustainability: The Mediating Role of Financial Condition**

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## **Abstract**

This study aims to assess the effect of green intellectual capital on corporate economic sustainability in the manufacturing sector of Pakistan. Moreover, it also investigates whether the financial condition of a firm mediates the relationship between green intellectual capital and corporate economic sustainability. Data from the managers of 294 manufacturing firms were collected through a questionnaire and analyzed using SPSS and AMOS. Structural equation modeling has been used for hypotheses testing. Results indicate that green human capital and green relational capital significantly influence corporate economic sustainability while the effect of green structural capital is not significant. The results also elucidate that the financial conditions of a firm significantly mediate the impacts of green human capital, green structural capital, and green relational capital on corporate economic sustainability. Green intellectual capital facilitates the production of eco-friendly products and contributes to reducing waste, cost, time, and emission of harmful gases. Finally, study concludes that organizations should invest in green intellectual capital to meet the objective of corporate economic sustainability.

**Keywords:** Green intellectual capital, green human capital, green structural capital, green relational capital, financial condition, corporate economic sustainability.

## **1 .Introduction**

The surge in research on sustainability and strategies for sustainable development has led to an increase in environmental consciousness. The increased consciousness towards environmental issues has highlighted the significance of becoming green (Bombiak & Marciniuk-Kluska, 2018, Shah, et al. 2021). More than 50 percent of the world's population lives in emerging economies. Being the producer of above 40 percent of the global output, emerging economies contribute substantially to environmental pollution (EMBI Global, 2016). Among all sectors, the manufacturing sector has been identified as

the biggest source of ecological degradation. CO<sub>2</sub> emission from the manufacturing and construction sector for the world was estimated to be 20 percent of the total fuel combustion. For South Asia it was 25.8 percent, for China it was 31.7 and for Pakistan, it was calculated as 23.8 percent (World Bank, 2020). The impact of manufacturing processes on the environment has pushed the companies to redesign their business models and to rethink capabilities to innovate so that they can protect themselves from environmental damages and resource wastage (Yusliza et al., 2020). Due to environmental issues, objectives and goals have been redefined by the companies. Instead of only looking for economic and financial gains, companies strive for environmental and societal goals as well (Bombiak & Marciniuk-Kluska, 2018). Therefore, the manufacturing companies in the emerging economies need to find out ways through which they can enhance their sustainable economic performance by rebalancing and restructuring their business models.

The present study is motivated by the need to identify factors that can be utilized to generate profits along with protecting the environment. Companies can have a competitive advantage over others by developing strategies that simultaneously focus on increasing profit and environmental protection. Previous research studies have explained different aspects of intellectual capital, while Chen (2008) introduced the concept of green intellectual capital (GIC) and linked it with gaining competitive advantage. GIC termed as the use of knowledge, capabilities, skills, abilities, expertise, and relationships of the organizations for the protection of the environment (Wang & Juo, 2021). It was defined in terms of three dimensions namely green human, green relational, and green structural capital. The modifications in the business processes in response to environmental degradation have led the firms to increase their profits and to maintain the ecosystem sustainably. By following the principle of GIC, businesses and processes have an effective impact on environmental sustainability. Previous studies confirm that organizations' strategies restructured to control environmental degradation have been effective in reducing the emission of carbon in the ecosystem (Yusliza et al., 2020). Organizations have been reorganized to become socially accountable for keeping the environment clean and for accomplishing economic objectives.

To satisfy the growing demands put forth by the regulatory authorities and the stakeholders regarding environmental preservation, manufacturing firms focus on environmental performance, and this helps them to increase their competitive position in the market (Driessen et al., 2013, Aljuboori, et al., 2022). The performance of a firm and its competitiveness improves by emphasizing green policies that not only sustains profitability but also shields from environmental changes (Yong et al., 2019). Elshamy and Ahmed (2017); Zhixia et al. (2018) examined the influence of green sustainable operations on financial performance and concluded that these factors are related inversely. As a result, some firms were observed to be reluctant to convert their practices according to green sustainability requirements completely. This misconception was corrected by highlighting the significance of considering intangible assets for the assessment of profits and competitiveness.

This paper conceptualizes the impact of green intellectual capital on sustainable economic performance of the manufacturing firms of Pakistan. It also analyzes the mediating role of financial condition on financial performance which guides the investor about the financial

side of the organization. Due to high ecological awareness, manufacturing firms all over the world have started following environmental regulations and green practices. These measures drive the companies towards sustainable development and prosperity (Shabbir & Wisdom, 2020; Tang et al., 2018). The rising environmental issues have moved the interests of organizations towards environmental protection. These issues exert adverse effects on environment therefore, organizations should consider environmental practices and regulations to create a sustainable environment. Asiaei, Jusoh, Barani, and Asiaei (2022) stated that due to little participation of green practices in corporate profitability, organizations feel reluctant while adopting these green practices. (Chen, 2008) discloses that (green) intangible assets increases firm's profitability along with gaining competitive advantage and enhances corporate economic sustainability (CES). This study focuses on the implementation of environmental aspects, green resources, and intangible assets that will increase corporate economic sustainability and helps in protecting the environment by enhancing financial condition. In emerging economies, ecological policies are not easy to follow. They are considered hindrances to future improvement. Hence, this research mainly focuses on the utilization of intangible resources that would bring intangible goodwill to an organization which leads to improving financial performance. The corporate economic sustainability of a firm can be increased by implementing sustainable practices mediated by the financial conditions of a firm. The study covers the manufacturing sector of Pakistan. Primary data was gathered through a questionnaire developed specifically for this study using recognized scales. The manufacturing sector has a great impact on ecology and one of the major sources of pollution. Therefore, it is important to evaluate the utilization of GIC on the firm's financial conditions. The research question answered in this study is:

RQ1. Does the financial condition of a firm mediate the relations between GIC and sustainable economic performance?

