Strategic Innovations for Sustainability and Their Impact on Business Performance in Dynamic Environments: A Mediatedâ€“Moderation Perspective

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Abstract

Purpose: This paper explores how strategic innovation (SI) can impact business performance (BP) through the mediating effect of sustainability (SS) and moderating effect of environmental dynamism (ED). The research is seeking to comprehend how companies can improve on performance outcomes through incorporation of innovation strategies with sustainability practices within dynamic business environments.

Design/methodology/approach: The study adopted a quantitative and cross-sectional research design. A survey was conducted on 188 enterprises which practiced sustainability using a structured questionnaire. The hypothesis was tested using Structural Equation Modeling (SEM) to assess the direct and mediating as well as the moderating relationships between SI, SS, BP, and ED.

Findings: The results demonstrate that SI has a positive impact on BP both directly and indirectly via SS. Sustainability was identified as a considerable mediating variable, which means that the better the organizations are aligned to sustainability goals, the better the performance results are achieved. Moreover, the ED mediates the association between SI and BP in a positive manner, which implies that innovation strategies are more efficient in uncertain and rapidly changing conditions.

Originality: This research has implications in the current body of literature as it creates a comprehensive framework that explores the direct, intermediate and moderating relationships between SI, SS, BP and ED concurrently. The research offers empirical information on the enhancement of strategic innovation on organizational performance by sustainability and environmental dynamism, thus presenting a holistic view of strategic management in business sustainability in contemporary business settings.

Keywords - Strategic Innovations, Sustainability, Business Performance, Dynamic Environments

1 Introduction

In the world where environmental issues and competition are growing, organizations are forced to reconcile economic goals with the wider sustainability objectives. This change has made the concept of sustainability (SS) one of its main strategic priorities as companies need to incorporate the environmental and social concerns into their business operations. Strategic innovation (SI) has been such a process in the context of which organizations have the possibility to attain sustainable growth besides improving business performance (BP). SI involves how new processes, technologies, and business models can be developed in a manner that helps firms to respond successfully in changing market demands and sustainability issues (Boons et al., 2013; Varadararajan, 2017).

The current literature points out that SI has a considerable contribution to enhancing firm competitiveness and performance. When actively involved in SI, organizations are in a better position to gain in efficiency, differentiation, and long-term value creation (Prajogo, 2016; Kalay & Lynn, 2015). Simultaneously, SI will help firms to embrace sustainable practices, which may involve decreasing the amount of resources used, introducing technology-friendly methods, and improving social responsibility (Tseng et al., 2019; Le, 2022). Consequently, SS has become more and more accepted as a primary consequence of innovation-based approaches and a major driver of enhanced BP (Fernando et al., 2019; Kneipp et al., 2019).

Nevertheless, the connection between SI and BP is usually indirect and it works via SS. Companies that effectively integrate sustainability in their innovation policies are likely to have better performance results because of the enhanced reputation, performance, and credibility of stakeholders (Klein et al., 2021; Rubio-Andrés et al., 2025). Moreover, external environmental conditions affect the effectiveness of SI. Environmental dynamism (ED) defined by swift technological transformations and uncertainty in the market is significant in determining the way innovation converts into performance outcomes. SI has a more significant effect on SS and BP in a highly dynamic environment because companies must always be innovative to stay competitive (Ch'ng et al., 2021; Rauter et al., 2019).

Although the body of research continues to expand, there is paucity of empirical studies that combine SI, SS, BP, and ED into a single model especially through the combination of mediating and moderating mechanisms. To fill this gap, the current research study comes up with a detailed model to investigate the direct effect of SI on BP, the mediating effect of SS, and the moderating effect of ED.

The rest of the paper is organized in the following way. The review of literature and hypothesis development is presented in the next section. This is followed by the research methodology, data collection and measurement scales. Empirical results and hypothesis testing are reported in the following section. Lastly, the paper is concluded with a discussion of findings, implications, limitations, and future research directions.

