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Research Article

Impact of Green Intellectual Capital upon Sustainable Performance of Pakistan's Manufacturing Industry.

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ABSTRACT

The aim of this study was to investigate the impact of green intellectual capital (GIC) on sustainable performance (SP). For this purpose, survey approach design was adopted. Population of the study was manufacturing firms. Non-probability convenience sampling technique was used. Total 214 completed questionnaire were used in the analysis. Unit of analysis were organizations. Findings revealed that there is significant positive correlation among predictors and criterion moreover, predictors significantly predictors sustainable performance. GIC, encompassing green human capital, green structural capital, and green relational capital, is explored as a driver of environmental sustainability and competitive advantage. Through a quantitative analysis, the research identifies how the integration of eco-friendly knowledge, innovation, and practices into business operations contributes to the long-term performance of manufacturing firms. The findings highlight that organizations leveraging GIC experience improved resource efficiency, reduced environmental impact, and enhanced corporate reputation, ultimately fostering sustainable growth and industry-wide environmental responsibility. It is concluded that importance of GIC and SP must be raised in seminars to prevent environmental issues. Future studies can add moderators like green human resources management (HRM) and environmental corporate social responsibility (ECSR) in the theoretical and conceptual models.

KEYWORDS: Green intellectual capital, Sustainable performance, Manufacturing sector, Pakistan

1. Introduction

Sustainable performance is the main problem of the manufacturing sector. Environmental problems are the results of human negligence in manufacturing processes. Manufacturing sector is considered as one of the major contributors towards country's economy on the contrary contributed significantly towards pollution and environmental issues (Malik *et al.,* 2020). Green intellectual capital is derived from the intellectual capital with aim of addressing environmental concerns and taking care of intangible assets. Business firms must pay attention to environmental issues to get competitive advantage. This kind of corporate concern is commonly known as corporate social responsibility. Combining intellectual capital (IC) and environmental concerns gives rise to new paradigm which is green intellectual capital (GIC) (Yusoff *et al.,* 2019). GIC has three dimensions green human capital (GHC), green structural capital (GSC) and green relational capital (GRC) (Malik et al., 2020). GIC can be defined as total value of skills, knowledge, innovation and environmental concern at corporate and individual level (Jirakraisiri *et al.,* 2021). GIC is related with intelligence, skills, knowledge, experience and efforts of employees (Ullah *et al.,* 2022). GIC not only help to get competitive

advantage but also help firms to meet stringent international environment rules and regulations (Chen 2008).

GIC is related with innovation, creativity and novelty of the employees towards attaining sustainability. Green human capital delas with capabilities kills, knowledge of employees. Structural capital concerned with brand image, reputation, trademark and good will of the company while green relational capital deals with relations with suppliers, creditors, stakeholders (Xi *et al.*, 2022). Through GIC manufacturing firms can produced eco-friendly and sustainable developed products which would help firms to gain competitive advantage over competitors and sustainable performance (Yusliza *et al.*, 2020). Manufacturing firms in Pakistan are giving more attention to communication with external partnership especially suppliers and stakeholders in a systematic way while keeping in mind the significance of GIC. Investors, suppliers, customers want authentic information regarding environmental issues. Several studies have been conducted on GIC and sustainable performance (Malik et al., 2020; Malik et al., 2021). Studies reported positive and significant impact of GIC upon sustainable performance (Weqar et al., 2020). The current study has contributed towards literature of GIC and sustainable performance through lens of intellectual capital-based view theory in Pakistani perspective by answering the following research question:

RQ1: How does GIC effect sustainable performance?

RQ2: How does GIC help firms to obtain competitive advantage and enhance sustainability?

By answering these questions this study has contributed using intellectual capital-based view theory by adding deeper theoretical insights into GIC and sustainable performance. The framework provided by this study is important as past studies investigated GHRM impact on sustainability. It is very important to promote the concept and idea of sustainability to control pollution, degradation of the natural resources and to decrease environmental problems in Pakistan (Mughal et al., 2023).

2. Literature Review

2.1 Sustainable Performance

Sustainability is also known as triple bottom line principle, and it was first discussed at World Commission on Environment and Development (WCED) in 1987 presented in Brundtland report. 4.0 industrial revolution has brought rapid changes in manufacturing industry and brought environmental challenges as well. Sustainability can be defined as “meeting the needs of the present without affecting the needs of future generations”. Sustainable performance has three dimensions economic, environmental and social indicators. Business firms must meet the economic and financial needs day to day operations so economic performance deal with financial matters, environmental performance help to decrease the damages to natural resources and social performance deals with well-being of employees and stakeholders (Malik et al., 2020). Therefore, firms need to hire those talented, hardworking employees who has knowledge of environmental problems, awareness of sustainable performance and GIC and willingness to help firms to obtain competitive advantage, sustainability and green objectives (Shiri et al., 2018).