This study describes the role of the green intellectual in enhancing the sustainable economic performance of manufacturing firms considering the financial conditions of a firm as mediator. To the researchers' knowledge, this relationship has never been investigated earlier, that makes this study novel.

After presenting the introduction of the study in Section 1, the literature review is presented in Section 2. Next, the details of the methodology are provided. The subsequent sections present the analysis, discussion, and conclusion respectively.

## **2 .Literature Review and Hypothesis Development**

The theoretical model developed in this study is backed by the intellectual capital based view (ICV) developed by Sveiby (1997) and the resource-based view (RBV) developed by Barney (1991). ICV was further developed by Edvinsson and Malone (1997), Stewart (1997), and Reed, Lubatkin, and Srinivasan (2006). Intellectual capital (IC) has been identified as a key factor of production that can ensure sustained competitive advantage for a firm. It represents the intangible or knowledge assets (Martín-de-Castro et al., 2011). This theory is an extension of the Knowledge-based view (KBV) promulgated by (Leonard-Barton, 1992). Stewart (1997) stated that the wealth of a firm can be enhanced through experience, skills, capabilities, knowledge, information, and intellectual property.

Intellectual capital (IC) is one of the key factors which causes the difference between market value and book value (Maditinos et al., 2011). According to Reed et al. (2006) intellectual capital has three knowledge components. These are human capital (HC), structural capital (SC), and relational capital (RC). Human capital is the tacit knowledge, techniques, skills, competencies, and experiences of employees in a firm (Nghah & Ibrahim, 2012) It also refers to the knowledge produced by collaboration or division of workers and information about human capital inherent by nature. Human capital consists of skills, knowledge, capabilities, and information possessed by each worker of a company. This is accounted for as an asset and can become a base for the competitive advantage of a company. Organizations need structure or environment for the transmission of knowledge. Structural capital is represented by the process, patents, copyrights, culture, and procedures of the organization. If the human capital of the organization is not strong then structural capital supports human capital and provides opportunities for improvement (Ahangar, 2011).

For the model presented in this study, the concept of green intellectual capital (GIC) is taken as the antecedent to explain variation in corporate economic sustainability (CES). GIC is the sum of three sorts of intellectual capital developed by considering environmental sustainability. Moreover, From the perspective of green innovation, many studies provide contradictory opinions about the association between GIC and business sustainability (Ullah et al., 2021; Ullah et al., 2022). These three components are defined as green human capital (GHC), green structural capital (GSC) and green relational capital (GRC) (Yusoff et al., 2019; (Chen, 2008) The three components of GIC are defined in the Sub-sections 2.2, 2.3 and 2.4.

On the other hand, RBV illustrated that a firm's superior performance is contributed by the combination and integration of resources. These resources include valuable strategic tools, resources, and capabilities of a firm. An increase in the value of a firm enhances its competitive advantage which leads to an increase in the performance of the company according to RBV (Hsiaoa et al., 2019). Competitive edge is gained by utilizing resources and it should be one of the primary goals of a company. The competitive advantage must be unique enough that it is difficult to imitate or substitute by competitors. Resources are assets, employees, production/operation processes, capabilities, competencies, abilities, skills, information technology, and information essential for implementing strategies (Nason & Wiklund, 2018). In this study, ICV and RBV were used to explain the impact of GIC (measured in terms of its three components, GHC, GSC, and GRC) on the corporate economic sustainability of the manufacturing sector. It is theorized that the sustainable performance of an organization is enhanced by achieving a competitive edge which gains through the implication of green activities and GIC in the operation of the business (Murthy, 2012; Yusoff et al., 2020).

### *2.1 Green Human Capital and Corporate Economic Sustainability*

Green human capital is a synopsis of employees' attitudes, capacities, proficiencies, competencies, knowledge, inventiveness, innovation, and commitment to the development and protection of the environment (Chen, 2008). GHC serves as a driving force for the other two components of GIC, namely GSC and GRC (Chahal & Bakshi, 2014; Li &

Chang, 2010). The financial performance indicates the position of the company and the effectiveness of operating management in the completion of objectives. Corporate economic sustainability indicates the revenues generated by a firm through operations that conform to the requirements of environmental protection. The unique traits of green human capital are core resource of strategic implication which help in attaining sustainable competitive advantage and consequently increase the performance of a company (Seleim et al., 2007); (Campbell et al., 2012). In a dynamic environment core source of achieving sustainable performance is affirmed through the effective utilization of green human capital. It helps in achieving sustainable competitive advantage due to its unique attributes that serve the organization and the environment (Campbell et al., 2012). Corporate environmental management is essential for achieving environmental goals. A high degree of green human capital also leads the organization towards the adoption and development of corporate environmental goals. As experienced, professional skills, excellence, creativity, capabilities of managers and employees towards fortification of the atmosphere are vital for the implications and adoption of green practices (Chang & Chen, 2012).

