

Responsible consumption and production as 12th sustainable development goal: a commentary on Pakistani students green entrepreneurship orientation

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Abstract

Purpose – Despite the discussion among scholars on green entrepreneurship and sustainable development, little is known regarding the role of responsible consumption and production implementation, which is the 12th goal among the sustainable development goals (SDGs) of the United Nations. Similarly, little is known about the role of country support for entrepreneurship between green entrepreneurship and sustainable development. The current study determined the role of green consumption commitment, green design, the green supply chain and green production in green entrepreneurship. This study aims to provide empirical findings for improving the implementation of responsible consumption and production to achieve its targets.

Design/methodology/approach – A sample of 311 students registered in business incubators was collected from 12 public sector Pakistani universities. Partial least squares–structural equation modeling (PLS-SEM) was applied via Smart PLS-4 to measure the relationships among the research variables.

Findings – Green consumption commitment, green design, the green supply chain and green production were found to significantly influence green entrepreneurship. Green entrepreneurship emerged as a significant predictor of sustainable development. Furthermore, country support for entrepreneurship has emerged as a significant moderator in the relationship between green entrepreneurship and sustainable development.

Originality/value – The contributions of the current research are novel in literature, as the 12th SDG was addressed.

Keywords Responsible consumption, Responsible production, Sustainability development, Green entrepreneurship, Environmental protection

Paper type Research paper

1. Introduction

The 12th sustainable development goal (SDG) is “responsible consumption and production.” The United Nations set the goal of encouraging companies, especially large and transnational companies, to adopt sustainable practices and integrate sustainability information into their reporting cycle. The 12th goal further emphasizes supporting developing countries in strengthening their scientific and technological capacity to move toward more sustainable



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patterns of consumption and production (Gunawan *et al.*, 2020). However, governments of developing countries focus less on having regulations for the corporate sector for the achievement of SDGs. Overall, it is the responsibility of the government to design and formulate strategies for businesses to work strategically and accomplish goals for responsible consumption and production (Arora and Mishra, 2023).

In developing countries such as Pakistan, there is a need for green practices in businesses to improve production and consumption (Shahzad *et al.*, 2020). However, traditional industrial work in Pakistan is based on unsustainable practices. These practices are problematic for improving businesses in the direction of sustainability. Entrepreneurial businesses are newly developing in Pakistan (Rasheed, 2022). Most of the new startups involve students who are working on their innovative ideas. The culture of green entrepreneurship has also developed among new startup pioneers to facilitate a sustainable environment (Ikram *et al.*, 2021). However, education related to green entrepreneurship is still less focused on university-level education in Pakistan. It is reliable for developing green entrepreneurial businesses in the market, which should be based on responsible consumption and production (Rustam *et al.*, 2020). According to Asif *et al.* (2023), the Pakistani government has failed to regulate sustainable consumption and production in the country, which is a challenge for sustainable development. According to the SDGs indicators, Pakistan ranked 137th among 166 countries. Hence, the conditions of Pakistan are poor in terms of the application of the SDGs. Therefore, the regulation and support of the government are imperative for different sectors to work for sustainable development (Ghaffar *et al.*, 2023).

On the other hand, unsustainable practices lead to pollution, environmental degradation, resource depletion, undermining ecosystem resilience and loss of biodiversity (Jie *et al.*, 2024; Shang *et al.*, 2023). In the social sector, unsustainable practices lead to reduced quality of life and exacerbate health problems (Araújo *et al.*, 2023). Moreover, on the economic side, increased waste generation and the depletion of natural resources create costs for businesses. Therefore, unsustainable practices are hurdles to economic growth and prosperity (Roberts *et al.*, 2023). Following this, there is an urgent need for government intervention and investment in entrepreneurship, which fosters sustainable business models that can mitigate economic growth, environmental impact and social well-being (Murad *et al.*, 2024b). Supporting green entrepreneurship serves as a mechanism for addressing unsustainable practices and advancing toward a green target, which is focused on the 12th SDG.

Moreover, scholars have discussed the establishment of green businesses as a key factor for the sustainability of the environment (Baah *et al.*, 2021). Scholars have also revealed that a commitment to green consumption should be the focus of society to promote green entrepreneurship. Similarly, the concept of the green supply chain is also emerging, where green resources are used in the process of logistical work (Xu *et al.*, 2022). Scholars have also focused on the green design of products, which is good for the environment. Moreover, government support is also needed to develop green businesses in the market (Haiyun *et al.*, 2021; Rasheed, 2022). However, the Pakistani government has taken a few initiatives for entrepreneurship students to support them in startups. Nevertheless, there is less focus on green entrepreneurship and responsible consumption and production (Gunawan *et al.*, 2020).

However, scholarly discussion paid less attention to the relationship between green entrepreneurship and sustainable development by considering the 12th goal, responsible consumption and production (Arora and Mishra, 2023). Since the United Nations is concerned with achieving success in the establishment of this goal, further research on this phenomenon is needed (Dwarapureddi *et al.*, 2021). Therefore, the current research aims to determine the structural relationships among green consumption commitment, green design,

the green supply chain, green production, green entrepreneurship, sustainable development and country support for entrepreneurship. The significance of finding the structural relationship is critical to improving the understanding of these relationships. Furthermore, gaps in the literature regarding the relationship between green entrepreneurship and sustainable development are addressed by this research. In particular, knowledge related to the structural relationship can be used to understand how the relationships mentioned above can contribute to the implementation of responsible consumption and production.

The importance of current research lies in its ability to understand how green entrepreneurship is significant for working toward sustainable development, which can ensure responsible consumption and production. Practically, working on the findings of the current research would be useful in developing policies for responsible consumption and production. The structure of this research is based on a review of the literature, the methodology of the study, the empirical findings, a discussion, a conclusion and theoretical and practical implications. This research makes a novel contribution to the body of knowledge by demonstrating the importance of green entrepreneurship for sustainable development, particularly in terms of responsible consumption and production, which constitute the 12th goal of sustainable development. However, the limitations of the current research are also highlighted in the final part, where directions for scholars are also given.