2.2 Green Intellectual Capital

This study got support form intellectual capital-based view theory (ICB) which support the intangible assets, employees are the assets of the firms, but human capital is the asset of the employees which help employees to obtain competitive advantage. ICB theory is the improvement form of resource-based view theory (RBV) the RBV theory is most widely used and accepted for green studies, but this

theory overlooked the importance of environment that is why ICB theory was introduced. Intellectual capital deals with knowledge. It was first introduced in 1969 in management literature. Employees' cognitive ability and skills to add value is called intellectual capital. Green intellectual capital is defined as to uplift the importance of environmental issues to get competitive advantage. Knowledge exists in various shapes and forms in the firms, databases, systems, relationships (Ulum *et al.*, 2016).

2.3 Green Human Capital (GHC)

This means creativity, knowledge, skills and capability of the employees towards environmental concerns. Firms might get capable workers by focusing on GHC. Human resources are non-substitutable, and firms can take advantage of these assets. When workers left jobs and switch to new jobs this GHC also withdrawn form the firms. GHC is an intangible asset which help employees to increase job satisfaction, commitment, loyalty. This capability can be developed among employees through training. Having knowledge about green objectives make employees more productive and competitive (Ghosh & Haque, 2022). Studies conducted on GIC and sustainable performance (Malik et al., 2020; Sukirman & Dianawati 2023) reported positive and significant impact of GIC upon sustainability. Therefore, the following hypotheses is postulated:
H_1: GHC significantly predicts sustainable performance

2.4 Green Structural Capital (GSC)

GHC is not sufficient to completely help firms to get advantage, but GSC is also significant in this process. Trademark, goodwill of the company, image of the firms could enhance sustainable performance of the manufacturing firms. Through GSC new market development, corporate image, and productivity can be enhanced. Logo, trademark presents the true image of the firms they create value of the firms in the market. These are assets of the firms. There is positive a significant impact of GSC upon sustainable performance (Forte et al., 2017), therefore, following hypotheses is postulated:
H_2: GSC significantly predicts sustainable performance

2.5 Green Relational Capital (GRC)

This is one of the very important indicators of GIC. This help firms to get benefits from stakeholders in hard times. This deals with keeping good relationship with banks, creditors, suppliers, customers, and all stakeholders. Stakeholder theory also supports this concept (Malik et al., 2020). Previously firms gave more important to pricing, packaging and profits they were profit oriented but now the firms are consumer oriented and trust on keeping good relationships with all stakeholders. The relationship between GRC and sustainable performance (Ginesti & Oss, 2018). Likewise, Mubarik et al., 2019) also reported positive and significant impact of GRC on sustainable performance. Hence following hypotheses is developed:
H_3: GRC significantly predicts sustainable performance

Conceptual Framework

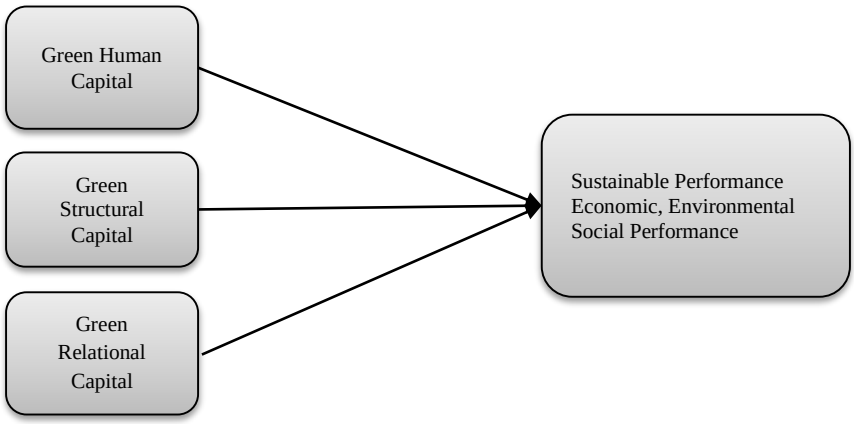

Figure 1: Conceptual Framework

3. Research Methods

3.1 Research Design

The current study adopted quantitative survey approach research design, in this self-administered questionnaire was adopted and distributed. The data collected was cross-sectional and primary. The questionnaire was measured on seven-point Likert scale range from 1 strongly disagree to 7 strongly agree.

3.2 Population and Sampling Technique

Population of this study consisted of manufacturing firms listed on PSX. Unit of analysis were organizations. Total 480 firms were selected. Non-probability convenience sampling technique was used for sampling. It is most convenient way whoever is willing, available and meet the criteria of sample were selected for inclusion in this study. Krejcie and Morgan (1970) table was used for selecting sample size. It gives us 214 sample size.

