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Enhancing firms' green innovation and sustainable performance through the mediating role of green product innovation and moderating role of employees' green behavior

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ABSTRACT

In today's competitive world, the growing role of firms' green innovation (GI) has caused organisations to respond to the demand for sustainable performance. Significantly, increasing environmental awareness has inevitably popularised GI approaches to maximise firms' sustainable goals. GI receiving international significance has become the prime driver accelerating firms' socio-ecological practices. Using the theoretical lens of resource-based theory, the study explores the impact of green process innovation, GI strategy and green action innovation on sustainable performance under the mediating role of green product innovation and moderating role of employee green behaviour. The data was collected from the 411 employees working in the Pakistani manufacturing sector. Structural equation modelling (SEM) and Partial Least Squares (PLS) regression were used for the proposed hypothesis testing. The employees' green initiatives ensure the organisation's sustainable performance through eco-friendly products. Employee green behaviour moderates between green product innovation and sustainable performance.

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1. Introduction

Over the years, progressing industrialisation has forced humans to face the severe effect of environmental degradation, which is weakening the world's socio-economic prosperity. The building ecological burden has caused the earth's biodiversity to experience unprecedented consequences. In particular, today, the dual environmental impact on social and commercial lives has elevated the need to find the solution to the developing socio-ecological problems (Awan et al., 2021; Sarfraz et al., 2020). This accelerating environmental pressure has strongly impacted the world's social

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foundations, with firms' sustainability having a significant role in combating the emerging ecological challenges (Bombiak & Marciniuk-Kluska, 2018).

Unsurprisingly, increasing environmental degradation has challenged the world's major industries as they face severe environmental consequences. The ecological decline becoming a global phenomenon has made stakeholders respond to the increasing climatic vulnerability through a sustainable model (Jakhar et al., 2020). In recent years, natural environment protection has received attention internationally. Given the application of environmental measures, regulations have forced firms to protect the natural environment by adopting sustainable innovation (Naseem et al., 2021; Vallaster et al., 2019).

As a result, paying attention to green innovation (GI) has become the prime motive of today's industries (Singh et al., 2020). Green process innovation mitigates unfavourable environmental effects, thereby improving the firms' processes (Chen et al., 2018). Green process innovation ensures pollution reduction (Ai et al., 2021), fundamentally promoting firms' sustainable performance. Considering the growing significance of firms' sustainability, organisations have started directing their activities towards green operations. This strengthening urge for sustainable performance has emphasised using green processes to minimise the increasing effect of environmental vulnerabilities (Yousaf, 2021). However, today, the protection of the natural environment is not only possible with innovative processes but also with green production. Study states that the increasing role of green product innovation has made organisations deliver eco-friendly products and services, influencing their sustainable performance (Saudi et al., 2019).

Indeed, identifying the inevitable role of GI (i.e. process and product) has encouraged businesses to integrate green measures into their business strategies. In recent years, scholars have realised the value of the inclusion of GI in a company's business strategy. Sustainable thinking widely leverages this strategic integration to uplift the GI paradigm, combating the progressing environmental vulnerabilities. The GI approach has enhanced firms' strategic vision towards achieving sustainability (Khan & Johl, 2020). Today, the GI strategy has made organisations realise the growing importance of sustainable performance. As a result, the literature shows that the GI strategy has become a sustainable goal of today's organisations, without which it is hard for them to survive (Wang et al., 2022).

In particular, with GI strategies becoming the heart of the enterprise's prosperity and well-being, employees' green actions have come into the limelight concerning the sustainability model. Employees are the fundamental stakeholders who influence a firms' sustainable performance. Employees' concrete GI actions make them perform environmental protection activities (Su et al., 2020), with the goal to, for example, protect the motherland (Kim & Thapa, 2018). Study shows that these ecological prevention concerns have inspired employees to take necessary action, thus promoting sustainable environmental performance (Song & Yu, 2018).

Undoubtedly, the massive emphasis on green implementation has encouraged firms to exhibit green behaviour. Green in this context stands for the eco-friendly concept, which has been revealed to profoundly influences firms' sustainability. Employees' scalable actions enable firms to meet their environmental standards

(Leung & Rosenthal, 2019), substantially improving their socio-ecological performance. Employees' pollution protection behaviour minimises the ecological burden on the enterprises, thus making them focus on GI approaches (e.g. green product innovation). Today's companies compound the GI behaviour as an effective tool for fostering the firms' sustainable performance (Yusliza et al., 2020).

Overall, the literature indicates that environmental awareness has upgraded firms' sustainable performance via GI. The GI approaches provide a win-win solution to organisations, thus assisting them to achieve sustainable performance. However, despite the increasing significance of GI, a past study shows that some organisations have failed to adopt green practices, ultimately hindering their employees' green behaviour (Zientara & Zamojska, 2018). In particular, the previous literature has shown that employees' poor understanding of green-sustainable behaviour has made some firms bear unprecedented environmental consequences, which potentially needs further investigation (Riaz et al., 2019). Undoubtedly, there is a lack of sufficient researcher attention concerning green human capital behaviour with regard to GI and sustainable performance. The prior literature suggests investigating these variables for legitimising firms' sustainable performance.

