STRATEGIC INTEGRATION OF GREEN INNOVATION, GREEN BEHAVIOR, AND INFORMATION SYSTEMS FOR SUSTAINABLE BUSINESS PERFORMANCE & COMPETITIVENESS

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ABSTRACT

Due to the emergence of the need for sustainable development, the COVID-19 pandemic, and the need to conduct business within the framework of the Fourth Industrial Revolution, businesses are facing a difficult environment in which they struggle to achieve and maintain competitiveness. To conduct business in today's globalized environment, innovation, behavior, and information are becoming increasingly important constructs to consider. This article investigates the effects of green innovation, green behavior, and information systems on the sustainable performance and competitiveness of businesses. The relationships between the constructs are discussed in terms of long-term development and post-pandemic business trends. Structural equation modeling is used to analyze data collected from 221 managers of small and medium-sized enterprises. All hypotheses are supported, and the results reveal the influence of green innovation, green behavior, and information systems on sustainable business performance and competitiveness. The findings are discussed, and managerial implications are highlighted, along with suggestions for future research.

Contribution/Originality: Previous research on environmentally friendly operational strategies, such as green behavior, information systems, and green innovation, has all been conducted either prior to COVID-19 or in isolation as related to business performance. The current situation necessitates the widespread adoption of environmentally friendly strategies, and the literature has not yet addressed the combined effect of the variables (green innovation, green behavior, and information systems) on the long-term viability of businesses. This study bridges the literature gap and establishes the combined positive effects of green innovation and green behavior on the business sustainability and competitiveness of manufacturing companies in the post-pandemic era.

1. INTRODUCTION

Environmental, ethical, legal, and social pressures have forced organizations to quickly embrace the environmental sustainability trend that has emerged in recent years. According to the World Resources Institute, global concerns about climate change, natural resource depletion, and environmental protection have put pressure

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on corporations to accelerate their transition toward adequate implementation and adaptation of environmental management systems and practices (Ashton, Russell, & Futch, 2017; Ganda, 2018; Longoni, Luzzini, & Guerci, 2018; Wu, Cheng, & Ai, 2018). In addition, the current business environment is witnessing the new forces of customer boycotts, preferences, and ethical values, all of which have the potential to positively or negatively impact an organization's efforts to gain a competitive advantage. Consumers these days are becoming more environmentally conscious, and their purchasing decisions are influenced by their perceptions of a company's brand image and commitment to environmentally sustainable operations (Ashton et al., 2017; Chung, 2020; Longoni et al., 2018; Wu et al., 2018).

Organizations have therefore already begun incorporating environmental goals into their strategies and policies (Chung, 2020), and as a result, they are devoting more attention to their operational systems, where service operations have been modified to a certain extent to comply with international environmental standards and legislation (Han, Yu, & Kim, 2019; Yu, Li, & Jai, 2017). Despite these efforts, pro-environmental behavior is complicated and necessitates the combination of a variety of interdisciplinary approaches (Jackson, Renwick, Jabbour, & Muller-Camen, 2011). Given this situation, it is difficult to assume that the simple inclusion of environmental objectives into a company's strategies and policies will result in the desired green behavior and outcomes. It follows that including sustainability objectives in a company's overall strategy and implementing a compliance-oriented approach in its operations may not ensure the complete and efficient achievement of those favorable objectives. Environmental behavior must be combined with innovation in order to achieve success. It should have pro-innovative connotations, including connotations of proactivity, voluntary behavior, enthusiasm, and dedication, among others (Ganda, 2018; Paillé, Boiral, & Chen, 2013). All of these characteristics refer to the human factor, which includes individuals' attitudes, perceptions, cognitive judgments, and social values. It is believed that these characteristics will help accelerate the implementation of ecological initiatives (Jabbour et al., 2019). Consequently, there have been calls for human resources management to be included in the environmental discourse by applying the organization's sustainability mantra to the development and implementation of human resources management practices and activities (Kim, Kim, & Han, 2019; Pham, Tučková, & Jabbour, 2019). In response to these calls, the concept of "green human resources management" has emerged, integrating environmental objectives into human resource management practices and activities and promising a positive influence on the environmental outcomes of individuals and organizations.