Chen (2008) identified that increase in green human capital significantly affected the competitive advantage of firms, which led to improvements in their performance. This study was carried out for SMEs in Taiwan. Hence, money spent on advancing human capital (HC) must be taken as an investment instead of considering it as an expense, as it enhances the value of a company, which is the main purpose of any firm (Lin & Zhu, 2019). HC also helps in enhancing the productivity of employees, which also contributes in increasing the performance of the company (Ahangar, 2011). Another study conducted in Indonesia investigated the relationship between GIC and financial performance. The result showed that green human capital has an insignificant and effect on performance (Erinos & Yurniwati, 2018). A study by (Yadiati et al., 2019) illustrated that the efficiency of an organization is enhanced by the application of green human capital which assures sustainability of the environment as well as performance improvement. Following hypotheses have been hypothesized based on the above discussion.

- **H<sub>1</sub>:** GHC has a positive association with the corporate economic sustainability.

## *2.2 Green Structural Capital and Corporate Economic Sustainability*

Green structural capital is a summation of organizational process, culture, mechanism, operation, information and technology, commitment, wisdom, patents, copyrights, managerial philosophies, and trademark for the preservation of the environment or innovations in the green practices in an organization (Chen, 2008; Kong & Thomson, 2009). To deal with ecological challenges, an organization should adopt a stable environmental structure that establishes policies for research and development and initiates practices for less carbon emission (Lee & Min, 2015). Green culture in a firm leads to optimistic environmental effects, greater well-being of employees, an increase in sales, and a reduction in cost. All these factors contribute to an increase in profits (Mehta & Chugan, 2015). Precisely, it can be said that green structural capital is positively associated with company's performance (Chen, 2008; Firmansyah, 2018).

Nowadays, manufacturing firms show a greater concern towards environmental issues particularly when they affect the supply of raw material, their manufacturing processes, or sales. They attach high priority to developing practices for sustainable ecology. Previous studies have established that green structural capital positively influences environmental commitment and competencies. Green structural capital covers all those activities which lead to achieving environmental protection and sustainable performance (Delgado-Verde et al., 2014). The main objective of any organization is to improve its position in the market and to generate a higher profit. To meet this objective an organization should adopt all those activities which contribute to improving its financial health. An increase in green structural capital has been identified as a significant factor that improves the financial performance of an organization (Erinos & Yurniwati, 2018). The performance is also enhanced by gaining competitive advantage achieved through innovation and it should be unique enough that it is difficult for competitors to produce a substitute. Organizations can have a uniqueness in any aspect like culture, product, skills, techniques, and abilities. In this context, Gürlek and Tuna (2018) identified a positive and significant relationship between the green culture of the organization and green innovation. Another study, conducted in Malaysia concluded that GSC influenced green HRM (Yong & Mohd-Yusoff, 2016). A study by Ahangar (2011) concluded that structural capital has no relationship with the financial performance of a firm. Supporting this finding, Maditinos et al. (2011) stated that market price and book value are not associated with structural capital. A study on sustainability and performance of multinational firms of Indonesia identified that sustainability and performance of a firm can be enhanced by increasing green structural capital. The study explains that an increase in GSC helps in turning ideas into operational activities for the safety of the environment (Yadiati et al., 2019). A critical review of the literature on GSC indicates that factors like financial performance, green HRM, and competitive advantage have been identified as the outcomes of an increase in GSC. Summing up the review of literature on GSC, we hypothesize:

- **H<sub>2</sub>:** GSC has a positive effect on the corporate economic sustainability

### *2.3 Green Relational Capital and Corporate Economic Sustainability*

Green relational capital (GRC) is the sum of an organization's association with its stakeholders, customers, suppliers, partners, competitors, and other parties for sustainable environmental management and green practices. A greater stock of GRC enables the firms to earn more profit and to gain a competitive advantage (Chen, 2008). It is considered as a substantial driver of competitiveness. Relational capital is also linked with the exchange of information among partners. Healthy association with business partners leads to stimulate learning and improve skills by collaboration. Close relationships with the stakeholder's support and increase the performance of the organizations. Corporate economic sustainability is a tool for assessing the capabilities of an organization for achieving financial objectives and value in the market (Yamin et al., 1997).

Good practices for the sustainability of the environment can be developed by relational activities of the organization (Hansen, 2014). To maintain sustainability, sharing of information, and collaboration between partners is a very effective approach. It leads to an increase in the performance of companies and contributes to the preservation of the ecosystem (Matinaro et al., 2019). A study by Erinos and Yurniwati (2018) concluded that

GRC has a positive effect on the corporate economic sustainability of a company as it deals with suppliers, customers, and other parties. It also requires gathering data about the demand and expectations of customers from the organization. Hence, the organizations put their effort into producing products and services up to the expectations of their clients to make profits. Competitive advantage is one of the factors which helps to upsurge the performance of a firm. Competitive advantage means a unique aspect of a firm which makes it different from others and it is difficult for competitors to produce the substitute of that product or service. It helped the firm to gain an advantage over competitors. Another similar study by Akhtar et al. (2015) found that green relational capital is associated with environmental sustainability. Later, Firmansyah (2018) associated relational capital with the competitive advantage of a firm. In a study based on the data from the manufacturing sector of Pakistan found that corporate economic sustainability and competitive advantage of a firm were significantly influenced by relational capital (Chaudhry et al., 2016). Previously, similar results were obtained by Kianto and Waajakoski (2010). Based on the above review of the literature we can hypothesize the following relationship.