The current study highlights the fundamental approaches to GI in light of the sustainability model. It investigates the different determinants influencing firms' sustainable performance. Concerning the sustainable framework, the study objective is to determine the role of GI (e.g. process and product) in influencing firms' sustainable performance. Furthermore, it determines the underlying drivers of GI (i.e. strategy and action) affecting firms' socio-ecological performance. Also, the article highlights the mediating role of green product innovation and moderating effect of GI behaviour, demonstrating the relationship between the proposed interdependences.

This article presents a rich body of literature concerning GI practices and firms' sustainable performance. It is a unique contribution to the growing GI literature that incorporates the mediating and moderating roles of green constructs (i.e. green product innovation and employees' green behaviour) influencing the firms' sustainable performance. Previously, studies have illustrated that the manufacturing sector is the largest waste producer industry, with a drastic negative impact on the world's ecosystem (Mathiyazhagan et al., 2021). Therefore, to balance the rising issue of environmental pollution, this industry requires companies to adopt GI practices to achieve sustainable performance. Hence, in this regard, this article offers an all-purpose innovation model to investigate the GI approaches implemented in the manufacturing industry. This study includes the potential drivers that help manufacturing companies combat the increasing environmental degradation. Following the resource-based theory, this study presents a pioneering conceptual framework that guides researchers and managers to understand the notion of GI and sustainable performance. The article suggests that managers, employees, researchers, policymakers, and scholars view the study findings as a critical way of boosting firms' sustainable performance. Moreover, the current study findings present significant evidence for incorporating GI strategies as a subsidiary to achieve sustainable performance.

This article consists of six different sections. [Section 2](#) highlights the background of the study, while [section 3](#) describes the study methods and tools. [Section 4](#)

highlights the study results, while [section 5](#) discusses the study's findings. Lastly, [section 6](#) concludes the study by outlining the research limitations, implications, and future directions.

2. Literature review

2.1. The relationship between green process innovation and sustainable performance

In the era of globalisation, climate change has become a heated topic of discussion among researchers. Climate change, a global problem, has brought severe consequences to world organisations. In recent years, progressing environmental awareness has compelled firms to attempt to control the accelerating climatic deterioration, thus maintaining firms' sustainable performance. These companies' processes foster their performance by greatly minimising the effect of environmental depletion via adopting innovative practices. Green process innovation guides firms' social and environmental performance (Asadi et al., 2020). It reduces the negative impact of a changing climate, thus receiving international significance. Indeed, green process innovation is an integral tool, eradicating the degradation of the natural environment. For example, Hernandez-Vivanco et al. (2018) state that green process innovation radically improves organisational operations, thus contributing to firms' long-term sustainability.

Indeed, the GI process is a profound phenomenon that plays a dominant part in mitigating the increasing impact of ecological vulnerabilities. GI is a fundamental tool that allows enterprises to achieve sustainable performance (Elzek et al., 2021). Green process innovation is a strategic construct that ensures the firm's enduring performance (Abdullah et al., 2018; Wu et al., 2022; Xie et al., 2019). Significantly, it helps companies achieve eco targets, thus promoting their sustainable operations (Shahid et al., 2020). Hence, based on the prior literature, the current study proposes the following hypothesis:

H1: Green process innovation has a positive effect on sustainable performance

2.2. Green innovation strategy and sustainable performance

As environmental issues are accelerating, the effect of climatic change has become increasingly prominent. These abrupt socio-environmental changes have lead companies to adopt green strategies to achieve sustainable performance. GI is a dominant strategy for combating the excessive climatic burden (Singh et al., 2020). Highlighting the need to reduce the ecological footprint, companies have redesigned their innovation strategies, strengthening their sustainable performance (Yusliza et al., 2020). The stimulation of a GI strategy enhances firms' production process. Fundamentally, it reduces the pollution effect on the firm's business operations. In explaining this notion, Sun et al. (2020) state that sustainability makes firms design green strategies for sustaining today's environment.

In recent years, GI strategies have gained remarkable research attention (Zhou et al., 2019) by opening new avenues to enduring stability. The firms' cleaner

strategies make the organisation realise the value of achieving sustainable performance (Musaad O et al., 2020). It enables enterprises to respond to the stakeholders' needs by meeting the socio-ecological standards. Therefore, study states that a green strategy reduces the impact of environmental degradation via adopting innovative practices (Singh et al., 2020). Due to the increasing significance of GI, numerous enterprises have adopted eco-friendly strategies as a novel tool for upgrading firms' performance. In explaining this notion, the study states that the growing environmental issues have profoundly compelled firms to adopt green strategies for supporting sustainable functioning (Ameer & Khan, 2022; Zhang et al., 2020). In the previous literature, scholars have identified GI as a strategic development tool that fosters firms' sustainable performance. Consequently, referring to the prior literature, the current study proposes the following hypothesis:

H2: Green innovation strategy has a positive and significant impact on sustainable performance

2.3. Green innovation actions and sustainable performance

Undoubtedly, not having a plan to adapt to rapid climatic change is costly. It is noteworthy that today's organisations are facing extensive environmental vulnerabilities, thus potentially forcing them to employ innovative measures for better utility of their processes. Fundamentally, driven by accelerated environmental deterioration, researchers and practitioners have started working on adopting green practices to promote firms' sustainable performance. The increasing rate of environmental degradation has strongly suppressed human commercial activities, leading to calls for urgent measures. Indeed, in this regard, GI actions (i.e. employees' green operations) have gained researchers' attention. In recent years, employees have found sustainable ways to improve their firm's performance (Wong et al., 2018). Arguably, the sustainability model indicates that firms undertake green actions to support the firms' sustainability objectives. Grigore and Kifor (2021) state that employees' green actions play a critical role in minimising environmental impact, thus achieving sustainable goals. In explaining this notion, study shows that greener actions have gained the stakeholders' attention in the sustainability context (Shu et al., 2020).