3.3 Data Collection Instrument

Questionnaires were adopted from Malik et al (2020). All items were measured on 7-point scale. GIC has 15 items, five items for each construct and sustainable performance have also 15 items five items for each dimension.

3.4 Data Collection Methods

Director, human resource managers were contacted for permission and included in the study. As these personnel are posted at high positions where they have high responsibility, knowledge and experience that is why they were included in the study. Questionnaires were distributed online using WhatsApp. Emails.

3.5 Data Analysis Tools and Techniques

SPSS 25 was used for reliability, validity and hypotheses testing. Frequency and percentages were calculated for demographic information and inferential statistics bivariate correlation, multiple regressions were run for hypotheses testing.

Results and interpretations.

Table 1 **Demographic Information**

Variables	Categories	n	%
Gender	Male	121	56.54
	Female	93	43.45
Position	Assistant HR	72	33.64
	Deputy Director HR	77	35.98
	Director HR	65	30.37
Age	30-45 years	15	7.00
	46-60 Years	199	92.99
Experience	1-10 Years	91	42.52
	11-20 years	74	34.57
	More than 20 years	49	22.89
Education	Bachelor	109	50.93
	Master	95	44.39
	Ph.D.	10	4.67

Table 1 presents personal information of the informants. Regarding gender majority of the respondents were male (56.54%) followed by female respondents (43.45%). Regarding positions most of the informants were deputy director HR (35.98%) followed by assistant director HR (33.64%); 30.37% respondents were directors. In case of age most of the informants fall in age of 46-60 years (92.99%) followed by 7% in the range of 30 to 45 years. Related with length of service or experience most of informants were having 1-10 years of experience (42.52%). As for education is concerned most of them had bachelor's degree (50.93%0 followed by master's degree holder (44.39%) and only 10 respondents were pursuing doctoral degree (4.67%).

Table 2 **Correlation**

Variables	1	2	3	4	α
GHC	1				0.775
GSC	0.711**	1			0.877
GRC	0.761**	0.746**	1		0.792
SP	0.623**	0.566**	0.621**	1	0.840

** significant at 0.01 level

Table 2 explains that all the predicting variables i.e. GHC, HSC and GRC are significantly and positively correlated with sustainable performance. Moreover, for reliability Cronbach alpha is reported table 2 presented alpha values of all constructs. The threshold for Cronbach alpha is >0.70 (Hair et al., 2022). It is evident from Table 2 that all the constructs met threshold hence reliability is established.

Table 3 **Regression Analysis**

DV	IV	R^2	F	β	p
SP	Constant	0.802	765.213		0.000
H_1	GHC			0.075	0.000
H_2	HSC			0.251	0.020
H_3	HRC			0.624	0.000

Multiple regression analysis was runt to test three hypotheses. Table 3 presents the results of multiple regression. It is evident form the above table 3 that one percent change in GHC could possibly change SP up to 7.5%. in the same way, GSC could change SP up to 25.1% and most dominant role is played by GRC i.e. 62.4% change in SP is expected due to per unit change in GRC. It means that relationships paly significant role in obtaining competitive advantage and sustainable performance. Hence all three hypotheses are substantiated.

Discussion

The originality of this study lies in exploring GIC effect on sustainable performance in manufacturing sector. To the best of researcher's knowledge this is one of the pioneer studies conducted in manufacturing sector of Pakistan. This study findings of GHC significantly related with sustainable performance are in line with findings of Mubarik et al (2019) also found positive and significant impact. Likewise, the findings of GSC on SP are also consistent with findings of Malik et al (2020). Similarly, GRC and SP agree with findings of Sukirman and Dianawati (2023) conducted study on GIC upon Firm performance and found positive and significant impact. Hence, all three hypotheses are accepted and substantiated.

Conclusion

It is concluded that hiring talented, hardworking and those workers having knowledge of green objectives and have develop high level of GHC to get competitive advantage could benefit the firms as well. It could enhance corporate image, trust with stakeholders and enhance sustainability. Moreover, pollution, degradation of natural resources, waste of energy, paper, water could also be reduced. Environmental issues and challenges can be handled efficiently and effectively.

Theoretical and Practical Implication

This study has extended the body of knowledge of ICB theory on GIC and sustainable performance. Moreover, this study has implications for academicians, scholars and managers f manufacturing firms. Importance of GIC and sustainable performance could be raised in firms through seminars and conferences. Talented hardworking workers can be hired. Pollution can be controlled, and natural resources degradation can be prevented though GIC and SP.

Limitations and Future Research Directions

The first limitation of this study is small sample and sampling technique. It is recommended that future studies must use big sample size and probability sampling techniques. Non-probability sampling limits the generalization of the findings. Secondly, one should be careful while generalizing the findings to other sectors as this study has used only manufacturing sector.

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