- **H<sub>3</sub>:** GRC is positively associated with corporate economic sustainability.

#### *2.4 Mediating Role of Financial Condition*

Although the financial condition of a firm represents its position in the market and it is measured through financial statements, cash flow statements, profit and loss statements, the balance of owner's equity, total assets, or liabilities in the balance sheet. In this study, the financial condition is defined as the capacity of a firm to finance activities that facilitate environmental sustainability. If a firm spends more on environmental protection, there will be a greater impact of GIC on its corporate economic sustainability and vice versa. Growing cash and profits depict a positive image of the company in the market and attract investors for future investments. Investors make decisions by looking at the financial condition of any organization. Green intellectual capital contributes to enhancing corporate economic sustainability. The latter indicates how much a company is successful in generating profit while sustaining the environment. A study based on data from the banking sector of Jordan identified that financial condition mediated the relationship between green human capital and corporate economic sustainability significantly (Shrouf et al., 2020).

Green social capital represents a company's responsiveness and concern towards the betterment of the environment. A study showed that green social capital mediates the impact of GIC on the innovation of the products, which leads to an increase in the firm's competitiveness and profits (Delgado-Verde et al., 2014). Another study based on data from the manufacturing sector of Jordan analyzed the impact of intellectual capital on a firm's corporate economic sustainability. The result revealed that the IC was significantly linked with the corporate economic sustainability. Later, a study concluded that knowledge sharing is directly associated with corporate economic sustainability. Moreover, it mediates the effect of IC on the corporate economic sustainability of a firm (Obeidat, Tarhini, Masa'deh, & Aqqad, 2017). SC is used to meet market demand and accomplish its objectives through organizational structure, production processes, organizational culture,

strategies, and capabilities which lead to enhance the profitability of the company (Nuryaman, 2015).

Organizations must adapt or initiate strategies or techniques which are beneficial for the environment, society, and all its stakeholders. Sustainability in the environment can be achieved by following green practices and by increasing GIC. Hence, firms that allocate more money for environmental sustainability will have a greater impact of GIC on corporate economic sustainability. To get a better insight into the association between the three dimensions of GIC and corporate economic sustainability, we posit:

- **H4:** Financial condition significantly mediates between GHC and corporate economic sustainability.
- **H5:** Financial condition significantly mediates between GSC and corporate economic sustainability.
- **H6:** Financial condition significantly mediates between GRC and corporate economic sustainability.

2.5 Theoretical Framework

The proposed theoretical model is presented in Figure 1. It shows that green intellectual capital (GIC) is measured in terms of its three categories, i.e., GHC, GSC, and GRC. The theorized model asserts that the financial condition of a firm mediates the effect of green intellectual capital on the corporate economic sustainability of the manufacturing firms.

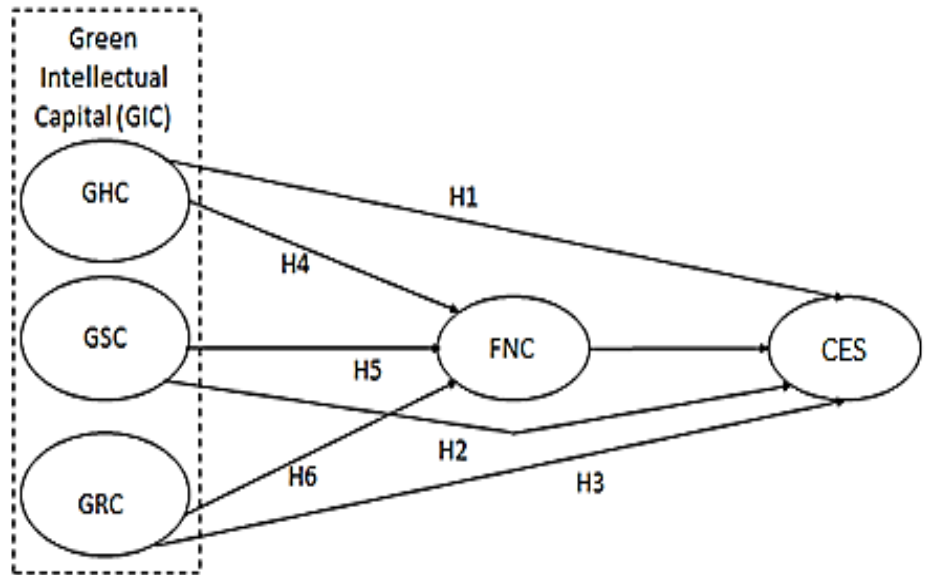


Figure 1: Proposed Model



### 3. Methodology

For the collection of data, manufacturing firms with ISO 14001 certification located in Pakistan were selected. To get the ISO 14001 certification, firms must fulfill the requirements of maintaining the environmental management system. According to the ISO Survey (2018), 416 firms located in Pakistan have ISO 14001 certification. The contact details of these firms were obtained from Company List (2019). A total of 370 questionnaires were mailed to the finalized sample on their company email accounts with a cover letter requesting the senior managers to fill the questionnaire. The data collection process took two months (November & December 2021). Two reminder emails were sent every fortnight after the initial mail. The first email was an explanatory email that explained the purpose of the study with a confidentiality statement, and the questionnaire attached. The first email generated a total of 164 responses. The next email was sent as a reminder to the non-responding participants two weeks after the initial email. This effort resulted in the collection of 94 responses. The third and final email was sent two weeks after the second mail, and it produced 67 responses. Thus, a total of 325 responses were generated entailing a response rate of 87 percent. These 325 responses were analyzed for missing values. 31 responses were discarded due to having more than 50 percent missing data. The remaining 294 responses were used for analysis and final hypotheses done with structural equational modeling (SEM). SEM is used to verify the validity of the research model and estimation of path structurally. It observes the association of observed and latent variables in a single comprehensive way. This single procedure can evaluate multiple interrelated dependencies that lie in the research constructs. Therefore, the researcher has used this technique for hypotheses testing and analysis of relationships of variables.