In the general management literature, the majority of human resource management professionals and scholars have paid particular attention to the role of green human resource management practices in promoting environmentally friendly activities and behaviors in the workplace (Ababneh, 2021; Longoni et al., 2018; Renwick, Redman, & Maguire, 2013; Roscoe, Subramanian, Jabbour, & Chong, 2019). The direct relationship between employee participation and green human resources practices, including green recruitment and selection, green performance management, green training and development, green rewards and incentives, as well as green employee involvement, has been established in the literature. Despite the large amount of research that has been done in this area, most studies have concentrated solely on the performance of organizations as a result of these green activities. However, in light of the current challenges, most businesses are not only concerned with performance, but also with issues of sustainability and competitiveness. Therefore, there is a need for empirical research to prove the effect of green activities on sustainability, especially in the face of the current global COVID-19 pandemic, which provides an opportunity for businesses to focus on their effect on the environment to achieve an advantage in the midst of the challenges they face. This paper addresses that need. Previous research on environmentally friendly operational strategies, such as green behavior and innovation, was conducted either prior to COVID-19 or related solely to business performance. The current situation necessitates the widespread adoption of environmentally friendly behavior and innovation; hence the need for an empirical investigation of the effects of both green behavior and innovation in the current, post-COVID-19 era. Relatively few studies have discovered a

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positive relationship between environmentally conscious behavior and company performance (Asim & Li, 2019; Dumont, Shen, & Deng, 2017; Kim, Kim, Han, Jackson, & Ployhart, 2017; Kim, Kim, Choi, & Phetvaroon, 2019). Others have established that green innovation improves the overall performance of a company (Kraus, Rehman, & García, 2020; Mahto, Belousova, & Ahluwalia, 2020). However, the literature has not yet addressed the combined effect of these variables (green innovation and green behavior) on businesses' long-term viability. Therefore, the current study bridges this gap as it establishes the positive effects of green innovation and green behavior on business sustainability and competitiveness. Another important issue that must be addressed in this context is the role that information systems play in bringing the ideal of green behavior and green innovation to fruition. Management and employees must be aware of their company's internal and external business environments in order to improve business performance in the long term. For this to be sustainable, it requires effective decision-making (Rahimnia & Molavi, 2020) and an adequate supporting information system (Elbashir, Sutton, Mahama, & Arnold, 2021). Some argue that the era of rigid, status-quo-oriented enterprises is over and that the new norms of conducting business are flexibility, rapid adaptation, and risk-taking. Managers must take into account changing market trends due to technological advances and, in the face of today's environmental challenges, must maintain a laser-like focus on satisfying customers to foster customer loyalty and increase customer retention, which, taken together, will have a positive impact on sustainable business practices (Popescu, Iancu, Avram, Avram, & Popescu, 2020). Regarding business metrics and factors, the current body of literature addresses them in a variety of contexts, although there seems to be an oversight when it comes to analyzing the impact of information systems on sustainable business performance and competitiveness (SBP&C), a gap that appears to be particularly relevant in the current transitional environment. This study fills that gap by examining the collective direct effect of green innovation, green behavior, and information systems on the long-term sustainable performance and competitiveness of small and medium enterprises (SMEs) during and after the COVID-19 pandemic. The study is important because it uses a structured approach to look at how businesses in transitional economies are dealing with the challenges of achieving long-term growth and competitiveness in the wake of the COVID-19 pandemic.

2. THEORETICAL FRAMEWORK AND HYPOTHESIS

Business performance and competitiveness must be sustained over time for businesses to survive in a highly competitive environment (Haseeb, Hussain, Kot, Androniceanu, & Jermsittiparsert, 2019a). The synchronization of social and ecological value with economic value is an important component of sustainable business performance and competitiveness (Hair, Risher, Sarstedt, & Ringle, 2019). To achieve social, economic, and environmental objectives, sustainable business performance and competitiveness models must be used (Nosratabadi et al., 2019). Consequently, the concept of sustainable business performance and competitiveness can be thought of as a complex and integrated system of various business objectives that takes into account not only the economic aspects of conducting business but also the impact of doing business on social and environmental dimensions. Sustainable business performance must adapt to market changes and take into account customers' values as well as the technological innovations that impact today's business environment in order to be successful. It has been noted that nowadays, the so-called Industry 4.0 has an impact on the market and how businesses conduct their operations (Haseeb, Hussain, Ślusarczyk, & Jermsittiparsert, 2019b). In this context, it is possible to argue that green innovation, green behavior, and information systems, as components of the broader set of factors that characterize Industry 4.0, could have a positive impact on companies' long-term business performance and competitiveness. The following subsections demonstrate the development of this hypothesis in greater detail.