In particular, as people's environmental awareness has gradually grown, companies have widely adopted green actions to improve firms' social, economic, and ecological spheres. Due to the growth of stakeholder environmental knowledge, today's companies have motivated their employees to adopt green practices to achieve sustainable performance. GI actions promote the implementation of green practices, ultimately enhancing firms' sustainable performance (Liao et al., 2022; Sroufe & Gopalakrishna-Remani, 2019). Undoubtedly, employees' GI activities bring surprising results in firms' sustainability. This greener implementation prompts valuable environmental outcomes. In supporting this notion, Sartal et al. (2020) show that the high efficacy of GI actions enhances firms' sustainable performance. Hence, based on the previous literature, the current study proposes the following hypothesis:

H3: Green innovation action has a positive and significant impact on sustainable performance

2.4. The moderating role of green product innovation

In the current era, climate change has originated a debate on firms' innovative approaches. Due to industrialisation, GI has emerged as the most effective solution to ecological deterioration. Curbing ecological devastation through innovation is the prime motive of today's businesses (Tang et al., 2018). Concerning the growing significance of green product innovation, various companies have embraced effective innovation processes for accelerating firms' green production. The literature depicts that GI processes are strongly related to green products. The GI literature suggests that innovation processes systematically enhance firms' operations, thus promoting the development of green products.

Green process innovation causes a radical change in the environment, such as the introduction of eco-friendly products. In recent years, green process innovation has become a critical factor in the growth of green product innovation. Also, GI influences firms' processes and products, thus satisfying stakeholders' needs. Accordingly, study states that the GI process fulfils stakeholders' needs, thus promoting the development of eco-friendly products (Zhang & Zhu, 2019). Undoubtedly, green process innovation is the prime determinant of green production (Ma et al., 2018). Green process innovation brings improved goods and services to society. Investing in green process innovation leads companies to green product innovation success. Indeed, this unique innovation process strengthens firms' motives to go greener as the green product innovation outperforms others in the competitive market (Karabulut & Hatipoğlu, 2020; Naz et al., 2021). Hence, the current study proposes the following hypothesis

H4: There is a positive and significant relationship between green process innovation and green product innovation

In recent years, environmental depletion's threat to organisational performance has increasingly gained researchers' attention. The progressing environmental concerns have enabled enterprises to develop innovative strategic plans. With the increasing trend towards environmentalism, companies have shifted their focus to eco-friendly products by adopting green strategies. GI strategies have gradually gained researchers' attention by inevitably enhancing the organisations' production. GI is a beneficial strategy that endorses firms' green transformation process. Engaging in green product development encourages the adoption of sustainable strategical plans, influencing the company's output. The green product strategy is a fundamental driver of green product innovation. GI strategies effectively promote green product quality and improve firms' production efficiency (Chang, 2019). Green production procedures supported by GI strategies facilitate firms' green product development. Firms stimulate their eco-friendly products and activities by applying GI strategies (Yang & Liu, 2021). Also, green product strategies redefine firms' activities by bringing numerous benefits to the stakeholders. The GI strategy limits environmental depletion, substantially reducing firms' manufacturing costs. In industries where the production of eco-friendly products is low, stakeholders have emphasised the need for organic strategies, enhancing societal needs (Ilg, 2019). However, it is the dominant tool that enhances the firms' green product innovation, thus meeting the stakeholders' expectations

regarding protecting the natural environment. Therefore, the current study proposes the following hypothesis:

H5: Green innovation strategy has a positive and significant impact on green product innovation

Undoubtedly, the world's rapid expansion of economic activities have led organisations to face the repercussions of extensive environmental damage. This increasing natural devastation means innovative actions are needed to reinstate environmental standards. In recent years, the problem of pollution exploitation has continuously weakened the natural resources, thus making it imperative for organisations to take necessary actions to deal with the increasing environmental threats. Today, GI actions have become a prime factor in combatting the accelerated ecological issues. Study states that this growing green consciousness has shifted organisations' focus towards eco-friendly practices (Xu et al., 2021). This new green paradigm has enhanced organisations' ecological activities towards green production. GI orientation encourages employees to embrace cleaner activities by promoting eco-friendly production (Vilkaite-Vaitone & Skackauskiene, 2019).