#### 3.1 Measures

Green intellectual capital was measured through its three dimensions, namely green human capital, green relational capital, and green structural capital. Green human capital was measured using five items. Green relational capital was measured using five items and green structural capital was measured using nine items. All items used to measure the three dimensions of green intellectual capital were taken from Huang and Kung (2011). Each item was measured through a 5-point Likert scale with 1 indicating strongly disagree and 5 representing strongly agree. The scale followed in this study was used by previous studies (Yusoff et al., 2019; Omar, Yusoff and Kamarul Zaman, 2017).

The corporate economic sustainability of a firm was measured using six items developed by Chow and Chen (2012). A 5-point Likert scale has been used, ranging from 1 (strongly disagree) to 5 (strongly agree). Three-item scale on 5-point Likert scale developed by Burrit (2004) was used to measure the financial condition of firm. This scale was previously used by Le, Nguyen, and Phan (2019).

### 4. Results and Analysis

#### 4.1. Demographic Profile of the Respondents

The final sample comprising 294 respondents included 136 females (46.3%) and 158 males (53.7%). It shows that there is low gender disparity in the sample. 89 respondents were

from the age group of 20 to 30 years. 124 respondents were from the age group of 31 to 40 years. Moreover, 67 respondents were from the age group of 41 to 50 years. Only 14 respondents were more than 50 years old. We have also asked the respondents about their experience of working with the current organization. 44 respondents reported experience of fewer than 2 years. 129 respondents had an experience of 2 to 5 years, while 94 respondents had an experience of 5 to 10 years. The remaining 27 respondents had the experience of more than 10 years.

#### *4.2. Data Analysis*

Data were checked for missing values and outliers before running the descriptive analysis. SPSS v-25 was used to perform descriptive and exploratory factor analysis (EFA). AMOS v-24 was applied to perform confirmatory factor analysis (CFA) and to estimate the structural model. Descriptive analysis indicated that the values for all variables were within the acceptable ranges and do not have problems of skewness and asymmetrical distribution.

##### *4.2.1. Exploratory Factor Analysis*

The scales used to develop the questionnaire were adapted according to the local requirements. Hence, it was important to run exploratory factor analysis (EFA) to validate the scales of items used in the questionnaire (Watkins, 2018). First, Kaiser Meyer Olkin (KMO) test for sample adequacy was performed. The value for the KMO test was 0.944, which indicates that the sample size is adequate to perform EFA. Next, Bartlett's data sphericity test was performed. The test statistic was significant with Chi Sq. value of 6372.66 with df 378 ( $p < 0.00$ ). This indicates that the variables' relation with each other is sufficient for a meaningful EFA. We have estimated the rotated component matrix to perform EFA.

According to Hair, Babin, Anderson, and Black (2018), for EFA, the factor loadings of each factor must be above 0.6. Loadings of all the included factors have significant contributions, as all factor loadings are greater than 0.6. Moreover, there are no cross-loading among the items measuring different variables. The results of EFA validate the scales of items for subsequent analyses.

##### *4.2.2. Measurement Model*

To assess the reliability and validity of the constructs given in the proposed model, we have estimated factor loadings, composite reliability (CR), average variance extracted (AVE), and maximum shared variance (MSV), and values for the model fit indicators for the measurement model. CR measures the reliability or internal consistency of a measure. AVE measures the amount of variance that a construct captures as compared to the amount of variance that exists due to measurement error. A measure is considered reliable if CR is greater than 0.7. For convergent validity, AVE must be greater than 0.5. Rotated compound matrix summarizes the variables and enlists the items used to measure them along with their factor loadings. The values of composite reliability and AVE for each construct are also given in the last two columns. The composite reliability values for all five constructs are greater than the threshold value of 0.7. The values of AVE are also above the threshold level of 0.5 for each variable. These values verify that the scales applied possess convergent validity.

The discriminant validity indicates that the factors that are not related in theory are not related mathematically as well (Holton III, Bates, Bookter, & Yamkovenko, 2007). Discriminant validity of a scale is determined by comparing MSV with AVE and by comparing inter-construct correlations with the square root of AVE for each variable. Table 1 presents indicators to check discriminant validity. For each latent variable, the values of MSV are reported in column 2. The values of the square root of AVE for each variable are given in the diagonal in bold. Below these values, the inter-construct correlations are reported.

For a measure having discriminant validity, its MSV must be less than AVE (Hair et al., 2018). Comparing values of MSV and AVE for each variable given in columns 2 and 3, it can be stated that MSV is less than AVE for all variables. This indicates that the scales used have discriminant validity. A similar conclusion can be derived by comparing the square root of AVE for each variable with the values of inter-construct correlations. For a scale to have discriminant validity, AVE- square root must be more than the corresponding inter-construct correlations. The correlation values and AVE validate that the measures used possess discriminant validity.