2.1. Green Innovation and Sustainable Business Performance & Competitiveness

Green innovations include extraction and exploration innovations, with the former focusing on improving but not radically altering existing products and processes to make them more environmentally friendly, and the latter

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focusing on introducing new products and processes into existing markets (Rehman, Kraus, Shah, Khanin, & Mahto, 2021). New products and processes developed as a result of green innovation have the potential to fundamentally alter existing business models, thereby significantly reducing their negative environmental impact (Ar, 2012). Green innovation that is based on exploratory research may also result in the development of novel products and processes that can aid in the cleaning and recovery of the environment (Saxena & Khandelwal, 2012). Overall, green innovation can help businesses grow and recover the costs of raw materials, which have been rising in recent years (Chen, 2008). It is thought to be linked to the overall success of a company (Kraus et al., 2020; Mahto et al., 2020). Furthermore, research has demonstrated that a company's environmental strategy, as well as specific proactive strategies aimed at developing environmentally friendly technologies, can have a positive impact on its financial outcome (Fousteris, Didaskalou, Tsogas, & Georgakellos, 2018; Walker, Ni, & Huo, 2014). On the other hand, an inefficient management culture could result in a company's environmental strategy becoming reactive rather than proactive, potentially increasing the risk of disasters and damaging the company's reputation (Zhang, Wang, & Zhao, 2019). The natural-resource-based theory considers pollution prevention, product stewardship, and sustainable development important environmental strategies that help firms gain competitive advantages over their competitors (Hart, 1995; Hart & Dowell, 2011). Therefore, the following hypothesis was developed:

Hypothesis 1 (H1): green innovation is positively associated with sustainable business performance & competitiveness.

2.2. Green Behavior and Sustainable Business Performance & Competitiveness

Through ecologically responsible work practices, it is possible to establish a long-term competitive edge. As a result of rising population numbers and new city growth, the environment is under three times as much stress as previously (Iqbal, Hassan, Akhtar, & Khan, 2018). According to the World Bank (Uwem, Oyedele, & Olubiyi, 2021), because the public is increasingly aware that economic growth leads to increased environmental degradation, business actors have a responsibility to decrease the detrimental impact of their operations on the environment. In addition, individuals are confronted with significant obstacles as a result of the overexploitation of human resources, environmental deterioration, and unsustainable living standards, among other factors (Uwem et al., 2021). Moreover, recent environmental disasters have been caused by excessive tree cutting, the burning of fossil fuels, and the production of carbon monoxide as a result of organizational and human activity (Fawehinmi, Yusliza, Mohamad, Faezah, & Muhammad, 2020). In short, the increase in the number of people and the production of industrial waste has serious ramifications for mankind and businesses (Iqbal et al., 2018). According to previous studies, green workplace conduct increases an organization's overall success (Dumont et al., 2017; Kim et al., 2017; Kim et al., 2019). Consumers, particularly those of small and medium-sized enterprises (SMEs), are increasingly concerned with cleanliness and environmental sustainability in this post-pandemic era, meaning that SMEs that care about the environment have a more positive image in the eyes of consumers. Employee understanding of the importance of environmental sustainability is critical to a firm's long-term viability (Süßbauer & Schäfer, 2018). Dumont et al. (2017) emphasized that creating an ecologically friendly culture in the workplace will increase employee motivation and satisfaction. Additionally, Ababneh (2021) and Kim et al. (2017) found that encouraging green behavior in the workplace boosts employee happiness, which leads to improvements in the overall performance of the organization. Therefore, the following hypothesis was developed:

Hypothesis 2 (H2): green behavior is positively associated with sustainable business performance & competitiveness.

2.3. Information Systems and Sustainable Business Performance & Competitiveness

Because of the hyper-distributed nature of information in today's business world, organizations must adapt and implement information systems to successfully perform business activities, as well as to attain and maintain a solid competitive position in the market. The successful implementation of those information systems and their

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appropriate application in accordance with market demands and corporate objectives are two separate but related tasks (Sánchez-Hernández, Vázquez-Burguete, García-Miguélez, & Lanero-Carrizo, 2021). Technology-enabled information systems are at the heart of a modern and sustainable circular economy model, in which the use of digital platforms, data analysis, block-chain technologies, artificial systems, and other ICT solutions is increasingly becoming a must for business success (Roztocki, Strzelczyk, & Weistroffer, 2020). It is estimated that the number of organizations using some type of information system will increase in tandem with an increase in the fragmentation and segmentation of markets where information is the driving force of business. The fact that the analysis of market dynamics and business objectives is required when developing an information system solution further demonstrates that obtaining the optimal cost-benefit ratio from the implemented solution is essential. Taking the changes brought about by the COVID-19 pandemic into consideration, it becomes clear that businesses today, as Laudon and Laudon (2020) note, have become even more reliant on effective and efficient information systems than they were before the outbreak. In this context, it is clear that the use of information systems in various organizations will continue to spread rather than diminish.

Overall, the implementation and deployment of information systems are critical, as evidenced by the substantial majority of businesses that use some form of information system. Because of this, the use of information technology has become almost a requirement to "keep up" with competitors in the market (DeLone & McLean, 2016).