2. Review of literature

2.1 Theoretical underpinning

The theory of planned behavior (TPB) is considered in the current study to measure the effect of contextual factors on green entrepreneurship in Pakistan (Nordin, 2020). According to the TPB, intention is a significant factor in human behavior, as it influences it (Ajzen, 1991). In this study, the TPB is employed to underpin the proposed framework, highlighting the role of behavioral intentions in driving green entrepreneurship and sustainable development. The TPB posits that behavior is guided by three primary factors: attitudes toward the behavior, subjective norms and perceived behavioral control (Lortie and Castogiovanni, 2015). Within this framework, green consumption commitment, green design, the green supply chain and green production represent critical antecedents that shape positive attitudes and subjective norms favoring green entrepreneurship. The incorporation of country support for entrepreneurship emphasizes the importance of perceived behavioral control, illustrating how external support mechanisms influence entrepreneurs' ability to engage in green practices. Collectively, these elements work to strengthen entrepreneurial intentions and actions that contribute to broader sustainable development outcomes, aligning well with the predictive capacity of the TPB in understanding pro-environmental behavior. The framework of the current research is shown in Figure 1. In the model, the dependent variable, sustainable development, is an extension of the TPB to highlight findings significantly. In addition, the moderating variable of country support for entrepreneurship is also a significant addition to literature.

The variables included in the framework are essential for understanding the complex drivers of green entrepreneurship and their link to sustainable development. Green consumption commitment reflects consumers' increasing preference for eco-friendly products, shaping market demand and entrepreneurial actions (Chen *et al.*, 2023). This aligns with the TPB, where attitudes influence intentions. Green design focuses on integrating environmental considerations into the creation of products and services, promoting innovation that aligns with sustainability goals (Chalfin *et al.*, 2022). The green supply chain highlights the importance of sustainable practices throughout the production and distribution processes, ensuring that businesses operate with minimal environmental impact (Guo *et al.*, 2023; Jalil *et al.*, 2023).

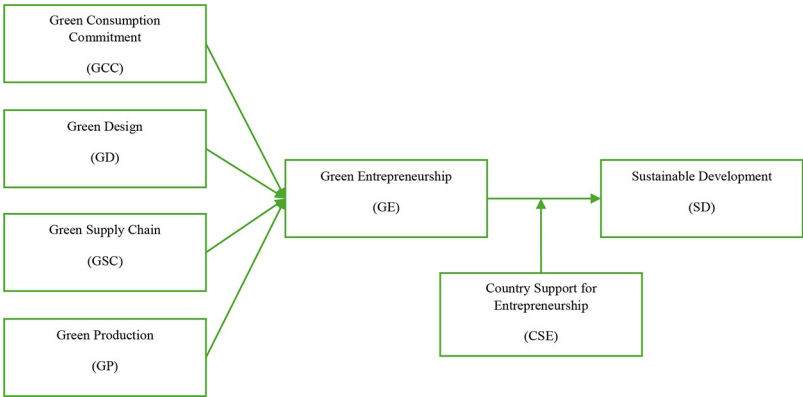


Figure 1. Research framework
Source: Author’s own work

Green production ensures that manufacturing processes are resource efficient and eco-conscious, further reinforcing the TPB’s emphasis on attitudes and norms that drive behavior. Finally, country support for entrepreneurship is included, as it underscores the role of perceived behavioral control in the TPB, illustrating how governmental and institutional backing can empower entrepreneurs to implement green practices, ultimately contributing to sustainable development (Govindarajan *et al.*, 2024; Leng *et al.*, 2024). Each of these variables directly supports the development of green entrepreneurship, which is a crucial vehicle for achieving sustainability.

2.2 Green consumption commitment

A green consumption commitment is dedication by the public to improve their eco-friendly consumption method. It is based on the purchase of eco-friendly products to reduce waste (Saeed and Shafique, 2021). It is a process to support the ethical brands that are working to improve the sustainability of the environment. The commitment to reducing waste can lead the public to improve their behavior and contribute to an eco-friendly environment (Amankwah and Sesen, 2021). The commitment to developing environmental understanding is necessary for the public (Han, 2020). Sustainability in the environment is also possible with the green consumption commitment of the public (Sun *et al.*, 2021). Thus, the public must be motivated and educated for consumption improvement to advance their behavior.

2.3 Green design

Green design refers to developing a product with a green approach to reduce the environmental effect (Rai *et al.*, 2021). It is a complete process based on material selection and energy efficiency. Green design helps improve the overall lifecycle of products, from raw materials to the disposal of products (Bag *et al.*, 2021b). The packing and durability of the product are also significant in green product management, which is a critical factor for the environment (Chen *et al.*, 2020). The green design of products is useful for protecting against environmental degradation, which is necessary for improving product usage and consumption (Basso and Antle, 2020). Modern brands are working on green design to improve the efficiency of their products.

2.4 Green supply chain

The green supply chain is based on a green process from the source of raw materials to the development of final products (Abbasi and Choukolaei, 2023). It is based on sustainable sourcing, which is necessary for a green environment. Furthermore, the green supply chain is important for waste reduction and recycling, which is also critical for improving the environment (Bhatia and Gangwani, 2021). Similarly, transparency and reporting are critical for the advancement of the supply chain (Herrmann *et al.*, 2021). Green supply chain practices help improve behavior and enhance the reputation of brands. A green supply chain is necessary for creating long-term value for stakeholders (Bag *et al.*, 2021a). Customers are also attracted to the green supply chain, which is eco-friendly.

2.5 Green production

Green production is based on maximizing the efficiency of resources and minimizing the environmental impact of products (Zameer *et al.*, 2020). The avoidance of pollution is necessary for advancing green production. The use of environmentally friendly processes and materials helps improve green production (Sana, 2020). Sustainability in the environment is possible with green production, which is integral to green manufacturing. Employees' training in green production is also necessary to improve their behavior (Sun and Wang, 2020). Green production helps employees improve their standards, which is necessary for continuous improvement (Zhang *et al.*, 2020). The certification of green production standards is also possible with green working patterns by modern businesses.

2.6 Green entrepreneurship

The prime objective of green entrepreneurship is to work for the sustainability of the environment (Zi, 2023). Green entrepreneurship provides innovative solutions for its products. Innovative and green solutions that cause any environmental degradation are possible with green entrepreneurship (Nordin, 2020). Green entrepreneurship further helps to use resources efficiently with ethical leadership. It is also necessary for leadership to measure the impact of entrepreneurial business on the environment (Skordoulis *et al.*, 2022). A supportive environment for entrepreneurial business is necessary to develop advancements in green working (Li *et al.*, 2022). One objective of green entrepreneurship is also to educate customers properly, which is necessary for environmental management.