**Table 1: Discriminant Validity**

	MSV	AVE	FNC	GHC	GSC	GRC	CES
FNC	0.429	0.684	<b>0.827</b>				
GHC	0.352	0.630	0.593	<b>0.794</b>			
GSC	0.429	0.662	0.655	0.554	<b>0.813</b>		
GRC	0.326	0.559	0.571	0.505	0.550	<b>0.748</b>	
CES	0.424	0.731	0.651	0.587	0.512	0.524	<b>0.855</b>

Table 1 summarizes the five latent variables, items used to measure each latent variable, their factor loadings, reliability indicator, and AVE obtained by estimating the measurement model. The factor loadings of all items are greater than 0.7. These factor loadings indicate that each item used has a strong influence on the variable it measures. The results also show that CR and AVE for each latent variable are greater than 0.8 and 0.5 respectively. These values indicate that the scales applied are valid and reliable.

Model fit statistics along with their threshold values (Hair *et al.* 2018) are reported in the bottom rows of Table 2. These indicators include Chi-square/df (CMIN/DF), Goodness of Fit Index (GFI), Incremental Fit Index (IFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). All indicators show that the measurement model is a good fit and the scales used to estimate the measurement model can be used to estimate the structural model.

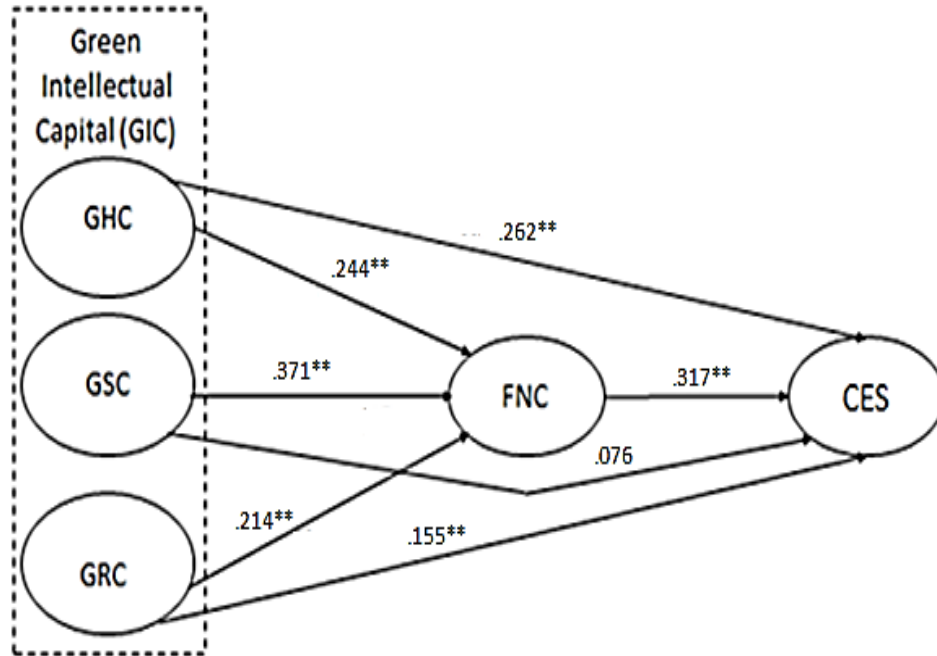
**Table 2: Measurement Model**

<b>Construct</b>	<b>Items</b>	<b>Loadings</b>		<b>CR</b>	<b>AVE</b>
Green Human Capital	GHC1	0.73		0.895	0.630
	GHC2	0.75			
	GHC3	0.83			
	GHC4	0.80			
	GHC5	0.84			
Green Structural Capital	GSC1	0.90		0.946	0.630
	GSC2	0.80			
	GSC3	0.81			
	GSC4	0.83			
	GSC5	0.86			
	GSC6	0.83			
	GSC7	0.78			
	GSC8	0.78			
	GSC9	0.72			
Green Relational Capital	GRC1	0.76		0.864	0.559
	GRC2	0.71			
	GRC3	0.73			
	GRC4	0.77			
	GRC5	0.76			
Financial Condition	FNC1	0.75		0.866	0.684
	FNC2	0.80			
	FNC3	0.92			
Corporate economic sustainability	CES1	0.88		0.942	0.731
	CES2	0.91			
	CES3	0.86			
	CES4	0.84			
	CES5	0.84			
	CES6	0.79			
Model Fit Indices	CMIN/DF	GFI	IFI	CFI	RMSEA
Recommended Value	≤ 3	≥ 0.80	≥ 0.90	≥ 0.90	≤ 0.08
Studied Value	1.998	0.865	0.952	0.951	0.055

#### 4.2.3 Structural Model

The model presented in Figure 2 was estimated using the structural equation modeling technique (Sinharay, 2010; Hair, et al. 2018). Standardized coefficients and corresponding values of standard errors, critical ratios, and the p-values for each proposed relationship are reported in Table 3. The results indicate that the effect of GHC on financial condition (FNC) is positive and significant with  $\beta=0.244$ , Critical Ratio (CR) = 4.746, and  $p<0.01$ . Similarly, the effect of GSC on FNC is positive and significant ( $\beta=0.371$ , CR= 6.947, and

$p < 0.01$ ). The effect of GRC (the third dimension of Green Intellectual Capital) is also positive and significant ( $\beta = 0.214$ ,  $CR = 4.197$ , and  $p < 0.01$ ).