2 Review of Literature

2.1 Literature Review Methodology

A systematic review of the literature on SI, SS, BP, and ED was used in the conduction of the literature review of this study. Peer-reviewed research articles (n=50) were identified in well-known academic databases including Scopus, Web of Science, Science, Direct and Google Scholar to make sure that the articles are of the high quality and impact. The criteria used in the selection process were mainly publications dating back to 2010 to 2025, with some of the early works that were seminal also included to give theoretical background. Some of the main search terms were strategic innovation and sustainability and business performance and environmental dynamism and green innovation and sustainable business strategies and innovation performance. The articles were filtered according to their relevance to the study variables, the empirical rigor, and the development of the theory. Only those studies which specifically studied the relations between innovation, sustainability, and performance were kept. The last literature was critically discussed and synthesized to detect the main themes, theoretical connections, and gaps in the research, which will serve as the foundation of the conceptual framework and hypothesis writing of the study.

2.2 Literature Analysis

The literature confirms that SI is not just the technological advancement but a total strategic approach of business models, processes, and organizational change in line with SS objectives. The early typologies of Szekely and Strebel (2013) distinguish between SI in the form of incremental, radical, and game-changing innovations, each of which has a different impact on SS outcomes. In a similar manner, Boons et al. (2013) underline that long-term BP is impossible without integration of sustainability in the business models. Varadararajan (2017) defines the concept of sustainable innovation as the strategic orientation, which aligns environmental and social goals and competitive advantage. This view is supported by Dogan (2017) who proposes that the innovation needs to be integrated into the corporate strategy to create quantifiable performances. Therefore, SI is an introductory mechanism by which companies can attain SS and remain competitive.

2.2.1 SI as a BP driver

There is a substantial amount of literature on the positive association between SI and BP. Empirical research establishes that companies that embrace innovative strategies can better enhance operational efficiency, flexibility, and financial outcome. Hermundsdottir and Aspelund (2022) demonstrate that innovations with sustainability in mind can greatly benefit BP, especially within competitive manufacturing. On the same note, Prajogo (2016) underlines that the level of alignment of innovation strategies with environmental conditions is the key to high-performance. Kalay and Lynn (2015) also believe that structured SI practices enhance innovation performance, which in turn can boost BP. Gomes et al. (2013) also affirm that sustainable management strategies that are innovation based will result in enhanced organizational performance. All these results suggest that SI is a determinant of BP that cannot be ignored, but its performance can be influenced by other organizational and environmental factors.

2.2.2 SI and SS

The connection between SI and SS has a long history of literature, and innovation has been defined as one of the factors that enable sustainable practices. Companies investing in SI tend to adopt more environmentally friendly processes, use fewer resources and increase their social responsibility efforts. Tseng et al. (2019) show that environmental innovation capabilities are greatly dependent on strategic orientation, which positively affects SS outcomes. Le (2022) also emphasizes that green innovation, when it is consistent with the corporate strategy, turns sustainability efforts into practical outcomes. Likewise, Wijethilake et al. (2018) reiterate the importance of management control systems in promoting environmental innovation strategies. These studies indicate that SI is critical in integrating sustainability in organizational processes and attainment of SS objectives.

2.2.3 SS and BP

SS has become a key defining factor of BP, with organizations becoming more aware of the economic advantages of sustainable practices. Companies which take sustainability measures usually achieve increased efficiency, reputation, and stakeholder trust. Kneipp et al. (2019) present empirical data that the sustainable innovation practices are positively related to the firm performance. Fernando et al. (2019) also indicate that environmental innovation is a contributor to sustainable BP, especially in technology-intensive industries. Maletič et al. (2016) also note that sustainability-oriented innovation practices enhance the overall performance of the organization. These results show that SS is not a strategic BP driver only or merely an ethical or regulatory imperative.