2.7 Country entrepreneurship for support

The support of countries for entrepreneurship is necessary for entrepreneurs (Tien *et al.*, 2023). It can be accelerated by providing appropriate funding, education, training and regulations. Governments are responsible for providing an entrepreneurial ecosystem that is necessary for innovation (Alvarez-Risco *et al.*, 2021). Support related to research development is also critical for entrepreneurs. Strategic advancement to entrepreneurship is necessary to advance the behavior of entrepreneurs (Amankwah and Sesen, 2021). The use of entrepreneurial networking platforms by the government is necessary to support the culture of entrepreneurship in a country (Cooke, 2020).

2.8 Sustainable development

Sustainable development is integral to improving the environment on Earth to make it livable for the public (Mai and Yao, 2023). It is necessary to control climate change and improve it strategically, which is necessary for natural resource protection (So, 2023). Many businesses use resources in unethical ways, and these practices lead to problematic environments and

less sustainability (Chien *et al.*, 2022). Therefore, it is necessary to improve the behavior of individuals, corporations and governments to promote sustainability in the environment (Zhou *et al.*, 2022). In addition, the issue of climate change, which promotes inequality, is challenging, and other problems are also connected to it.

2.9 Formulation of hypotheses

Green consumption helps reduce environmental degradation (Sun *et al.*, 2021). It is necessary to reduce the waste of natural resources that can lead to a bad ecosystem. Awareness related to green consumption is necessary for customers (Han, 2020). Businesses working on green consumption mechanisms are strategically active in advancing green consumption performance. Support for green consumption is necessary, and it leads businesses to work for innovation (Cooke, 2020). The reliability of innovation in entrepreneurial business improves public behavior toward consumption (Soomro *et al.*, 2020). Thus, green entrepreneurship is a significant solution to green consumption. Furthermore, green consumption helps improve green behavior through the use of resources and green utilization to protect the environment (Amankwah and Sesen, 2021). Ogiemwonyi and Jan (2023) reported that green consumption by consumers influences manufacturing companies to work on green ideas to protect natural resources, which results in a green entrepreneurship orientation. Furthermore, Xie *et al.* (2022) reported that the green consumption commitment of consumers leads to purchasing from green entrepreneurial businesses. Thus, on the basis of a discussion of previous studies, green consumption commitment is considered a way forward for the development of green entrepreneurship (Ren *et al.*, 2023):

H1. Green consumption commitment predicts green entrepreneurship.

The concept of green design is critical for protecting the natural environment (Basso and Antle, 2020). However, the green design of businesses should be eco-friendly to improve the overall environment. It is strategically important to develop a reliable attitude toward green work (Rai *et al.*, 2021). A strategic approach to green design is necessary for entrepreneurial outcomes. The concept of green entrepreneurship is also linked with green consumption, which is a way forward for strategic advancement (Bag *et al.*, 2021b). The green design of products and manufacturing contributes less to environmental degradation, which is a necessary factor for environmental advancements (Chen *et al.*, 2020). Therefore, green consumption is considered a way forward for developing entrepreneurial businesses in the market (Baah *et al.*, 2021). Huang *et al.* (2023) reported that the green design of products helps to save natural resources via efficiency and effectiveness, which is translated into green entrepreneurship. Moreover, Batwara *et al.* (2022) reported that the green design of products leads to the development of entrepreneurship into a green orientation, which is necessary for green business. Previous studies Kong *et al.* (2022) reported that green entrepreneurship is improved with green product design:

H2. Green design predicts green entrepreneurship.

A green supply chain is also necessary for modern business, as it does not degrade the quality of the environment (Bhatia and Gangwani, 2021). The role of the green supply chain is to improve entrepreneurial behavior critically. The supply chain management process is necessary for a green environment, and it should be monitored properly (Bag *et al.*, 2021a). A green supply chain helps improve the ecosystem, which is necessary for the sustainability of business (Abbasi and Choukolaei, 2023). Furthermore, green supply chain-related work

can lead businesses in a significant direction. Modern customers are also advanced in their approaches, and they focus on a green environment and working (Potluri and Phani, 2020). Therefore, the concept of a green supply chain must be developed properly to facilitate the public and the environment (Herrmann *et al.*, 2021). The green supply chain is important for saving the environment and becoming eco-friendly, which is the focus of green entrepreneurship. Furthermore, Feng *et al.* (2022) reported that the green practices of businesses lead them to work in the direction of saving natural resources, which is also the focus of green entrepreneurship. Hence, previous studies Gawusu *et al.* (2022) reported that a green supply chain is a critical component factor for green entrepreneurship:

H3. The green supply chain predicts green entrepreneurship.

The green production process is critical for advancement in the ecosystem (Sana, 2020). It is necessary to have an appropriate production design that would help improve the environment (Sun and Wang, 2020). However, strategic advancement in entrepreneurship is required to develop it strategically. An improvement in the production process can reduce the waste of natural resources (Zhang *et al.*, 2020). The stability of the environment is also linked to green production, which is necessary for better entrepreneurial development. The opportunities to have green resources are necessary for reliable production, which is necessary for green entrepreneurship (Zameer *et al.*, 2020). The efficiency and effectiveness of resource utilization for production can save the environment from ecological degradation (Tien *et al.*, 2020). Li *et al.* (2023) highlighted that green product manufacturing saves the natural environment, which is the focus of green entrepreneurship. Similarly, Han *et al.* (2023) noted that green entrepreneurial businesses focus on green production, which is necessary to improve the environment critically. Therefore, green entrepreneurship is developed with green production (Sarkar *et al.*, 2022):

H4. Green production predicts green entrepreneurship.

Green entrepreneurship helps to save the environment sustainably (Sadiq *et al.*, 2022). It has become necessary to protect the earth by limiting the use of extra resources. The recycling approach for entrepreneurial businesses can develop a concept of sustainability in the business environment (Yi, 2021). It is critical to develop green entrepreneurial businesses in a modern environment to contribute to a sustainable environment. However, green entrepreneurship helps develop positive ideas in business, which are necessary for improving the business environment (Amankwah and Sesen, 2021). There is a need for sustainable development, which can be achieved through green work (Hameed *et al.*, 2021). Thus, green entrepreneurial intention is considered a way forward for green business development. Zi (2023) reported that green entrepreneurship is important for the achievement of SDGs, as green production is associated with it. Furthermore, Tien *et al.* (2023) reported that green entrepreneurship is helpful for green consumption, which is a way forward for sustainable development. Previous studies (Skordoulis *et al.*, 2022; Yasir *et al.*, 2023) have discussed green entrepreneurship as a significant factor for sustainable development:

H5. Green entrepreneurship is an antecedent of sustainable development.