**Figure 2: Structural Model**

Further, the results indicate that the impact of financial condition (FNC) on corporate economic sustainability (CES) is also positive and significant ( $\beta = 0.317$ ,  $CR = 5.310$ , and  $p < 0.01$ ). The direct effect of GHC on firm's corporate economic sustainability is estimated to be 0.155 with  $CR = 4.804$  and  $p < 0.01$ . The impact of GRC on CES is positive but insignificant ( $\beta = 0.076$ ,  $CR = 1.298$ , and  $p = 0.194$ ). The influence of GRC on CES is positive and significant ( $\beta = 0.155$ ,  $CR = 2.893$ , and  $p = 0.004$ ). A careful review of the results presented in Table 3 indicates that the impact of GSC on FNC is the largest as compared to the other two dimensions of the Green Intellectual Capital. However, the direct effect of GSC on CES is the weakest among the three dimensions of Green Intellectual Capital.

**Table 3: Standardized Regression Weights**

Relationship	Estimate	S.E.	C.R.	P
GHC → FNC	.244	.057	4.746	.000
GSC → FNC	.371	.064	6.947	.000
GRC → FNC	.214	.053	4.197	.000
GHC → CES	.262	.059	4.804	.000
GSC → CES	.076	.069	1.298	.194
GRC → CES	.155	.055	2.893	.004
FNC → CES	.317	.059	5.310	.000

Table 4 provides information regarding testing of hypotheses developed in this study. H<sub>1</sub>, H<sub>2</sub>, and H<sub>3</sub> tested the direct impact of each of the three dimensions of green intellectual capital on the firm's performance. The results show that only H<sub>1</sub> and H<sub>3</sub> are supported by the statistical evidence. The mediating effect of FNC on the relationships between the three indicators of green intellectual capital and firm's performance was estimated by calculating the direct, indirect and total effects of GHC, GSC and GRC on CES. The indirect effect of GHC on CES was calculated by multiplying the standardized coefficient measuring the impact of GHC on FNC with the standardized coefficient measuring the effect of FNC on CES. Total effect is simply the sum of direct and indirect effect (Hair et al., 2018). Following this method, the indirect and total effects for all three dimensions of green intellectual capital (GIC) on CES with FNC as the mediator were calculated. The results show that although the direct effect of one of the three dimensions of GIC on CES is not significant, inclusion of FNC as mediator makes the impact of all three dimensions of GIC on CES significant. Hence, H<sub>4</sub>, H<sub>5</sub> and H<sub>6</sub> are accepted.

**Table 4: Hypotheses Testing**

	Relation	Direct Effect	Indirect Effect	Total Effect	Decision
H <sub>1</sub>	GHC→CES	0.262**	-	-	Accepted
H <sub>2</sub>	GSC→CES	0.076	-	-	Rejected
H <sub>3</sub>	GRC→CES	0.155**	-	-	Accepted
H <sub>4</sub>	GHC→FNC →CES	0.262**	0.244X0.317=0.077**	0.339	Accepted
H <sub>5</sub>	GSC→FNC →CES	0.076	0.371X0.317=0.117**	0.193	Accepted
H <sub>6</sub>	GRC→FNC →CES	0.155**	0.214X0.317=0.068**	0.223	Accepted
Note: **p<0.01					

The total effect of GHC on CES is estimated to be  $\beta_t=0.339$  with the direct effect  $\beta_d=0.262$  ( $p<0.01$ ) and indirect effect  $\beta_i=0.077$  ( $p<0.01$ ). Which mean that one unit increase in GHC directly increase the 26.2 percent positive outcome in CES while through 7.7 percent positive influence. Mediation of FNC it can bring the total effect of GSC on CES with FNC

as the mediator is calculated as  $\beta_t=0.193$  with the direct effect of  $\beta_d= 0.076$  ( $p=0.194$ ) and indirect effect  $\beta_i=0.117$  ( $p<0.01$ ). Similarly, the total effect of GRC on CES with FNC as the mediator is estimated as  $\beta_t=0.223$  with the direct effect  $\beta_d= 0.155$  ( $p<0.01$ ) and indirect effect  $\beta_i=0.068$  ( $p<0.01$ ). Therefore, it can be stated that FNC mediates the impact of GSC, GSC and GRC on CES.

## 5. Discussion

This study examined the impact of green intellectual capital (GIC) in terms of its three dimensions on a firm's corporate economic sustainability considering the mediating role played by the financial condition of a firm. This study is among the growing literature on green intellectual capital and its impacts on multiple factors and includes uniquely the role of financial condition as a mediator. The challenges faced by the manufacturing sector in the developing economies are different from those faced by the manufacturing sector in developed economies. These challenges include a lack of technical skills, less awareness of environmental concerns, and the weak role of the regulators. In this context, the financial condition of a firm plays a very significant role in transferring the impact of GIC on the firm's corporate economic sustainability. This study contributes by explaining the role played by GIC in explaining variation in CES in the context of a developing economy. It also contributes by providing robust empirical evidence based on a third-generation multivariate analytical tool called structural equation modeling.