In particular, embracing GI actions has become a global trend today. Cultivating green practices helps employees become more efficient, competitive, and profitable. Notably, employees are the visionary actors that drive firms' activities. They are the leaders whose actions must meet the stakeholders' expectations. In explaining this notion, Zhang et al. (2021) state that increasing stakeholder pressure has forced employees to adhere to the green production standards via green practices. Undoubtedly, green product innovation, as part of firms' activities, has obtained a prominent position in accelerating their efficiency. As companies increasingly engage in pro-ecological activities, employees' green actions profoundly contribute towards green product innovation (Chang, 2019). Under this environmental trend, companies are encouraging their employees to work proactively towards adopting GI actions, thus enhancing green product innovation. Accordingly, the current study proposes the following hypothesis:

H6: Green innovation action has a positive effect on green product innovation

The literature shows that people have become more concerned and aware of environmental standards. The recent shift in people's preferences in this regard has made employees more responsive to environmentally friendly products. This increasing awareness has considerably minimised the progressing environmental pollution influencing ecological welfare. Accordingly, study shows that a company's green product innovation improves the firm's sustainable performance (Song et al., 2020). With the increasing demand for green products, numerous companies are acquiring innovative ways to increase product quality in response to environmental constraints. These companies' eco-friendly production has helped them to minimise the organisations' waste. Therefore, green product innovation is a profound phenomenon that is achieving long-term socio-environmental performance (Elzek et al., 2021). Hence, the current study proposes the following hypothesis:

H7: Green product innovation performance has a positive and significant impact on Sustainable Performance

Recently, the sustainability concept has emphasised the need to drive firms' operations with innovative green processes. Today's sustainability challenge has initiated companies to enhance their business processes, stimulating eco-friendly production to foster firms' socio-ecological performance (Singh et al., 2020). Eco-friendly products have become the most fundamental tool in enhancing firms' sustainable operations. Today, green product innovation has emerged as a critical driver of firms' sustainable activities (Elzek et al., 2021). Significantly, a firm's green process innovation radically improves its production activities, ultimately contributing to its environmental performance (Afum et al., 2021). The increasing demand for greener products strengthens firms' processes and sustainability. Study shows that to ensure firms' sustainable development, companies have widely adopted green processes, ultimately influencing sustainable performance (Lukitaruna & Sedianingsih, 2018). Green product and process innovation bring radical changes in firms' ecological activities, thereby supporting their sustainable performance (Hu et al., 2022; Muangmee et al., 2021; Sarfraz et al., 2022). Altogether, this relationship between green approaches (i.e. GI processes and products) inspires organisations to exploit novel business processes to achieve sustainable development.

The literature reveals, in advancing the GI perspective, green product innovation encourages firms to modify their business strategies to improve firms' ecological sustainability. Indeed, progressing pollution prevention has demanded that firms focus on sustainable development via the development of innovative strategic capabilities. Today, GI has compelled enterprises to design and implement eco-friendly strategies that lead to sustainable operations. Green product innovation is a most beneficial strategy leading to sustainable performance. A firm's innovation strategy guides the organization's environmental goals, thus influencing sustainable performance (Soewarno et al., 2019). It speeds up the production process, continually advancing the firm's sustainable performance (Irfan et al., 2022; Kraus et al., 2020). As such, one study states that organisations strengthen the effect of GI strategy on firms' production, ultimately leading to sustainable performance (Rehman et al., 2021).

In particular, while GI creates value for the firm, the firm's green strategy captures the market potential, thus making the company gain sustainable success. A green product strategy helps companies gain legitimacy by overcoming environmental barriers, thus benefiting society. The green strategies make the business pursue its development goals sustainably. This readiness for a GI strategy helps the company develop new products that lead to sustainable services (Huang & Li, 2018). Study states that a GI strategy increases the effectiveness of green product innovation, thus accelerating the firms' socio-ecological performance (Zhang et al., 2018). Indeed, green product innovation is an important aspect influencing firms' sustainability.

Noticeably, the literature also reveals that employees' innovative actions play a significant role in ensuring the development of eco-friendly products. Sustainable production demands employees' green activities to foster the firm's socio-ecological performance. In terms of sustainable innovation, evidence states that cleaner activities ensure a firm's sustainable performance (Hernandez-Vivanco et al., 2018; Turi & Sarfraz, 2022). Accordingly, today, numerous firms are adopting green initiatives to ensure long-term business survival. GI pushes companies to undertake GI activities to

develop green production. The GI action is a sustainable way to achieve eco-friendly production. The advanced research on green management states that firms' innovative measures facilitate green production, thus making them environmental responsible (Xie et al., 2019). Abiding by this notion, companies are implementing green activities, enhancing their eco-friendly product development, and influencing sustainable performance (Zhang et al., 2021). Accordingly, the current study proposes the following hypotheses:

H7(a): Green product innovation mediates the relationship between green process innovation and sustainable performance

H7(b): Green product innovation mediates the relationship between green innovation strategy and sustainable performance

H7(c): Green product innovation mediates the relationship between green innovation action and sustainable performance

2.5. The moderating role of employee green behavior

Over the years, organisations have significantly evolved by demonstrating numerous solutions and causes of employees' green behaviour. Given the illustration, the study states that the workers' environmental behaviour increases the value of the firms' operations, with eco-friendly developments increasing the employees' environmentalism (Unsworth et al., 2021). The employees' green behaviour is a vital driving force emphasising the development of eco-friendly products and processes. In the explanation, Yusliza et al. (2020) reveal that employee pro-environmental behaviour enhances the firms' practices, substantially influencing the firms' sustainable performance.

Today, the increasing environmental awareness has directed employees' pro-environmental behaviour to enhance firms' operations, thus leading to GI production. The high need for environmental protection has considerably made the management ensure the employees' green behaviour for fostering the firms' production activities and performance. Employees' green performance significantly relates to the firms' green production. The employees' green morale drives the companies to pursue green product innovation, thus gaining sustainable performance. These green motives inspire the employees to follow sustainability guidelines, substantially improving the firms' sustainable performance (Paillé et al., 2020).