A well-implemented information system has a favorable impact on the performance of a variety of corporate activities, including, but not limited to, supply chains, decision making, and real-time data tracking (Peppard & Ward, 2016). The implementation of an information system can help an organization make long-term improvements in the areas of time management, cost overruns, safety, quality management, customer value management, safety issues, and other business metrics and procedures (Lu, Pishdad-Bozorgi, Wang, Xue, & Tan, 2019; Zeng, Lee, & Lo, 2020). As a result, the following hypothesis is proposed:

Hypothesis 3 (H3): information systems are positively associated with sustainable business performance & competitiveness.

3. METHOD

A quantitative research design follows a logical approach in which hypotheses are developed and tested. Therefore, a quantitative methodology based on the deductive technique is used in this study, and quantitative data is used to investigate the link between the study variables (Creswell & Creswell, 2017). The quantitative information was acquired through the use of survey instruments, such as questionnaires with closed-ended questions concerning the variables under investigation.

3.1. Population and Sample

According to a national study conducted by the Small and Medium Enterprises Development Agency of Nigeria in 2017, Nigeria has 82,534 registered small and medium-sized manufacturing firms. This industry is well-known for producing significant amounts of air pollution, waste, and water pollution. It is also a significant contributor to climate change and the overconsumption of natural resources, among other things. Thus, these small and medium-sized manufacturing companies represent a relevant group for the present research. The sample size was determined using the sample size chart developed by Krejcie and Morgan (1970). The appropriate sample size was determined to be 384 enterprises. Questionnaires were issued to managers at each firm using a convenience sampling approach, and after a series of follow-ups, 221 questionnaires were returned, representing a response rate of 57%.

3.2. Measurement and Method of Analysis

All variables within the study were assessed using previously developed scales. The scales were well-developed and their reliability and validity have been strongly confirmed. The coefficient alphas reported in the original

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studies were above 0.70 for all scales, and a five-point Likert scale was used in the questionnaire. The measurement scale for green innovation, which comprises product and process innovation, was adapted from Singh, Del Giudice, Chierici, and Graziano (2020); the scale for green behavior from De Roeck and Farooq (2018); the scale for information systems from Djalic, Nikolic, Bakator, and Erceg (2021); and the scale for sustainable business performance and competitiveness, which comprises items on economic, environmental, and social welfare, was adapted from Khan, Wu, Saufi, Sabri, and Shah (2021). Tables 1 to 4 show the array of measurement scales used in the study.

Table 1. Concept and measurement scale – green innovation (GI).

Conceptualization	Code	Item
Green innovation is an invention that focuses on waste reduction, pollution prevention, and environmental management systems.	Product Innovation	
	GI1	The enterprise uses materials that consume less energy and resources.
	GI2	The enterprise uses materials that produce the least pollution.
	GI3	The enterprise uses materials to design environmentally friendly products.
	GI4	The enterprise uses materials that are easy to recycle, reuse, and decompose.
	Process Innovation	
	GI5	The manufacturing processes of the enterprise effectively reduce hazardous substances or waste.
	GI6	The manufacturing processes of the enterprise effectively reduce the use of raw materials.
	GI7	The manufacturing processes of the enterprise effectively reduce the consumption of coal, oil, electricity, or water.

Table 2. Concept and measurement scale – green behavior (GB).

Conceptualization	Code	Item
Green behavior is a set of actions taken with the goal of reducing the negative environmental impact of operations and contributing to the long-term sustainability of the environment.	GB1	The enterprise insists on the adequate completion of duties in environmentally friendly practices.
	GB2	Employees carry out the responsibilities outlined in their job description in an environmentally friendly manner.
	GB3	Employees perform the job tasks that are expected of them in environmentally friendly ways.
	GB4	Employees have a chance to get actively involved in environmental protection at work.
	GB5	Employees take the initiative to act in environmentally friendly ways at work.
	GB6	Employees do more for the environment at work than expected.

Table 3. Concept and measurement scale – information systems (IS).

Conceptualization	Code	Item
An information system (IS) refers to a collection of various pieces of equipment that are used in the gathering, processing, storage, and distribution of information.	IS1	The enterprise has modern information systems.
	IS2	Modern information systems are widely used in the enterprise.
	IS3	The enterprise applies information systems when hiring new employees.
	IS4	Information systems are applied in a sustainable manner.
	IS5	Employees have access to information systems.
	IS6	Communication through information systems is widely used in the enterprise.
	IS7	All employees are trained to work with information systems owned by the enterprise.
	IS8	Information systems are applied in the quality section.
	IS9	Information systems are applied in the human resources section.
	IS10	Information systems are applied in the manufacturing section.
	IS11	The enterprise invests in modern information systems so it can develop business processes in a sustainable manner
	IS12	The enterprise seriously takes into consideration sustainable development through advanced information systems.
	IS13	Information systems are applied by both managers and employees.