2.2.4 Mediating Role of SS

One of the major themes in the literature is the mediating effect of SS in the correlation between SI and BP. It has been found out that the effect of SI on BP is usually indirect and works in the form of sustainability practices. Klein et al. (2021) discover that BP is affected by sustainability-oriented innovation via business model innovation, which underscores the relevance of considering sustainability in innovation strategies.In a parallel manner, sustainability and innovation performance have been cited as mediating variables in the corporate strategies and sales performance as stated by Rubio-Andrés et al. (2025). These are indications that SS is a key process by which SI can be converted into better BP and firms must ensure that innovation is integrated with the sustainability goals.

2.2.5 Green Innovation and Environmental Strategies

Green innovation is a very important aspect of SI and contributes greatly to the realization of SS and BP. Such works as Liu et al. (2024) distinguish between various forms of green innovation and their effects on performance, referring to both direct and indirect ones. Fernando et al. (2019) also show that environmental innovation is beneficial to BP as it improves service capabilities.According to Baeshen et al. (2021), the critical factors of green innovation are culture and leadership within the organization and external forces. Correspondingly, Srouji et al. (2023) validate the fact that green innovation has a positive impact on sustainability and financial performance. Such studies emphasize the need to incorporate environmental concerns to SI.

2.2.6 Innovation Capabilities and Organizational Competitiveness

The ability to innovate is always cited as one of the factors that affect SS and BP. Hanaysha et al. (2022) prove that companies that have great levels of innovation attain greater sustainability and business success. Jin and Choi (2019) also discover that innovation ability also has a significant influence on BP in service and technology companies.Khan and Naeem (2018) also associate strategic quality orientation and innovation capabilities by demonstrating that quality strategies promote innovation and improvement of BP. The results indicate that the organizational capabilities are important in harnessing SI to better performance results.

2.2.7 Enterprise Innovation and Sustainability Integration

To incorporate SS into corporate strategy, business model innovation is critical. According to Cheah et al. (2018), novel business models can help a company attain sustainable performance within the competitive industry. It is also important to note that the authors in the research by França et al. (2017) stress the need to develop business models which facilitate strategic sustainable development. Hall and Wagner (2012) emphasize that, when sustainability is incorporated in firm processes, backed by innovation, it has a great role in enhancing BP. These reports confirm the significance of ensuring that business models are aligned to sustainability goals in order to fully utilize the advantages of SI.

2.2.8 Role of ED

External environmental factors, especially ED, affect the effectiveness of SI in the enhancement of SS and BP. Firms in dynamic settings where the pace of technological change and market uncertainty is high are more inclined to enjoy the benefits of SI. Chng et al. (2021) show that market turbulence enhances the association between eco-innovation and sustainable performance. Rauter et al. (2019) also emphasize that dynamic environments make innovation more effective as they make it more adaptable and responsive. Another crucial aspect of the achievement of high-quality BP is the alignment of strategies of innovation with the conditions of the environment (as Prajogo, 2016). Therefore, ED is an important contextual determinant of the SI-BP relationship.

2.3 Research Gap

In general, the literature is highly supportive of the argument that SI is a major contributor of SS and BP, and sustainability is one of the most important mechanisms that enable the connection between innovation and performance. Also, ED affects the intensity of these relationships, which emphasizes the role of contextual aspects. Nonetheless, there are still a few unanswered questions. The literature tends to investigate SI, SS and BP independently, but there has been a dearth of research incorporating these variables in the same model. Additionally, limited attention is given to the concurrent role of SS as a mediator and ED as a moderator, especially in the emerging markets. This underscores the importance of detailed empirical research that looks at these relationships in concert, which is the objective of the current study.

2.4 Hypothesis Development

SI and BP

SI is very well known as a key driver of firm competitiveness and high quality BP. It involves the embrace of new ideas, processes and business models that allow organizations to adapt well to the dynamic market environment. According to previous studies, the firms which take part in SI realize greater efficiency, differentiation, and financial performance. An example is that Hermundsdottir and Aspelund (2022) discovered sustainability-oriented innovation is a key boost to the competitiveness and BP of firms. On the same note, Prajogo (2016) highlighted that a fit between innovation strategy and business environment enhances organizational performance. These results indicate that SI is directly related to higher BP.

H1: SI is significantly positively affecting BP.