However, business sustainability depends on the employees' green behaviour. In particular, the demand that employees exhibit green behaviour enhances the firm's sustainable performance (Zaid et al., 2018). Indeed, to get a better understanding of green human resource behaviour, one study states that employees' eco-friendly behaviour maximises the firms' production, thereby strengthening the firms' sustainable performance (Mousa & Othman, 2020). Moreover, extending the research on this notion, another study states that employee pro-environmental behaviour enhances the corporations' sustainable performance by synergizing the firms' green product practices (Suganthi, 2019). Therefore, employees form a strong relationship with the firms' sustainability practices. This greener responsibility makes the employees adopt innovative skills and behaviours that increase the firm's effectiveness, thus achieving

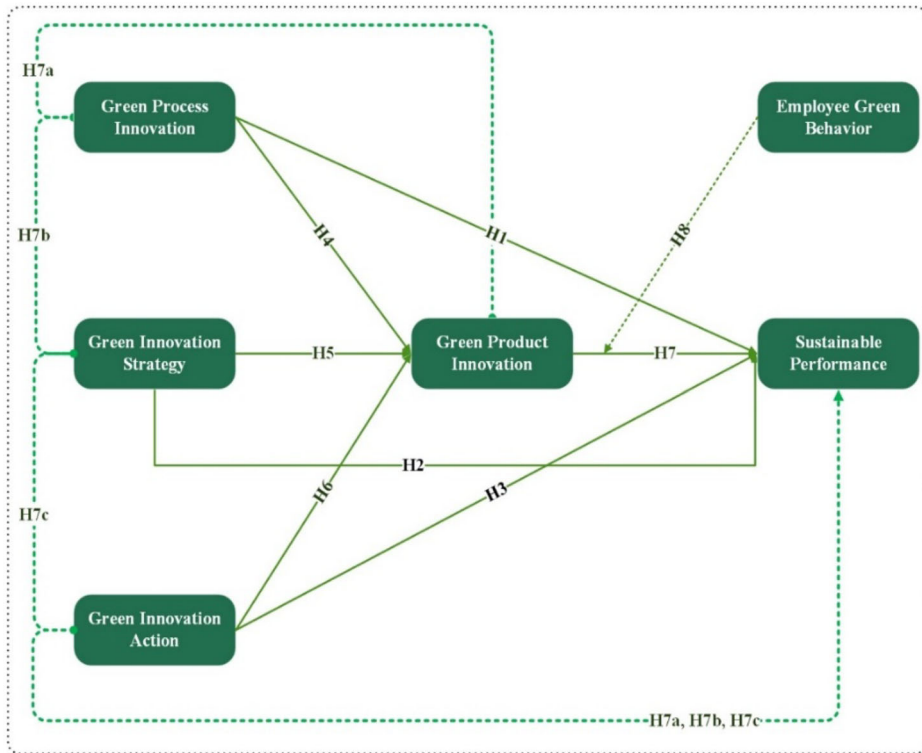


Figure 1. Study conceptual framework. Source: Authors

sustainable performance (Morgan & Rayner, 2019). In conclusion, the literature infers that employees' green behaviour led organisations to a sustainable future. Figure 1 shows the study's conceptual framework. As such, the current study proposes the following hypothesis:

H8: Employee green behaviour plays a moderating role between sustainable performance and green product innovation

3. Methodology

The quantitative approach was adopted, and we collected data via a questionnaire survey. Convenience sampling method was adopted for the data collection from the Pakistani manufacturing sector employees. The manufacturing sector has been chosen because it faces pressure from governmental regulations and public environmental concerns. All the study participants consent was obtained before conducting the survey. The target population comprises the managers and employees of manufacturing companies that have adopted GI and implemented it. Five hundred questionnaires were distributed to respondents, of which 460 questionnaires were returned; 411 questionnaires were found to be valid and useable, an 82% response rate. Harman's single factor approach was adopted to check the common method bias. This study has no common method bias because one single factor variance was 8.555%, less than 50% (Podsakoff et al., 2003).

Table 1. Demographic characteristics.

	Participants Frequency (N = 411)	Percentage
Gender		
Female	213	51.8
Male	198	48.2
Age		
20–25	55	13.4
26–30	106	25.8
31–35	100	24.3
36–40	94	22.9
Over 40	56	13.6
Education		
Intermediate	82	20
Bachelor	131	31.9
Master	136	33.1
MPhil / Others	62	15.1
Marital Status		
Single	73	17.8
Married	338	82.2

Source: Authors

Green process innovation was assessed on the 5-item scale, and green product innovation was assessed on the 3-item scale adopted from the study of Xie et al. (2019), while green innovation strategy and green innovation actions were measured on the 3-items scale. The measurement items scale was adopted from the study of Su et al. (2020). The moderating variable (employees' green behaviour) was measured on the 5-item scale adopted from the study of Sabokro et al. (2021). Sustainable performance was measured on the 5-item scale adopted from the study of Gelhard and Von Delft (2016).

Table 1 presents the study participants' demographic information, such as gender, age, education, and marital status.