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To follow the methods and recommendations of strategic and operations management studies, it was decided to use SmartPLS-SEM to evaluate the acquired data and test the study hypotheses (Adel, Mahrous, & Hammad, 2020; Bambale & Shamsudin, 2015; Hair, Sarstedt, Pieper, & Ringle, 2012). As stated in the introduction to this paper, the research integrates three environmentally significant variables and determines the combined influence of these variables on sustainable company performance and competitiveness in the global marketplace. SmartPLS was selected because it offers the ability to analyze complicated structural models in which the scores of the latent variables are employed in a successive analysis to analyze contemporary links (Hair et al., 2019; Raza, Rather, Iqbal, & Bhutta, 2019).

Table 4. Concept and measurement scale – sustainable business performance & competitiveness (SBP&C).

Conceptualization	Code	Item
Sustainable Business Performance & Competitiveness (SBP&C) is a complex and interconnected system of diverse business objectives that takes into account not only the economic aspects of doing business but also the impact on social and environmental components.	Economic performance	
	SBPC1	Return on investment (ROI) has increased above the industry average during the last 5 years.
	SBPC2	Sales growth has increased above the industry average during the last 5 years.
	SBPC3	Profit growth rate has increased above the industry average during the last 5 years.
	SBPC4	Market share has increased during the last 5 years.
	Environmental performance	
	SBPC5	The efficiency of the consumption of raw materials has improved during the last 5 years.
	SBPC6	Resource consumption (thermal energy, electricity, water) has decreased (e.g., per unit of income, per unit of production) over the last 5 years.
	SBPC7	The percentage of recycled materials has increased during the last 5 years.
	SBPC8	The waste ratio (e.g., kg per unit of product, kg per employee per year) has decreased during the last 5 years.
	Social performance	
	SBPC9	The turnover ratio has decreased during the last 5 years.
	SBPC10	Employees' satisfaction has increased during the last 5 years.
	SBPC11	Employees' motivation has increased during the last 5 years.
	SBPC12	Health and safety performance has improved during the last 5 years.
	SBPC13	Employee education and training (man-days per employee per year) have increased during the last 5 years.

4. ANALYSIS AND RESULTS

4.1. Measurement Model

Initially, the measurement model was tested using the algorithm on SmartPLS; factor loadings, Cronbach's Alpha, and composite reliability were all calculated to determine the reliability and validity of the study measures. With the exception of two items (GI7 and IS4), which were later removed from consideration due to low loading, as shown in Table 5 and Figure 1, all items loaded above 0.5, as illustrated in Table 5.

4.2. Reliability and Validity Test

The results of the reliability and validity analyses are presented in Table 5. Cronbach's alpha was used to conduct a reliability analysis of the scales to assess their consistency. Ordinarily, the dependability coefficient of Cronbach's alpha is between 0 and 1, with a maximum of 1. The researchers determined that a good scale should have a coefficient greater than or equal to 0.80, an acceptable scale has a coefficient greater than 0.70, and an exploratory scale has a coefficient greater than or equal to 0.60. (Hair, Ringle, & Sarstedt, 2013). The Cronbach's

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alpha results are GI (0.929), GB (0.883), IS (0.912), and SBP&C (0.946). These indicators thus met all the requirements. Because none of the scales scored below 0.80, it implies that they are good and reliable measures of the relevant structures.

4.3. Composite Reliability

As a convergent validity test in a reflective model, composite reliability has advantages over Cronbach's alpha. It may be preferred as a measure of reliability to Cronbach's alpha since Cronbach's alpha has the potential to overestimate or underestimate scale reliability. Composite dependability is a numeric value between 0 and 1, with 1 indicating complete estimated reliability. Composite reliabilities should be equal to or greater than 0.6 in an exploratory model (Chin, 1998; Hock, Ringle, & Sarstedt, 2010); equal to or greater than 0.70 in a confirmatory model (Henseler, Ringle, & Sarstedt, 2015); and equal to or greater than 0.80 in confirmatory research (Daskalakis & Mantas, 2008). As shown in Table 5, the composite reliability values for GI (0.944), GB (0.911), IS (0.925), and SBP&C (0.953) demonstrate that all reflective paradigms exhibit a high level of internal consistency reliability. When the composite reliability and Cronbach's alpha values are considered, it is clear that the adapted measurement scales are extremely trustworthy.