An entrepreneurial environment is necessary for fostering new businesses in the market (Yi, 2021). The regulations set by the government and entrepreneurial networking play a key role in entrepreneurial development. Governments must develop entrepreneurial businesses strategically (Alvarez-Risco *et al.*, 2021). Advancements in entrepreneurial business attitudes can lead to the stable operation of entrepreneurial businesses. The goals of

sustainability can be achieved with a green entrepreneurial business when it minimizes the use of natural resources (Amankwah and Sesen, 2021). Support from the government can help businesses work in a green direction. A positive approach to entrepreneurship can be developed to improve the environment (Alwakid *et al.*, 2021). Therefore, the government has a key role in green entrepreneurship development. Murad *et al.* (2024a) and Murad *et al.* (2024b) discussed the support of any country to develop the entrepreneurial business critically. Furthermore, Cai *et al.* (2021) noted that country policy and ease of business push entrepreneurial businesses to work on SDGs, which are a way forward for sustainable development. Hence, it is assumed that the country's support for entrepreneurship has a major influence on sustainable development:

H6. Country support for entrepreneurship moderates the relationship between green entrepreneurship and sustainable development.

3. Methodology

3.1 Research design and questionnaire

The hypotheses developed in the present study were evaluated via quantitative data. The data were collected on a Likert scale for each variable. The process of data collection with the Likert scale is appropriate when one-time data need to be collected. The cross-sectional method of data collection was used in this research because it was considered appropriate for the findings. The scale items for this study were adopted from previous research (Alvarez-Risco *et al.*, 2021; Lotfi *et al.*, 2018; Shabeeb Ali *et al.*, 2023). According to Sekaran and Bougie (2016), an instrument can be considered significant when the coefficient of reliability (Cronbach's alpha) is above 0.70. The instruments used in this study achieved a significant coefficient of reliability and were considered for data collection. Furthermore, these instruments were selected for this research because previous studies also used these instruments for the collection of data from students. The questionnaire used in the present study was based on two sections: Section 1 collected demographic data, and Section 2 collected inferential data on a Likert scale. The scale items used in this research are reported in Table 1.

3.2 Population, data collection and analysis tool

The population of the current research included students enrolled in business incubators at 12 public sector universities in Pakistan. The subjective information of the students was collected to analyze the formulated hypotheses. The selection of these students was considered because they have information about entrepreneurial startups (Murad *et al.*, 2024c). Therefore, considering these students was appropriate for this research to collect data. The data collection period was from June 2023 to August 2023. Since the students at public sector universities share distinctive characteristics and represent diverse backgrounds, they were significant in generalizing to the large population (Murad *et al.*, 2024b). Random sampling was used in this research while having a sampling or research frame where the names of the students registered in each incubator were listed (Murad *et al.*, 2024b). The lists for the research frame were collected to randomly select the participants. The online tool "Simple Random Sampling Applet" developed by the University of Iowa was used to randomly select the respondents. In the tool, the total number of populations in each incubator was inserted into the tool individually, and participants were selected randomly via the tool. Hence, the permission of incubator management was granted, and data were collected with their support. In the data collection process, the printed questionnaires were distributed to collect the data. Out of the four hundred distributed questionnaires, a sample of

Table 1. Scale items

Variable	Scale items
Green production	It should contain elements that are useful for the environment It should be efficient in terms of energy consumption It should be made from materials that make the product recyclable Its production process should be environmentally friendly It should generate as low environmental pollution as possible The company should use ecologically effective transportation fleet Individuals should be promoted to adopt cost-effective driving to reduce fuel consumption Environment management systems should be adopted according to up-to-date standards Control and monitoring systems should be developed to ensure observance of environmental standards Collaboration with green suppliers should be promoted
Green design	Product design should be performed according to environmental regulations Product should be designed for lower adoption of hazardous raw material Product safety should be considered in the design process Products should be designed to minimize the consumption of sources of energy Product design should provide reusability My goal is to create environmentally friendly products in the future
Green consumption commitment	I plan to suggest eco-friendly products to my friends and others I speak favorably about green products to those around me I would motivate others to develop green products
Green entrepreneurship	Green entrepreneurship eliminates environmental degradation The company should establish a balance between raising profit, considering the environment and taking into account innovation and modern methods for green business Producing products and services for profitability and green commerce is a priority Green businesses present opportunities for making profit from ecological scopes Green entrepreneurship serves as a driving force for triggering new economic growth in modern economies Increased human welfare may not be attained at the expense of interrupting ecologic processes The company should prevent such problems as the degradation of natural resources The company should prevent lowered quality of life for humans at present and future The company should provide a basis for enhanced social and cultural positions of the societies The company should proceed toward job by synergizing economic, social and environmental factors
Sustainable development	

(continued)

Table 1. Continued

Variable	Scale items
Country support for entrepreneurship	In my country, green entrepreneurs are encouraged by an institutional structure
	My country's economy offers many opportunities for entrepreneurs
	Obtaining bank loans is quite difficult for entrepreneurs in my country
	The state laws of my country are adverse to the management of a company"
Source(s): Alvarez-Risco <i>et al.</i> (2021); Lotfi <i>et al.</i> (2018); Shabeeb Ali <i>et al.</i> (2023)	

311 was collected and considered for the final analysis of the data. Among the 311 respondents, 209 were male, and 102 were female. All the students were enrolled in entrepreneurship and innovation programs as undergraduates. The respondents have appropriate information about green entrepreneurship. A sample of 311 respondents was analyzed via Smart PLS-4. Partial least squares–structural equation modeling (PLS-SEM) was used to analyze the data. Furthermore, PLS-SEM is also recommended by scholars for testing the empirical relationships among variables when the model is complex. Thus, PLS-SEM was used to determine the structural relationships among the variables.