4. Study results

In the measurement model, we have analyzed variables' validity, reliability, and discriminant validity. In terms of reliability, it is suggested to have the value of Alpha and CR values higher than 0.7 (Gefen et al., 2000). Convergent validity includes the standardised loadings of each construct analyzed, which must also be higher than 0.5, as was the case in this study (Bagozzi et al., 1999). Furthermore, AVE was larger than 0.5, indicating that there was no convergent validity issue in this study (see Table 2). The assessment measurement model is depicted graphically in Figure 2.

The square root of AVE must be greater than the correlation coefficient, as indicated in Table 3, which indicates a good discriminant (Fornell & Larcker, 1981). The discriminant was evaluated using the second cross-loading approach. The results indicate no cross-loadings were found between variable items.

HTMT was also applied to test discriminant validity. Henseler et al. (2015) stated that a value of HTMT less than 0.85 indicates that there is no discriminant validity between the constructs (see Table 4).

The hypothesis testing utilised the partial least squares structural equation modeling (PLS-SEM) method using Smart-PLS software (version 3.3.3). Henseler et al. (2015) bootstrapped technique was used, which recommended a 5,000-sample size to acquire the hypothesis testing results. The outcomes of direct interaction effects are

Table 2. Validity and reliability analysis.

Variables	Items	Loading	α	CR	AVE
Green Process Innovation	GPCI-1	0.728	0.859	0.859	0.549
	GPCI-2	0.746			
	GPCI-3	0.749			
	GPCI-4	0.783			
	GPCI-5	0.695			
Green Innovation Strategy	GIS-1	0.720	0.761	0.761	0.515
	GIS-2	0.706			
	GIS-3	0.727			
Green Innovation Action	GIA-1	0.685	0.793	0.792	0.560
	GIA-2	0.780			
	GIA-3	0.776			
Green Product Innovation	GPDI-1	0.756	0.800	0.800	0.572
	GPDI-2	0.795			
	GPDI-3	0.717			
Employee Green Behaviour	EGB-1	0.881	0.904	0.902	0.652
	EGB-2	0.674			
	EGB-3	0.754			
	EGB-4	0.771			
	EGB-5	0.932			
Sustainable Performance	SP-1	0.729	0.857	0.856	0.544
	SP-2	0.749			
	SP-3	0.772			
	SP-4	0.762			
	SP-5	0.674			

Source: Authors

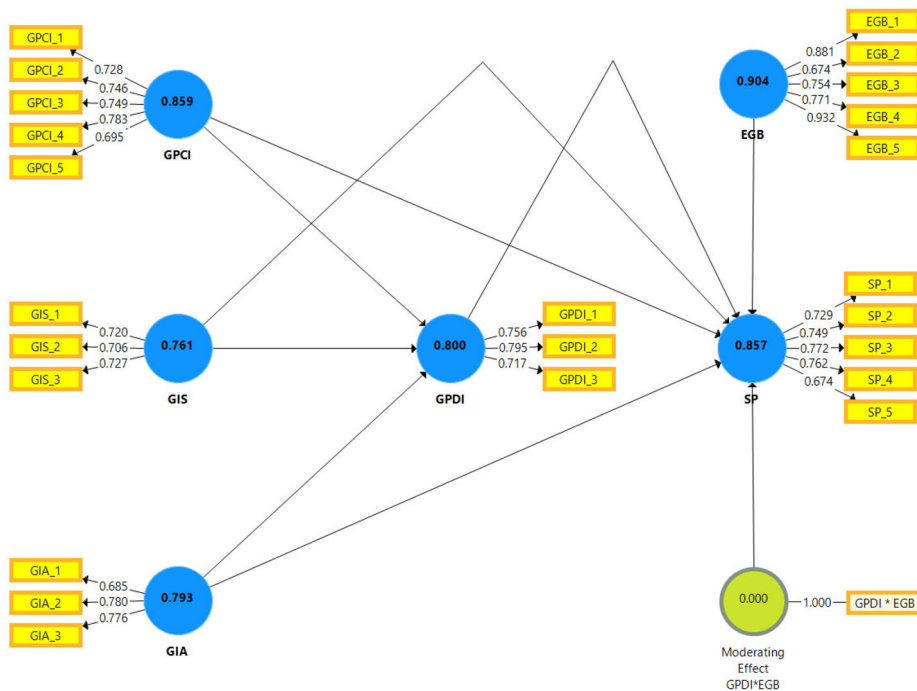


Figure 2. Results of measurement model assessment. Source: Authors

Table 3. HTMT and Fornel Larcker analysis.

Constructs	1	2	3	4	5	6
1. Employee Green Behaviour	0.808	0.184	0.194	0.232	0.497	0.289
2. Green Innovation Action	0.185	0.748	0.628	0.627	0.62	0.673
3. Green Innovation Strategy	0.194	0.628	0.718	0.662	0.629	0.681
4. Green Process Innovation	0.23	0.627	0.662	0.741	0.652	0.654
5. Green Product Innovation	0.493	0.622	0.629	0.653	0.756	0.660
6. Sustainable Performance	0.292	0.675	0.682	0.655	0.662	0.738

Source: Authors

Table 4. Variance influence factor.