4.4. Average Variance Extracted

The average variance extracted (AVE) can be used to test both convergent and divergent validity. In a reflective model, AVE represents the average communality for each latent factor. In an appropriate model, AVE should be greater than 0.5 (Chin, 1998) and greater than the cross-loadings, implying that the components should explain at least half the variance of their respective indicators. When the AVE is less than 0.50, it signifies that the error variance exceeds the explained variance. As shown in Table 5, the AVE values are GI (0.738), GB (0.631), IS (0.508), and SBP&C (0.612). This proves the validity of the constructs.

Table 5. Construct reliability and validity.

Constructs	Loadings Range	Cronbach's α	Composite Reliability	Average Variance Extracted (AVE)
Green Innovation (GI)	0.779-0.900	0.929	0.944	0.738
Green Behaviour (GB)	0.717-0.869	0.883	0.911	0.631
Information System (IS)	0.588-0.778	0.912	0.925	0.508
Sustainable Business Performance & Competitiveness (SBP&C)	0.640-0.887	0.946	0.953	0.612

4.5. Structural Model

The structural model included several tests, such as estimating path coefficients and their significance by running bootstrapping. In this investigation, the bootstrapping option was employed to determine the statistical significance of the route coefficient and to compute the t-values. The bootstrapping had 500 subsamples. Green innovation (= 0.394, t = 4.329, p 0.001), green behavior (= 0.97, t = 2.439, p 0.05), and information systems (= 0.203, t = 2.366, p 0.05) are all positively associated with long-term business performance and competitiveness, as demonstrated in Table 6 and Figure 2. Hence, H1, H2, and H3 are supported.

The coefficient of determination (R^2) was deemed satisfactory with a value of 0.313. Regarding the predictive relevance and effect size, as a guideline, Q^2 values of 0.35 (high), 0.15 (medium), and 0.02 (small) have predictive relevance (Cohen, Manion, & Morrison, 2013). Therefore, Table 7 and Figure 3 show that with Q^2 = 0.179, sustainable business performance and competitiveness fall into the medium range of predictive relevance. According to Götz, Liehr-Gobbers, and Krafft (2010), f^2 demonstrates whether exogenous variables have a significant impact on the endogenous variable. According to Cohen (1992) in Lorah (2018), the f^2 value is comprised of various categories of smaller (f^2=0.02), medium (f^2=0.15), and higher effects (f^2=0.35). Table 8 shows that green innovation

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has a medium effect on sustainable business performance and competitiveness, whereas green behavior and information systems have a smaller effect.

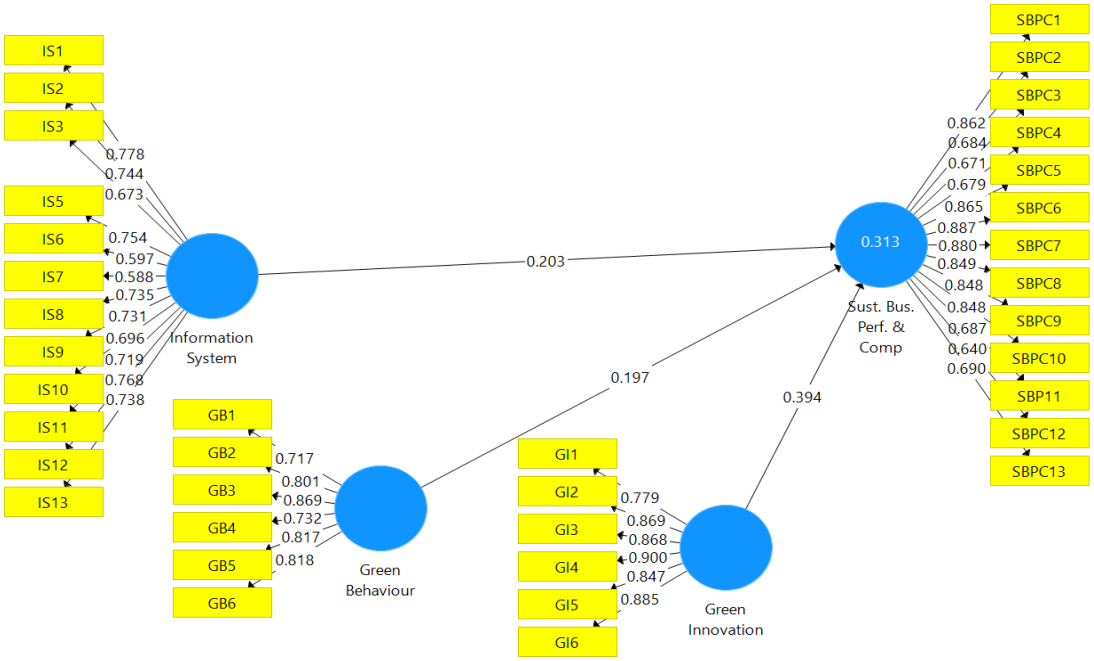


Figure 1. Smart PLS algorithm graph.