SI and SS

SI is also crucial in facilitating the promotion of SS since it allows firms to ensure that environmental and social concerns are incorporated as part of their operations. Companies with innovative approaches are in a better position to use green practices, maximize the use of resources, and enhance social responsibility actions. Tseng et al. (2019) emphasize that strategic orientation plays a crucial role in environmental innovation capabilities and SS outcomes. Moreover, as Le (2022) shows, green innovation, when assuming corporate strategy, turns sustainability efforts into quantifiable results. These results make SI a significant predictor of SS.

H2: SI positively affects SS.

SS and BP

SS has become an important factor in determining long-term BP, since it boosts corporate reputation, operational efficiency, and stakeholder trust. Companies that embrace sustainability practice tend to enjoy cost benefit, enhanced brand value and market opportunities. Empirical results in investigations by Kneipp et al. (2019) demonstrate that sustainable innovation practices and firm performance have a strong positive relationship. Likewise, Fernando et al. (2019) discovered that, in the case of technology-oriented companies, environmental innovation can play a significant role in sustainable BP. These results suggest that SS has a positive effect on BP.

H3: SS positively influences BP.

Mediation by SS.

SI and BP are usually indirectly related and act via SS. SI helps companies to implement sustainable processes, technology, and practices, which consequently boost overall performance results. Klein et al. (2021) discovered that sustainability-oriented innovation has an impact on BP due to the transformation of the business model. Similarly, Rubio-Andrés et al. (2025) found that SS and innovation performance are another mediating variable between corporate strategy and sales performance. These results indicate that SS is a key process by which SI is converted to improved BP.

H4: SS is the mediator between SI and BP.

Moderating Role of ED.

ED, which is dynamic, in terms of technology, market demand, and intensity of competition is influential in determining the effectiveness of SI. In such dynamic contexts, companies must be innovative at all times, and SI has a greater influence in achieving SS results. The study conducted by Ch’ng et al. (2021) revealed a stronger association between eco-innovation and sustainable performance in the presence of market turbulence. In the same vein, Rauter et al. (2019) highlighted that innovation strategies are more effective in dynamic environments. Thus, ED enhances the association between SI and SS.

H5: ED is a positive moderate between SI and SS, where the relationship is stronger when ED is high.

3 Research methods

3.1 Research Strategy

The research paradigm used in this study is positivist and the research design is quantitative, cross-sectional study to empirically investigate the structural relationships between SI, SS, BP and ED. It is a deductive research method and theorized hypotheses are formulated on the basis of available literature and then tested through the application of sophisticated statistical analysis.

3.2 Data Collection Instrument

The self-administered structured questionnaire was used to collect primary data, which was to operationalize the latent constructs of SI, SS, BP, and ED. Measurement items were transformed based on the already existing and psychometrically reliable scales to provide content validity and construct reliability. Specifically, SI was measured using items adapted from Varadarajan (2017) and Kalay and Lynn (2015), SS from Tseng et al. (2019) and Le (2022), BP from Prajogo (2016) and Fernando et al. (2019), and ED from Ch’ng et al. (2021) and Prajogo (2016).The measurements of all constructs were limited to a five-point Likert-type scale (1 strongly disagree, 2 strongly disagree, 3 strongly disagree, 4 strongly disagree, and 5 strongly agree). This was in line with previous empirical studies on the topic of innovation and sustainability research. The pilot study was done on a sub-sample of the respondents in an attempt to determine the clarity of the instruments, reliability of the items, and face validity. Pilot comments led to slight improvements aimed at increasing measurement accuracy and minimizing uncertainty.

3.3 Sample Design

This research uses non-probability purposive sampling method where enterprises that have been proven to have embraced sustainability-oriented practices are targeted. The last sample consists of 188 enterprises from Bangalore, comprising a heterogeneous sample of small, medium, and large companies and different industry sectors. To select respondents, the authors relied on their managerial positions and expertise in the domain so that they could be capable of giving informed and valid answers about organizational innovation, sustainability practices, and performance outcomes. The sample size adheres to the suggested levels of CB-SEM, in which a sample of 150 or more is deemed sufficient to have strong parameter estimates and model stability (Hair et al., 2019). The sampling strategy guarantees relevancy and situational suitability, especially in the context of accessing firms that are actively involved in sustainability efforts that are informed by SI.