Constructs	1	2	3	4	5	6
1. Employee Green Behaviour						1.418
2. Green Innovation Action					1.899	2.150
3. Green Innovation Strategy					2.055	2.208
4. Green Process Innovation					2.049	2.286
5. Green Product Innovation						3.641
6. Sustainable Performance						

Source: Authors

Table 5. Hypotheses results.

	Variables Direct Relationships	β	SE	T-Value	P-Value
H1	GPCI \rightarrow SP	0.155	0.071	2.194	*
H2	GIS \rightarrow SP	0.272	0.076	3.561	***
H3	GIA \rightarrow SP	0.223	0.078	2.855	**
H4	GPCI \rightarrow GPDI	0.322	0.086	3.753	***
H5	GIS \rightarrow GPDI	0.251	0.087	2.879	**
H6	GIA \rightarrow GPDI	0.262	0.088	2.991	**
H7	GPDI \rightarrow SP	0.343	0.112	3.054	**

GPCI = Green Process Innovation; GPDI = Green Product Innovation; SP = Sustainable Performance; GIS = Green Innovation Strategy; GIA = Green Innovation Action; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: Authors

Table 6. Mediation hypotheses testing.

	Indirect Hypothesis	β	SE	T-Value	P-Value
H7(a)	GPCI \rightarrow GPDI \rightarrow SP	0.110	0.048	2.306	*
H7(b)	GIS \rightarrow GPDI \rightarrow SP	0.086	0.041	2.098	*
H7(c)	GIA \rightarrow GPDI \rightarrow SP	0.090	0.042	2.157	*

SP = Sustainable Performance; GPCI = Green Process Innovation; GPDI = Green Product Innovation; GIS = Green Innovation Strategy; GIA = Green Innovation Action; * $p < 0.05$.

Source: Authors

displayed in Table 5. H1 shows GPCI has a significant and positive impact on SP ($\beta = 0.155$), while GIS positively and significantly affects ($\beta = 0.272$). All the direct hypotheses were accepted in this study.

Table 6 displays an analysis of mediation effects. The results reveal that the mediation effect from H7(a) to H7(c) has a significant mediation effect ($\beta = 0.110$, 0.086, and 0.090, respectively). Moreover, H7(a) to H7(c) are accepted. Figure 3 shows structural model results.

Hypothesis H8 was accepted in this study, as shown in Table 7. The interaction effect of EGB on environmental GPDI and SP are positively significant ($\beta = 0.181$). Figure 4 is a graphical representation of moderation analysis.

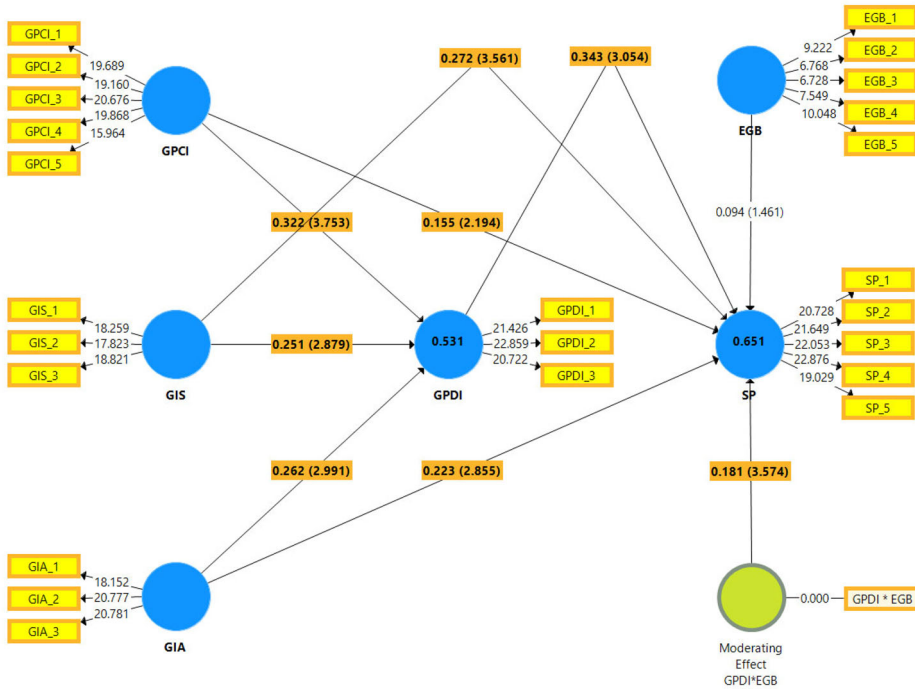


Figure 3. Structural model results. Source: Authors

Table 7. Moderating hypothesis testing.