4. Findings

The data normality was evaluated after the data were inserted into Smart PLS-4. The mean value and standard deviation of the data were initially assessed and found to be significant and normal. Furthermore, the skewness and kurtosis were assessed to identify the normality of the distribution of the data. The skewness and kurtosis explain whether the data have issues related to left- and right-skewed data. A skewness between -2 and $+2$ and kurtosis between -7 and $+7$ are considered significant for data normality (Royston, 1992). The reported data in Table 2 confirmed that normality was significantly achieved. Thus, the data reported in Table 2 were considered appropriate for further analysis.

Furthermore, the findings of the measurement model assessment and structural model assessment were investigated via Smart PLS-4. The guidelines for PLS-SEM recommended by Hair *et al.* (2011) were followed. The findings of the measurement model assessment were evaluated via PLS algorithm findings. The measurement model was drawn into Smart PLS 4. The findings of factor loadings were considered to measure the reliability of individual items of different instruments. A factor loading value above 0.60 is considered significant and acceptable (Hair *et al.*, 2010). The factor loading threshold confirmed that all the items were reliable, and no item was deleted. The measurement model is shown in Figure 2, and the factor loading values are shown in Table 3.

The findings of Cronbach's alpha and composite reliability were used to measure the internal consistency and reliability of the instruments. The thresholds for Cronbach's alpha > 0.70 and composite reliability > 0.70 were confirmed for validity and reliability (Cronbach, 1949; Peterson and Kim, 2013). The findings of composite reliability and Cronbach's alpha were significant and above 0.70. Finally, the findings of the average variance extracted were also measured to check the variance in an instrument. The average variance extracted is considered significant when the value is above 0.50. The statistics confirmed that all the constructs had significant variance in the data. The statistics of convergent validity consisting of all factors are reported in Table 3.

Multicollinearity issues were also evaluated in the data to confirm the discrimination in scale items. It was necessary to assess discriminant validity to consider data for further analysis. The findings of the Heterotrait–Monotrait (HTMT) were considered for measuring discriminant validity. It is used to confirm whether two or more constructs of any study have similarities in concepts and data (Hair *et al.*, 2011). The HTMT value should be less than 0.85 for significant discriminant validity (Henseler *et al.*, 2015). The results reported in Table 4 confirmed that all values were less than 0.85. Thus, discriminant validity of the data was achieved, and the data were considered appropriate for further analysis.

The findings of the structural model assessment were used to evaluate the relationships among the variables. The structural model was developed, and calculations of PLS bootstrapping were considered. The findings of $t > 1.96$ were considered significant acceptance of the hypotheses (Hair *et al.*, 2019). In this process, five direct hypotheses and one moderating hypothesis were tested. The structural model is shown in Figure 3.

Table 2. Data normality

No.	Items	Mean	Median	Min.	Max.	SD	Excess kurtosis	Skewness
1	GP1	3.243	3	1	7	1.497	-0.447	0.091
2	GP2	3.243	3	1	7	1.783	-0.547	0.450
3	GP3	3.515	3	1	7	1.872	-0.773	0.325
4	GP4	3.481	3	1	7	1.885	-0.751	0.401
5	GP5	3.527	3	1	7	1.708	-0.435	0.316
6	GSC1	3.490	4	1	7	1.797	-0.684	0.244
7	GSC2	3.494	4	1	7	1.818	-0.870	0.143
8	GSC3	3.665	4	1	7	1.858	-0.771	0.210
9	GSC4	3.695	3	1	7	1.849	-0.725	0.315
10	GSC5	3.657	3	1	7	1.921	-0.754	0.368
11	GD1	3.548	3	1	7	1.869	-0.686	0.388
12	GD2	3.573	3	1	7	1.844	-0.604	0.373
13	GD3	3.594	3	1	7	1.874	-0.742	0.322
14	GD4	3.481	3	1	7	1.780	-0.465	0.450
15	GD5	3.523	4	1	7	1.899	-0.894	0.213
16	GCC1	3.460	3	1	7	1.801	-0.603	0.324
17	GCC2	3.644	3	1	7	1.758	-0.584	0.270
18	GCC3	3.029	3	1	7	1.465	-0.031	0.624
19	GCC4	3.142	3	1	7	1.480	0.582	0.915
20	GE1	3.192	3	1	7	1.419	0.951	0.956
21	GE2	3.105	3	1	7	1.444	0.529	0.781
22	GE3	3.079	3	1	7	1.374	0.585	0.683
23	GE4	3.155	3	1	7	1.497	0.370	0.713
24	GE5	3.105	3	1	7	1.441	0.646	0.845
25	SD1	2.983	3	1	7	1.417	-0.207	0.447
26	SD2	3.151	3	1	7	1.358	0.483	0.663
27	SD3	3.067	3	1	7	1.436	0.215	0.650
28	SD4	3.071	3	1	7	1.463	0.304	0.714
29	SD5	3.172	3	1	7	1.408	-0.128	0.524
30	CSE1	3.243	3	1	7	1.497	-0.447	0.091
31	CSE2	3.243	3	1	7	1.783	-0.547	0.450
32	CSE3	3.515	3	1	7	1.872	-0.773	0.325
33	CSE4	3.481	3	1	7	1.885	-0.751	0.401

Source(s): Author's own work

H1 statistics confirmed that green consumption commitment is a significant predictor of green entrepreneurship ($t = 19.042$). Furthermore, *H2* statistics confirmed that green design is a significant predictor of green entrepreneurship ($t = 2.149$). Accordingly, *H3* statistics confirmed that the green supply chain is a significant predictor of green entrepreneurship ($t = 5.888$). *H4* statistics confirmed that green production is a significant predictor of green entrepreneurship ($t = 9.086$). Moreover, *H5* statistics confirmed that green entrepreneurship is a significant predictor of sustainable development ($t = 4.562$). Finally, it was statistically established that country support for entrepreneurship positively moderates the relationship between green entrepreneurship and sustainable development (*H6*). The path finding statistics are reported in [Table 5](#).