3.4 Plan of Analysis

The SPSS and AMOS were used to analyse the data after a multi-stage analysis process. First, data central tendency, dispersion and distributional characteristics were calculated using descriptive statistics. Skewness and kurtosis measures were used to assess the normality to ensure that the assumptions of SEM are met. This was followed by Exploratory Factor Analysis (EFA) using Principal Component Analysis with Varimax rotation to determine the factor structure underlying and determine dimensionality. This was accompanied by Confirmatory Factor Analysis (CFA) to test the measurement model on reliability (Composite Reliability), convergent (Average Variance Extracted) and discriminant (Fornell-Larcker criterion and HTMT ratios) validity.

According to the existing cut-off values, model fit was evaluated based on various indices, such as Chi2/df, Comparative Fit Index (CFI), TuckerLewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) (Hair et al., 2019). The hypothesis relationships were then tested by estimating the structural model. Indirect effect estimation was used to determine the mediation analysis, and interaction term Andrew Hayes process macros analysis was used to determine the moderation between ED and the SI-BP relationship, which was determined as conditional effect.

3.5 Ethical statement

The current research titled: Strategic Innovations towards Sustainability and their effects on Business performance in dynamic environments: A mediated-moderation perspective was carried out under standard rules of academic and research ethics. It was a perception-based research that included the administration of structured questionnaires exclusively to gather the opinions and perceptions of the respondents about sustainability-based strategic innovations and business performance.

The study did not involve any experimental procedures, clinical interventions or vulnerable populations. No physical, psychological or medical risk was observed in the research. The respondents were given a voluntary participation in the survey and the academic nature of the study. The information given by the respondents were kept as confidential and anonymous throughout the research and the data gathered were utilized to purely academic and research purposes. Since the study was based on perception-based survey data and did not presuppose human experimentation, the use of biological samples, and personal data, formal ethical risk was low in character. The research followed the informed consent, privacy, confidentiality and responsible data management principles.

4 Results and Discussion

In this section the results of the empirical research on the connections between SI, SS, BP, and ED are provided. The analysis is founded on the information that has been gathered on 188 enterprises that have embraced sustainability practices. The findings have been systematized to give a clear picture of the data as well as to test the hypotheses put across.

4.1 Demographic features of the Enterprises in the study

The demographics of 188 enterprises that implemented sustainable practices give valuable information about the nature of the sample. Regarding the size of the firms, most of the enterprises were small size (82, 43.6%), medium sized (64, 34.0%), and large enterprises (42, 22.3) meaning that, sustainability practices are more common among small and medium sized enterprises. As far as the type of the industry is concerned, the sample consisted of firms across different industries, with manufacturing firms (30.9) taking the majority, and technology-based firms (28.9) taking the second respectively. Regarding the number of years of operation, the majority of enterprises were aged 5-10 years (76, 40.4%), then there were over 10 years old (68, 36.2%), and under 5 years (44, 23.4%), which means that relatively mature businesses are more inclined towards sustainable practices. In terms of annual turnover, most enterprises indicated that they had a turnover of ₹1-10 crore (79, 42.0%), less than 1 crore (51, 27.1%), and more than 10 crore (58, 30.9%, respectively), which indicates that sustainability adoption is across the spectrum of financial capabilities. Besides ownership, most enterprises were privately owned (104, 55.3%), partnership firms (49, 26.1%), and public limited companies (35, 18.6%), which means that the majority of enterprises with sustainability practices are owned by private companies.