Table 6. Mean, STDEV, T-values, P-values.

Relationship	Beta	STDEV	T Statistics	P Value
H1: GI -> SBP&C	0.394	0.091	4.329	p≤0.001
H2: GB -> SBP&C	0.197	0.081	2.439	p≤0.050
H3: IS -> SBP&C	0.203	0.086	2.366	p≤0.050

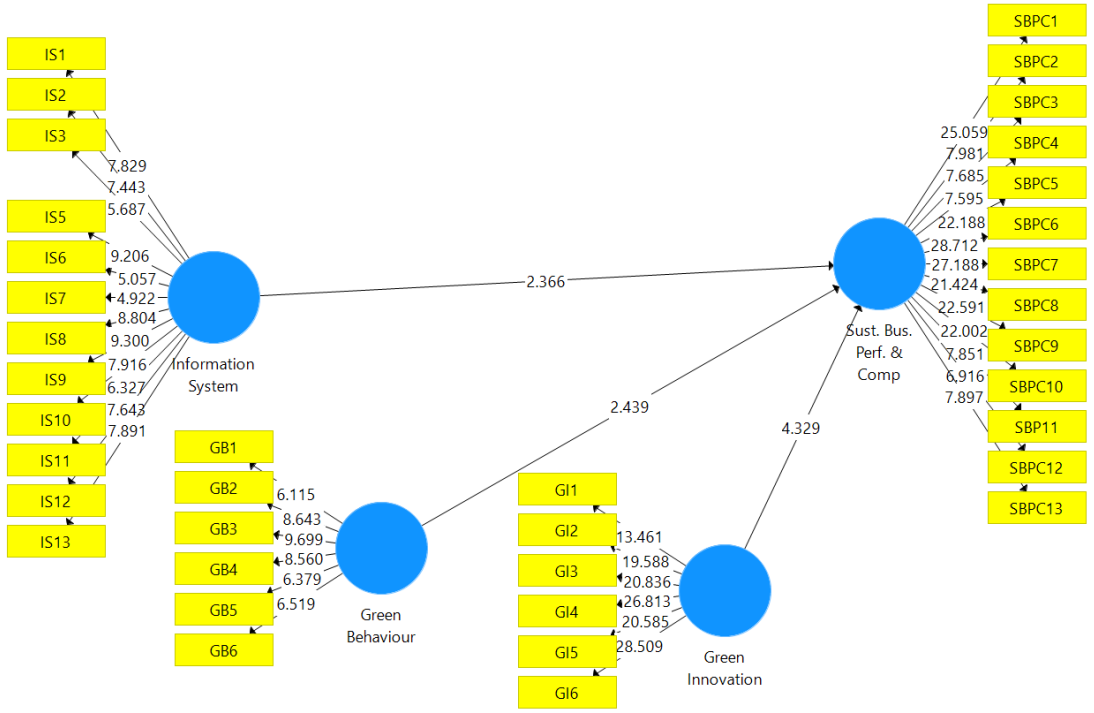


Figure 2. Smart PLS bootstrap graph.

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Table 7. Predictive relevance.

Constructs	SSO	SSE	Q^2
Sustainable Business Performance & Competitiveness	1274.000	1045.575	0.179