The study confirmed that the role of country support for entrepreneurship as a moderator is significant in the relationship between green entrepreneurship and sustainable development. Thus, the presence of country support for entrepreneurship positively strengthens the relationship between green entrepreneurship and sustainable development. [Figure 4](#) highlights that low country support for entrepreneurship moderates the impact of

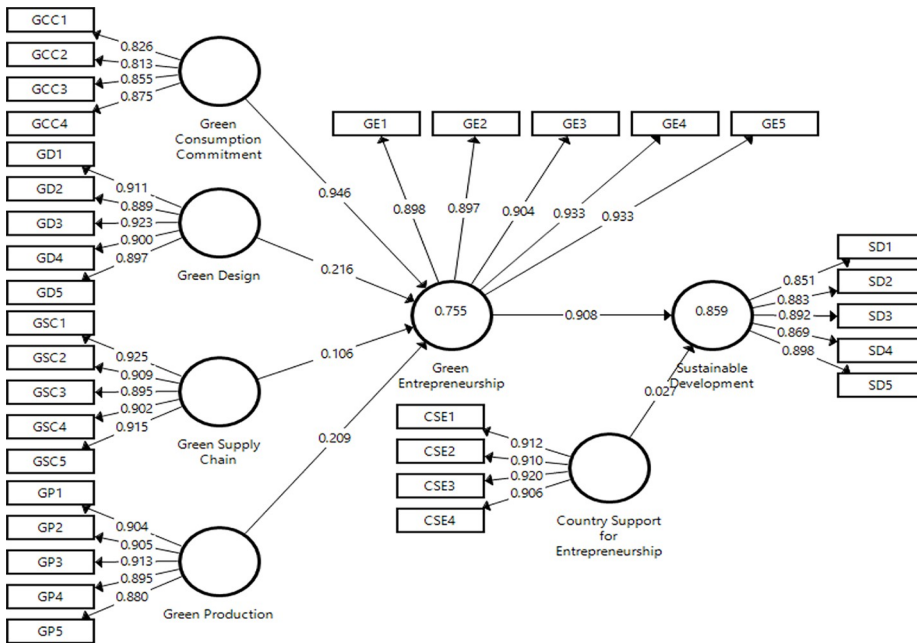


Figure 2. Measurement model

Source: Author's own work

green entrepreneurship on sustainable development at a lower level. Figure 4 also highlights that high country support for entrepreneurship highly moderates the impact of green entrepreneurship on sustainable development. Therefore, it is found that the presence of country support for entrepreneurship has improved the green entrepreneurship working to contribute to sustainable development.

The findings of the effect square were assessed to measure the effect of the independent variables on the dependent variable. It was necessary to measure the level of effect of the independent variables in the model. The effect size was measured by f^2 findings. The effect size is small when it is above 0.02, medium when it is above 0.15 and large when it is above 0.35 (Cohen, 2013). In the current research model, the effect of green consumption commitment is large for green entrepreneurship, and the effects of green design, green production and the green supply chain are small. However, the effect of green entrepreneurship on sustainable development has been reported to be large. The effect size statistics are reported in Table 6.

The predictive relevance was also checked to determine if the model has predictive power. It is significant when the Q^2 value is above 0. The findings reported in Table 7 confirmed that the predictive relevance was significant and above 0. It was measured via the PLS blindfolding test. Hence, the model of this research achieved significant predictive relevance.

Finally, the coefficient of determination was measured to identify the variance explained. According to Hair *et al.* (2011) and Henseler *et al.* (2009), "the rule of thumb for acceptable R^2 value is 0.75 which is considered substantial, 0.50 is moderate while 0.25 is labeled as weak levels of predictive accuracy." The findings reported in Table 8 confirmed that coefficients of determination were substantial for green entrepreneurship and sustainable development.

Table 3. Convergent validity

Construct	Items	Factor loadings	Cronbach's alpha	Composite reliability	Average variance extracted
Country support for entrepreneurship	CSE1	0.912	0.933	0.952	0.832
	CSE2	0.910			
	CSE3	0.920			
	CSE4	0.906			
Green consumption commitment	GCC1	0.826	0.866	0.907	0.710
	GCC2	0.813			
	GCC3	0.855			
	GCC4	0.875			
Green design	GD1	0.911	0.944	0.957	0.817
	GD2	0.889			
	GD3	0.923			
	GD4	0.900			
	GD5	0.897			
Green entrepreneurship	GE1	0.898	0.950	0.962	0.834
	GE2	0.897			
	GE3	0.904			
	GE4	0.933			
	GE5	0.933			
Green production	GP1	0.904	0.941	0.955	0.809
	GP2	0.905			
	GP3	0.913			
	GP4	0.895			
	GP5	0.880			
Green supply chain	GSC1	0.925	0.948	0.960	0.827
	GSC2	0.909			
	GSC3	0.895			
	GSC4	0.902			
	GSC5	0.915			
Sustainable development	SD1	0.851	0.926	0.944	0.772
	SD2	0.883			
	SD3	0.892			
	SD4	0.869			
	SD5	0.898			

Source(s): Author's own work

5. Discussion

In this section, the findings of the research hypotheses are discussed. Discussing *H1*, the statistics confirmed that green consumption commitment is a significant predictor of green entrepreneurship. The findings of this hypothesis are aligned with those of [Saeed and Shafique \(2021\)](#), who reported that green consumption commitment is necessary for green business. Furthermore, [Han \(2020\)](#) findings also emphasized that developing green entrepreneurial businesses that can help to advance green consumption commitment. Another study by [Amankwah and Sesen \(2021\)](#) highlighted that green consumption commitment leads customers to purchase from brands that are working on green strategies.

Table 4. Discriminant validity

Construct	Country support for entrepreneurship	Green consumption commitment	Green design	Green entrepreneurship	Green production	Green supply chain	Sustainable development
<i>Country support for entrepreneurship</i>							
Green consumption commitment	0.727						
Green design	0.767	0.711					
Green entrepreneurship	0.728	0.725	0.668				
Green production	0.758	0.646	0.677	0.739			
Green supply chain	0.673	0.627	0.688	0.696	0.691		
Sustainable development	0.698	0.623	0.646	0.687	0.707	0.667	
Source(s): Author's own work							