The enterprise analysis shows that there is a high tendency to use SI to apply to SS in the sample of 188 firms. Most of the businesses indicated that they often embrace new strategies to enable them to sustainability initiatives (112, 59.6%), with 48 companies (25.5%) reflecting occasional adoption, and only 28 companies (14.9) reflecting limited or no strategic innovation initiatives in terms of sustainability. This indicates that over fifty percent of the companies actively practice innovation in their sustainability endeavors. Rating the use of technology-driven innovation in the context of sustainability, 126 enterprises (67.0%), 40 enterprises (21.3%), and 22 enterprises (11.7%), respectively, expressed their active use of new technologies to enhance environmental performance. This underscores the increased significance of technological innovation towards the realization of sustainability objectives. In addition, on their incorporation of sustainability into their strategic plans, 108 enterprises (57.4) strongly agreed that sustainability is part of their innovations plans, 52 enterprises (27.7) moderately agreed, and 28 enterprises (14.9) weakly agreed. This means that even though most companies have realized the need to align innovation with sustainability, some businesses are yet to adopt the practice. Also, there was high management support towards innovation-driven sustainability with 118 enterprises (62.8) reporting strong managerial encouragement to innovative sustainability practices, 44 enterprises (23.4) reported moderate support, and 26 enterprises (13.8) reported limited support. This implies that leadership is essential in ensuring innovation towards sustainability. The general results suggest that a considerable percentage of businesses are actively deploying SI as an instrument of attaining SS, especially by technological adoption, strategic integration, and managerial support even though some companies have moderate to low levels of engagement.

4.2 Descriptive Statistics

Descriptive statistics were calculated to analyse the central tendency, dispersion and distribution properties of all measures items that were concerned with SI, SS, BP and ED. The research was performed on a sample of 188 respondents with no missing information (Valid N = 188).

4.2.1 Strategic Innovation (SI)

The average score of SI items was between 2.62 and 3.93, which shows that the firms have moderate to moderately high scores on strategic innovation practices. In particular, SI_1 (Mean = 3.93) and SI_2 (Mean = 3.78) imply that companies are proactive in implementing new strategies and creating new innovative processes. But SI3 (Mean = 2.62) and SI5 (Mean = 2.84) indicate relatively less focus on long-term innovation planning and managerial promotion of creativity. The values of standard deviations (0.859 to 1.529) show that there is moderate variability in responses. The skewness values of SI items are between -1.225 and 0.306, which is slight and moderate skewness but acceptable (within the range of +2). Kurtosis values are also within reasonable limits (± 3) indicating that the data distribution of SI is more or less normal.

4.2.2 Sustainability (SS)

The average values of SS are between 2.51 and 3.93, indicating a different degree of adoption of sustainability in the firms. SS3 (Mean = 3.92) and SS5 (Mean = 3.93) show that there is a high level of involvement in socially responsible activities and sustainable investments. On the other hand, the integration of environmental considerations in business operations is relatively low in SS_1 (Mean = 2.51).The values of the standard deviation (1.195 to 1.388) indicate average dispersion. The skewness values are within acceptable limits (-1.192 and 0.647) and the kurtosis values are within acceptable limits, which proves that the SS data is normally distributed.

4.2.3 Business Performance (BP)

The average scores of BP items are in the range of 3.50 to 4.20, which means that the perceived business performance among the respondents is relatively high. BP one (Mean = 4.20) and BP five (Mean = 4.17) have good concurrence on growth of profits and operational effectiveness. BP -4 (Mean = 3.50) indicates a relatively less agreement about the improvement of customer satisfaction. The values of the standard deviation (0.868-1.225) represent moderate variability. The skewness values are skewed (between -1.630 and -1.389) which indicates that the responses are skewed towards higher levels of agreement. The value of kurtosis is not extreme and shows that the data do not deviate far off the normality.

4.2.4 Environmental Dynamism (ED)

The average of ED is between 4.00 and 4.15 which shows that respondents find the business environment to be very dynamic and uncertain. It is apparent that firms are in a strong agreement regarding environmental uncertainty (ED_4, Mean = 4.15), other items also indicate high market turbulence and technological change. The values of the standard deviation (1.193 to 1.263) are indicative of an intermediate variability. The skew value lies between -1.308 and -1.530 which reveals that there is negative skewness, meaning that the majority of the respondents believe that their environment is dynamic. The values of kurtosis are in acceptable ranges that indicate normal distribution.