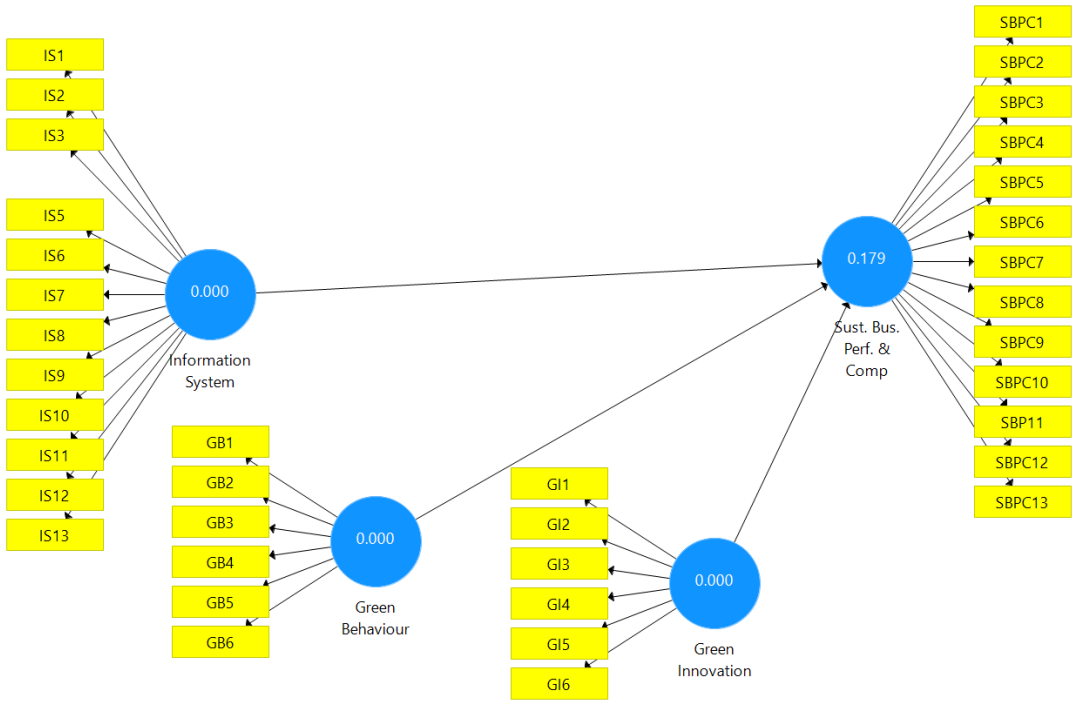


Figure 3. Blindfolding graph.

Table 8. The effect size of a model.

Constructs	f^2	Effect size based on Cohen (1992)
Green Innovation	0.202	Medium
Green Behavior	0.055	Small
Information System	0.054	Small

5. DISCUSSION, IMPLICATIONS, AND CONCLUSION

According to the existing theory of natural resource-based economics, businesses must employ pollution reduction measures, product stewardship, and sustainable development to attain competitiveness (Hart & Dowell, 2011). This research developed three hypotheses and investigated the effects of green innovation, green behavior, and information systems as independent variables on the dependent variable of sustainable business performance and competitiveness. All three proposed hypotheses (H1, H2, and H3) were supported, indicating that green innovation, green behavior, and information systems are all positively linked with long-term corporate success and competitiveness in the current "new normal" era of the COVID-19 pandemic. This bridged the literature gap by establishing the positive effects of green innovation and green behavior on business sustainability and competitiveness. The findings are consistent with previous studies in the area of green innovation (Kraus et al., 2020; Mahto et al., 2020); green behavior (Dumont et al., 2017; Kim et al., 2017; Kim et al., 2019), and information systems (DeLone & McLean, 2016; Lu et al., 2019; Peppard & Ward, 2016; Zeng et al., 2020), and above all, with the existing theory of natural resource-based economics (Hart, 1995).

The findings suggest that, with the challenge posed by the current COVID-19 pandemic, manufacturing enterprises should aim to effectively blend green behavior with green innovation and good information systems to achieve sustainable performance and competitiveness. Specifically, this study provides the managers of manufacturing enterprises with empirical evidence on the relative significance of green innovation practices in enhancing the firm's successful and efficient implementation of environment-related policies and strategies. For

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example, manufacturing firms are among the largest contributors to environmental degradation. Hence, for long-term environmental sustainability, an ecosystem approach to manufacturing management must be adopted by manufacturing firms as well as the government and other regulatory agencies.

Additionally, this study confirms the findings of the literature and provides a clear understanding that having a green innovation strategy alone or concentrating on only information systems is not enough to achieve sustainable performance and competitiveness. Managers of manufacturing firms need to adopt a comprehensive approach by integrating green innovation, green behavior, and information systems so that the issue of environmental protection and management becomes the responsibility of all.

The findings of this study can also help managers of manufacturing enterprises gain insight into how to adopt environmentally friendly strategies that enable their organization to shift from focusing solely on making a profit margin to becoming socially innovative by presenting innovative solutions to social, economic, and environmental problems and challenges, thereby ensuring their long-term viability and sustainability. This can be achieved by integrating the following:

- Innovation that focuses on waste reduction, pollution prevention, and environmental management systems.
- A set of actions taken with the goal of reducing the negative environmental impact of operations and contributing to the long-term sustainability of the environment.
- An information system consisting of various pieces of equipment used in information gathering, processing, storage, and distribution.

6. LIMITATIONS AND FUTURE RESEARCH

The paper focuses on small and medium manufacturing enterprises and used a self-reporting approach in a cross-sectional design, which limits the ability to draw definitive conclusions on the causal order of the tested associations. Therefore, it is recommended that this study be replicated, first in service-oriented organizations, then in larger companies, also taking employees' perceptions into account. Additionally, a longitudinal research approach should be adopted to confirm the findings of this study.

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