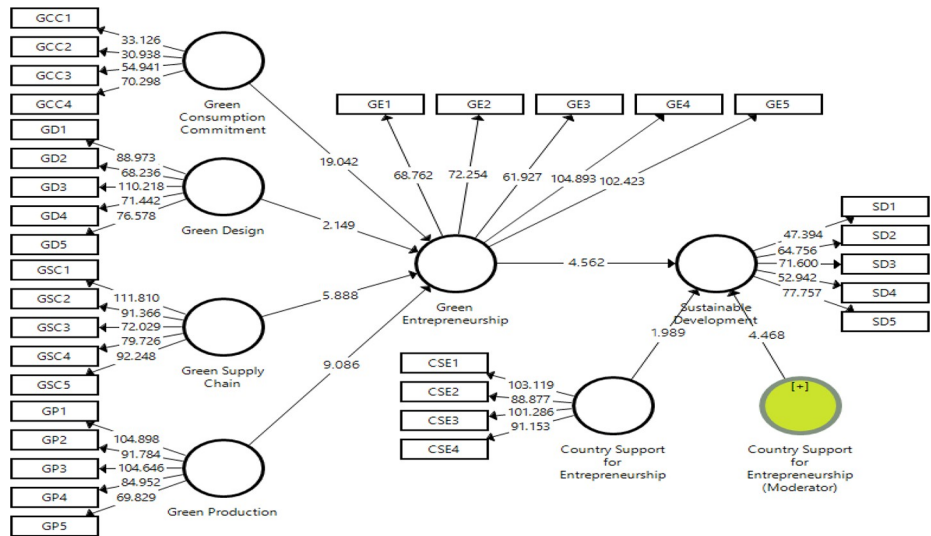


Figure 3. Structural model
Source: Author's own work

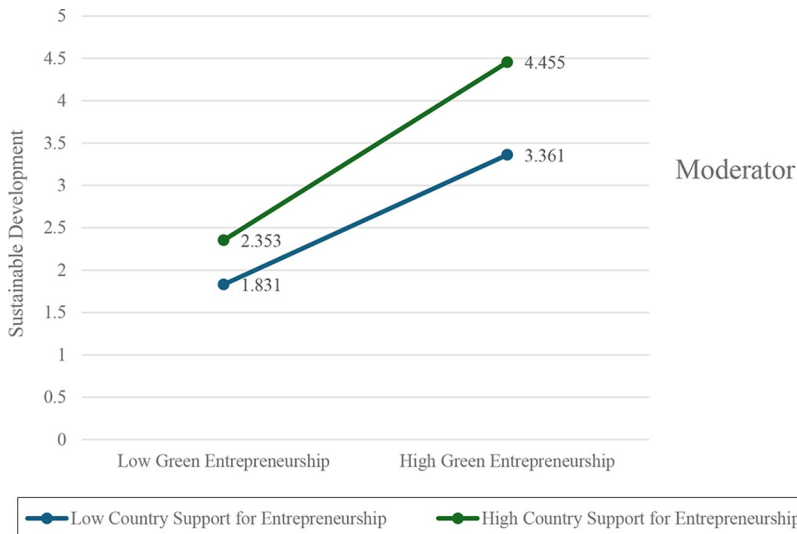
Table 5. Path findings

Hypotheses	Paths	Original sample	SD	t statistics	p values
H1	Green consumption commitment → green entrepreneurship	0.946	0.050	19.042	0.000
H2	Green design → green entrepreneurship	0.216	0.101	2.149	0.032
H3	Green supply chain → green entrepreneurship	0.106	0.018	5.888	0.000
H4	Green production → green entrepreneurship	0.209	0.023	9.086	0.000
H5	Green entrepreneurship → sustainable development	0.908	0.199	4.562	0.000
H6	Country support for entrepreneurship (moderator) → sustainable development	0.143	0.032	4.468	0.000

Source(s): Author's own work

Sun *et al.* (2021) also emphasized that a green business environment is necessary for green production, which is also helpful for green consumption. The findings of this research are similar to those of previous studies Xie *et al.* (2022) and Ogiemwonyi and Jan (2023), which reported that green consumption commitment improves the effectiveness of green entrepreneurship. Therefore, this relationship between green consumption commitment and green entrepreneurship is also accepted in the context of Pakistan.

Furthermore, the findings of H2 indicate that green design is a significant predictor of green entrepreneurship. The relationship between green design and green entrepreneurship is supported by previous research (Huang *et al.*, 2023). Similarly, Chen *et al.* (2020) reported

**Figure 4.** Moderating role of country support for entrepreneurship**Source:** Author's own work**Table 6.** Effect size

Construct	Green entrepreneurship	Sustainable development
Green consumption commitment	1.065	
Green design	0.021	
Green entrepreneurship		3.076
Green production	0.027	
Green supply chain	0.024	

Source(s): Author's own work

Table 7. Predictive relevance

Construct	SSO	SSE	$Q^2 (= 1 - SSE/SSO)$
Country support for entrepreneurship	956	956	
Green consumption commitment	956	956	
Green design	1,195	1,195	
Green entrepreneurship	1,195	450.205	0.623
Green production	1,195	1,195	
Green supply chain	1,195	1,195	
Sustainable development	1,195	411.852	0.655

Source(s): Author's own work

Table 8. Coefficient of determination

Construct	R square	R square adjusted
Green entrepreneurship	0.755	0.751
Sustainable development	0.859	0.858

Source(s): Author’s own work

that the green design of products is based on efficiency and effectiveness in the utilization of resources, which is fundamental to green entrepreneurship. Furthermore, [Basso and Antle \(2020\)](#) reported that green product development is based on green design, which is necessary to improve the commitment to green consumption. [Batwara et al. \(2022\)](#) reported that green product design saves natural resources, which is a core factor of green entrepreneurship. Another study [Rai et al. \(2021\)](#) reported that green production and green design are useful for business development. The findings of [Kong et al. \(2022\)](#) also revealed that green design is useful for saving natural resources, which helps achieve the SDGs. The findings of this hypothesis are significantly accepted in the context of Pakistan.

Accordingly, the findings of *H3* indicate that the green supply chain is a significant predictor of green entrepreneurship. The findings of this relationship are similar to [Bhatia and Gangwani \(2021\)](#) those of, who reported that a green supply chain is the future of businesses that focus on saving natural resources. [Abbasi and Choukolaei \(2023\)](#) also reported that a green supply chain is important for green business development, which is fundamental for green entrepreneurship. [Herrmann et al. \(2021\)](#) reported that modern businesses should focus on green supply chains for imports and exports. [Feng et al. \(2022\)](#) and [Gawusu et al. \(2022\)](#) also asserted that using a green supply chain is a significant factor influencing green entrepreneurship. Hence, this relationship is supported by previous studies and accepted in the context of Pakistan.