4.3 Exploratory Factor Analysis and Results of the validity

To investigate how measurement items reflecting SI, SS, BP, and ED are structured around some underlying factors, an Exploratory Factor Analysis (EFA) was performed. The appropriateness of the data was determined before factor extraction was done by measuring KaiserMeyerOlkin (KMO) and Bartlett Test of Sphericity. The KMO value was determined to be 0.912, which means that the sampling adequacy was excellent, and Bartlett Test of Sphericity was significant (2543.67, 190, $p < 0.001$), which confirms the ability to use the correlation matrix in factor analysis (Hair et al., 2019).

The communalities of all items were greater than the acceptable range of 0.50, with a 0.61 to 0.82, which means that every item had enough variance with the extracted factors. This indicates that the factor solution represented all the 20 items in a well and they were further processed.

With the help of the Principal Component Analysis with Varimax rotation, four factors were identified according to the eigenvalues more than one and they were SI, SS, BP, and ED. The cumulative variance of these four factors was 78.0 which is higher than the suggested limit of 60 and this implies that the model has a strong explanatory power. The first factor (BP) accounted for 30.6% of the variance, followed by ED (21.4%), SS (15.6%), and SI (10.4%).

The matrix of the rotated components showed that all the items loaded highly on their constructs and that factor loading was more than 0.70 in most of the instances and there were no any notable cross-loadings. This means that there is a definite factor structure and it also means that the items are measuring their desired constructs.

Convergent validity was determined because all of the factor loadings were bigger than 0.60, and Composite Reliability (CR) was between 0.91 and 0.95, which was significantly higher than the suggested value of 0.70. Besides, the values of the Average Variance Extracted (AVE) were 0.67 to 0.78, which is larger than acceptable limit of 0.50, which proves that each construct is associated with a significant amount of variance among the indicators (Hair et al., 2019).

Both the Fornell-Larcker criterion and the HTMT ratio were used to determine the discriminant validity. AVE square root of each construct was greater than the inter-construct correlations, which means that there was sufficient discriminant validity. Moreover, the range of values of HTMT was 0.60-0.82, that is, they do not exceed 0.90, and it proves the existence of distance between the constructs.

In order to determine common method bias, the single-factor test developed by Harman was used. The findings revealed that the former explained 30.6 percent of the overall variance, which is significantly lower than 50 percent, the critical value, meaning that there is no major issue of common method bias in the investigation.

Variance Inflation Factor (VIF) values were also used to determine multicollinearity. The VIF values were between 1.98 and 2.76, which is far below the suggested value of 5, meaning that there is no multicollinearity problem between the variables.

4.4 Model Fit Statistics

Table I – Model fit statistics for the model

Fit Index	Recommended Value	Obtained Value	Interpretation
Chi-square (χ^2)	Lower value preferred	312.45	Acceptable
df	df > 0	87	Model is over-identified
χ^2/df Ratio (CMIN/df)	< 5.0	3.59	Reasonable model fit
GFI	≥ 0.90	0.91	Acceptable fit
CFI	≥ 0.90	0.95	Excellent fit
TLI	≥ 0.90	0.94	Excellent fit
IFI	≥ 0.90	0.95	Strong incremental fit
RMSEA	≤ 0.08	0.055	Good model approximation
SRMR	≤ 0.08	0.041	Good residual fit