The findings of the study show that green human capital has a positive and significant impact on the corporate economic sustainability of a firm.  $H_1$  is accepted and it means that green human capital is not only a source of enhancing ecosystem fortification but also contributes to increasing the corporate economic sustainability of a firm. Hence, companies should invest in green human capital, as it can be a source of generating ideas, which can be useful in gaining a competitive advantage. Our finding supports the results of Yusliza et al. (2019), Wang et al. (2021), Campbell et al. (2012), and Ahangar (2011). Some studies claimed that GSC has a positive and substantial impact on economic performance. These also suggested that the organizations should continue investing in green human capital for gaining sustainability and competitive advantage.  $H_2$  theorizes that green structural capital has a significant impact on corporate economic sustainability. The results do not support this hypothesis. This result is in agreement with the finding of Ahangar (2011), which states that the impact of green structural capital on corporate economic sustainability is insignificant. The impact of GSC on CES becomes significant when the financial condition is introduced as a mediating variable, hence validating  $H_5$ . The result confirming a positive and significant relationship between GSC, and financial condition supports the finding of (Yong et al., 2019). The third hypothesis theorizes the impact of relational capital on corporate economic sustainability. The empirical results support the presence of a positive and significant impact of GRC on CES. This result confirms the findings of Yusliza et al. (2019). The result, confirming  $H_3$  implies that organizations should make investments in green relational capital, as it helps in spreading awareness about environmental concerns among the suppliers and the customers. It is also a source of creating an environment for collaboration and sharing of information for the protection of ecology.

H<sub>4</sub> states that there is a significant mediating effect of the financial condition among green human capital and the corporate economic sustainability of a manufacturing company. The result indicates that financial condition mediates the impact of GHC on CES. Financial condition is a source of maintaining the relationship between GHC and CES. H<sub>5</sub> is discussed above. H<sub>6</sub> theorizes that financial condition acts as a mediator between green relational capital and the firm's performance. The findings of this study confirm that financial condition mediates the impact of GRC on CES. A study by Delgado-Verde et al. (2014) found out that green relational capital influences innovation through social effect. The link established in this study can be extended to explain the relationship theorized in our study. More innovations aid in gaining a competitive advantage, which can contribute to enhancing the performance of a firm.

#### *5.1 Theoretical and Managerial Implications*

This study has significant theoretical and practical implications for the researchers, managers, consultants, and practitioners. The research shows the role of green intellectual capital on corporate economic sustainability and the mediating effect of the financial condition of a firm. The key benefit of green intellectual capital utilization is to gain a competitive advantage through intangible assets. It makes the organization competitively stronger than its competitors which yield more profit in return. Moreover, as the manufacturing sector of Pakistan is one of the significant sources of pollution, the consumption of resources and emission of harmful gases and the extensive consumption of resources and emission of harmful gases can be reduced by increasing green intellectual capital. Therefore, the current study provides insights into how the implementation of green human capital reduces pollution resources. So, the industrial managers take these insights into consideration to make a comprehensive framework for reducing pollution and achieving economic sustainability. Additionally, if the employees get more skilled to handle the environmental issues, the overall performance of the firm can improve (Akhtar et al., 2015); (Jabbour, de Sousa Jabbour, & Sarkis, 2019; Yong et al., 2019). The findings of the present study can be considered as a guide for the managers, consultants, and practitioners seeking ways for sustainable economic performance. Organizations should invest in skill enhancement programs for their employees. These skill enhancement programs must aim at developing green competencies, skills, and abilities for generating unique ideas so that their managers can make effective green strategies to achieve greater returns and competitive advantage over other firms (Doh & Quigley, 2014). Investment in GIC is not only beneficial in improving sustainable economic performance, but it also contributes significantly to improving society's safety, health, and welfare. Findings of the study further indicated that GRC and GSC on economic sustainability reveal the importance of capital relationship with the suppliers to achieve sustainability, which can be gained through appropriate awareness and management over stakeholders.

#### **6. Conclusion**

The basic purpose of this research was to evaluate the influence of GIC on the corporate economic sustainability of the manufacturing sector of Pakistan and the mediating effect of financial condition on GIC and corporate economic sustainability. The data was collected through a questionnaire from 294 top-level managers of the manufacturing firms.



Structural equation modeling was used to analyze the data. The results show that GIC is positively associated with corporate economic sustainability. GIC and GRC have a substantial impact on corporate economic sustainability (CES) but the influence of green structural capital on CES is not significant. The mediating effect of the financial condition of a firm is verified for all three components of GIC. The study provides strong evidence regarding the development of GIC and its impact on improving corporate economic sustainability. The organization should invest in green intellectual capital for better growth of employees, organizations, society, and to ensure environmental protection.

#### *6.1 Limitations and Future Suggestions*

The research design followed in this study has certain limitations. First, the data collected for this study is from the manufacturing sector of Pakistan. Data from other sectors can also be collected, analyzed, and compared in further studies based on methodological approaches. Second, the study can be further extended by comparing effects in developed and/or developing countries. Third, future studies can incorporate the other two dimensions of corporate sustainability, i.e., environmental and social sustainability. Further work can be done by analyzing the role of government in implementing green practices. Moreover, green innovation is one of the critical factors that can be tested in the upcoming investigation for business sustainability. Lastly, forthcoming studies may analyze the effect government enforcement and stakeholder interest can influence performance on influencing role in enhancing sustainable corporate development.

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