	Moderating Effect	β	SE	T-Value	P-Value
H8	Interaction GPD*EGB \rightarrow SP	0.181	0.051	3.574	***
	Moderation Level	Effect	Boot SE	LLCI	ULCI
H8	+1 Std Dev	0.734***	0.073	0.592	0.880
	Mean	0.600***	0.048	0.504	0.696
	-1 Std Dev	0.464***	0.049	0.367	0.561

GPD = Green product innovation; EGB = Employee green behaviour; SP = Sustainable performance; *** $p < 0.001$. Source: Authors

5. Discussion

Over the years, the increasing environmental depletion has pressured firms to promote ecological well-being. In this regard, determining the influence of sustainability on firms' innovation has become essential (Cherrafi et al., 2018). Notably, the adoption of green initiatives is growing worldwide, thus encouraging organisations to enhance their firms' socio-environmental performance via innovative practices. In recent years, firms' green processes have been found to minimise environmental waste, thus promoting the GI processes' sustainable performance (Shahid et al., 2020). Similarly, enterprises' GI strategies also play a fundamental role in supporting business objectives. Effective GI strategies direct the companies' structuring activities, thus reducing their environmental impact (Sun & Sun, 2021). Eco-friendly strategies have come into the limelight, accelerating firms' enduring performance. Green strategies have paved the way for emerging enterprises, thus promoting firms' sustainable

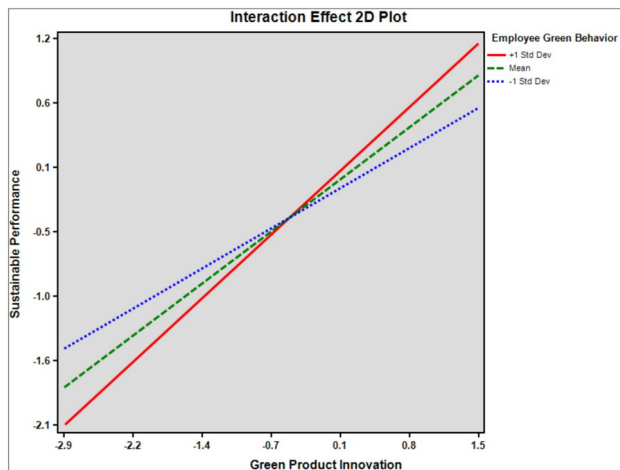


Figure 4. Moderating effect of employee green behaviour. Source: Authors

performance. Therefore, referring to these research findings, the results support H1 and H2 by concluding that green process innovation and GI strategy are crucial determinants driving firms' sustainable performance.

Companies have strongly responded to the 'go green' notion by rigorously adopting GI practices. These GI actions have helped them to overcome socio-environmental barriers, thus promoting their enduring performance (Baah et al., 2020). The previous study shows that the solution to the emerging environmental problem is firms' green initiatives, which improve the ecological outcomes. Accordingly, the current research findings is consistent with the previous literature, thereby accepting H3. Undoubtedly, Green process innovation and green product innovation are essential to the growth of businesses. Significantly, this increasing legitimacy of green process innovation provides firms with an opportunity to enhance their activities by adopting eco-friendly developments (Lukitaruna & Sedianingsih, 2018). Surprisingly, the study findings also reveal a positive relationship between green process innovation and green product innovation, potentially supporting hypothesis H4.

Furthermore, the prior literature also indicates that firm' GI strategies improve the product designs and environmental strategical plans facilitate green product development (Cheung & To, 2019). In particular, this 'going green' construct has inevitably made companies conscious regarding their production activities. The growing green phenomenon has caused stakeholders to opt for products that signify a greener sustainable notion of organic production. Therefore, the research states that the employees' green action fulfils the ecological needs of society via eco-friendly products and processes (Vilkaite-Vaitone & Skackauskiene, 2019). Comparing the prior literature to the current study finding, we found that the previous literature supports our study outcomes, thus confirming our assumptions made in H5 and H6.

However, the literature shows that research has contributed to green product innovation. As such, prior studies state that green product innovation encourages the

development of firms' strategies and employees' motives, accelerating firms' long-term innovative performance (Chang, 2019). Undoubtedly, intellectual capital significantly contributes to firms' sustainable performance. Accordingly, this study's findings reveal a significant mediating and moderating role of green product innovation and employees' green behaviour. These findings allow us to accept H7 (i.e. a, b, and c) and H8. Altogether, the study results are consistent with the prior literature, thus fulfilling the article's motive of investigation.

Significantly, these research findings provide a comprehensive understanding of GI in accelerating sustainable performance from a practical perspective. Green process innovation promotes green product innovation. As a result, firms should prioritise GI practices to bridge the gap that prevails in the global manufacturing sector. At present, it has become difficult for manufacturing companies to meet the necessary environmental vision. Therefore, this study suggests that managers should adopt and conserve green strategies for cultivating green functions, in turn influencing firms' sustainable performance. The study results propose that management should develop GI strategies for contributing to the corporation's societal well-being. Hence, in today's era of developing environmental legitimacy, organisations should cultivate green practices (e.g. green product innovation) to contribute to a better environment. In particular, the study suggests that incorporating green integration actions, innovation strategies, and resources to enhance green products and processes is conducive to improving firms' sustainable performance.

6. Conclusion

Undoubtedly, today, organisations must continually take into account environmental protection to achieve high sustainability. Accordingly, this study investigates the GI approaches under the sustainability model. The study provides a comprehensive view of GI practices influencing firms' sustainable performance. It includes the mediating and moderating effects of GI that drive the firms' socio-ecological performance. In particular, the study presents the theoretical literature on the prime determinants of firms' sustainable performance in correspondence with the previous literature.

Additionally, the current study has some limitations. First, the data was collected from the manufacturing sector of Pakistan. Future studies might consider data collection from different countries or industries for more comprehensive outcomes. Secondly, we have included employee green behaviour as a moderator in the current study. Some other variables, such as innovation capabilities, can be considered for moderating between green product innovation and sustainable performance.

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