With respect to *H4*, the data confirmed that green production is a significant predictor of green entrepreneurship. The findings of [Zameer et al. \(2020\)](#) discussed green production as useful for businesses to grow in the market. Furthermore, [Sun and Wang \(2020\)](#) reported that green production should be a priority for businesses to develop and grow in the market. [Zhang et al. \(2020\)](#) also supported the findings of *H4* while discussing that the efficiency of green production improved responsible production and consumption. On the other hand, [Sana \(2020\)](#) reported that businesses should work significantly to improve green production, which is a key factor for entrepreneurial businesses. The findings of other previous studies [Li et al. \(2023\)](#) and [Han et al. \(2023\)](#) also supported the relationship between green production and green entrepreneurship. Thus, this relationship is also accepted in the context of Pakistan by this research.

Moreover, the findings of *H5* indicate that green entrepreneurship is a significant predictor of sustainable development. This relationship was also supported by the findings of [Skordoulis et al. \(2022\)](#). Furthermore, [Skordoulis et al. \(2022\)](#) reported that green entrepreneurship helps save the natural resources that are important for sustainable development. The research by [Sadiq et al. \(2022\)](#) is also supported by the findings of *H5* while discussing green entrepreneurship as necessary for the sustainable development of business and protection of the natural environment. Moreover, [Tien et al. \(2023\)](#) reported that eco-friendly practices with efficiency and effectiveness are the core of green entrepreneurship. Another study by [Li et al. \(2022\)](#) revealed that green entrepreneurship is an important factor in improving the environment of the world while working on sustainable practices. Similarly, other previous studies ([Zi, 2023](#)) also support the relationship between

green entrepreneurship and sustainable development. Hence, the hypothesis of this study is accepted in the context of Pakistan.

Discussing *H6*, the findings reported that country support for entrepreneurship positively moderates the relationship between green entrepreneurship and sustainable development. Although this relationship was newly developed in the literature, it has been supported by existing studies. [Zi \(2023\)](#) reported that business policies should be developed to support entrepreneurial businesses in improving sustainable development. [Alvarez-Risco *et al.* \(2021\)](#) reported that policies to support newly developed entrepreneurial businesses facilitate growth in the market. Another study [Li *et al.* \(2022\)](#) reported that the government should provide networking and cooperation opportunities for businesses to work for sustainable development. [Amankwah and Sesen \(2021\)](#) reported that support for green business development by the government can lead to environmentally friendly opportunities. The findings of prior studies ([Cai *et al.*, 2021](#); [Murad and Rambely, 2024](#)) also support this hypothesis. Hence, this hypothesis is significantly accepted in the context of Pakistan.

6. Concluding comments and implications

The current research measured the relationships among green production, green design, green consumption commitment, the green supply chain, green entrepreneurship, country support for entrepreneurship and sustainable development. It is concluded that green production, green design, green consumption commitment and the green supply chain are significant predictors of green entrepreneurship. Furthermore, the study concluded that green entrepreneurship is a necessary factor influencing sustainable development. The findings of this research suggest the development of green entrepreneurship for sustainable development, which is the 12th goal (responsible consumption and production) of SDGs set by the United Nations. The targets of responsible consumption and production goals would be achieved by developing countries' support for entrepreneurship. Thus, developing countries are recommended to integrate policies to support entrepreneurship, which is necessary for green entrepreneurship and sustainable consumption. This research makes a novel contribution to the body of knowledge by demonstrating the importance of green entrepreneurship for sustainable development, particularly in terms of responsible consumption and production, which constitute the 12th goal of sustainable development.

6.1 Theoretical implications

The current research contributes to the knowledge of sustainable development and green entrepreneurship to improve our understanding. Specifically, the current research examined the factors that are necessary for working on green entrepreneurship and sustainable development. Previous studies recommended further investigations of green entrepreneurship and sustainable development ([Tien *et al.*, 2020](#)). Therefore, the current research discusses the relationships among green production, green design, green consumption commitment, the green supply chain, green entrepreneurship, country support for entrepreneurship and sustainable development. The current research is the first step in providing a comprehensive model for sustainable development and green entrepreneurship, which is necessary for responsible consumption and production and is the 12th goal among seventeen SDGs. The study empirically confirmed that green production, green design, green consumption commitment and the green supply chain are significant predictors of green entrepreneurship. Hence, the body of knowledge is extended by the findings of this research. Furthermore, the study contributes to the sustainable development literature in that green entrepreneurship has a significant influence on improving sustainable development. Therefore, this study provides related knowledge to advance responsible consumption and production, which is a goal of the United Nations. The

current study also discusses the significant moderating role of country support for entrepreneurship in the sustainable development literature. Thus, this study advances our knowledge and understanding of sustainable development on the basis of green entrepreneurship and country support for entrepreneurship.

6.2 Practical implications

The current work has some implications for practitioners beyond improvements in knowledge. If entrepreneurial students are trained for green consumption, their ability to work for green entrepreneurship can be influenced. Sustainable consumption would be helpful for the sustainability of the environment. Furthermore, if green design is considered for new product development, it would be useful for green entrepreneurship. Similarly, practitioners are required to motivate students toward green production and a green supply chain that is highly dependent on green entrepreneurship. The current work recommends that there is a need for green production, green design, green consumption commitment and a green supply chain for leading students toward green entrepreneurship. The study further recommends that green entrepreneurship be developed by students, which would influence sustainable development. The study reports that the role of country support for entrepreneurship is also critical to students working on entrepreneurship, leading to sustainable development. Therefore, university students must be trained in green entrepreneurship, and they would work for sustainable development. In addition, country-level policies should be developed by the government for bank loans and laws to support green entrepreneurship and sustainable development.

7. Limitations and future directions

The current study has a few limitations that need to be acknowledged to understand the findings with caution. In terms of methodology, only data from Pakistani universities were collected, which limits the generalizability of the findings. Therefore, future studies are required to collect data from a separate set of populations, considering universities from developed countries to interpret the results. The study collected cross-sectional data, which provide findings within a given time frame, which is another limitation in the methodology of this research. Thus, future studies are recommended to collect data with a longitudinal design because these findings might change over time. This would be an appropriate approach for scholars to contribute to literature. However, the current study determined that green production, green design, green consumption commitment and the green supply chain are significant predictors of green entrepreneurship. However, there could be other factors that influence green entrepreneurship. Therefore, future studies should work appropriately and use qualitative research designs to influence green entrepreneurship.

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