The goodness of the proposed structural model was evaluated on the basis of various goodness of fit measures, such as absolute, incremental and parsimonious fit measures as presented in Table I. These indices give a complete assessment of the goodness of representation of the model on the observed data. The Chi-square (2) of the model was 312.45 and the 87 degrees of freedom (df = 87) which gave a 4 ratio of 3.59. Though not exactly at the ideal value of 3, values less than 5 are acceptable, a sign of a reasonable model fit. The model has been over-identified (df > 0) indicating that it is suitable to Structural Equation Modeling (SEM).The goodness-of-Fit Index (GPI) was 0.91, which is higher than the recommended cutoff level of 0.90, which gives the index an acceptable level of fit. The Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were 0.95 and 0.94, respectively, indicating both excellent incremental fit since the values exceed the level of 0.90.Moreover, the Incremental Fit Index (IFI) was 0.95, which supports the strength of the model. Root Mean Square Error of Approximation (RMSEA) is 0.055 that is lower than the suggested value of 0.08 meaning that the model is a good approximation to the data. Also, Standardized root mean square Residual (SRMR) was 0.041 which is well around the acceptable range of 0.08 implying a good fit to the residual. Generally, most fit indices are within the recommended range (Hair et al., 2019; Hu and Bentler, 1999), which proves that the structural model has an acceptable to good fit and can be used to test the hypotheses.

4.5 Hypothesis Testing Results

Figure 1 – SEM model for Mediation analysis

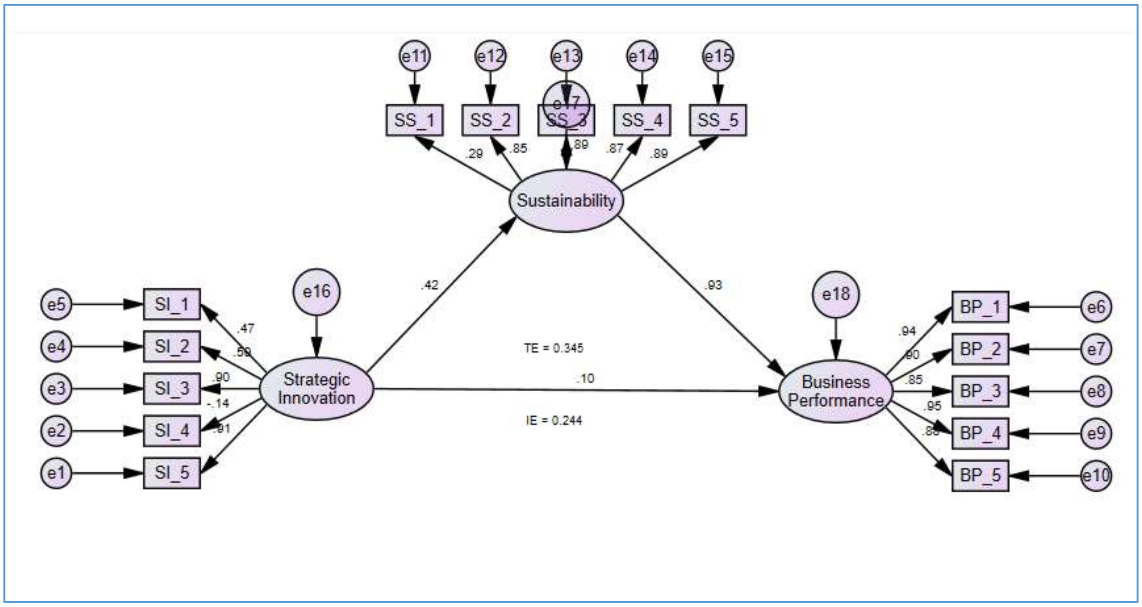


Table II- Results of Direct relationships – H1 to H3

Hypothesis	Structural Path	Standardized Estimate (β)	Significance Value	Result
H1	SI → SS	0.42	0.000	Supported
H2	SS → BP	0.93	0.000	Supported
H3	SI → BP	0.10	0.000	Supported

The results of Hypothesis as presented in Table II and Figure 1

H1: SI → BP

The findings reveal positive and statistically significant impact of SI on BP (= 0.101, C.R. = 2.986, p = 0.003). This observation implies that the companies that implement new strategic solutions have a better chance to improve their overall performance outcomes, such as financial development, operational efficiency, and competitiveness in the market. The size of the direct effect is quite insignificant, but it is statistically significant, which proves that SI has a significant contribution to BP. This finding is consistent with the existing literature that highlights the importance of innovation-based strategies to enhance the performance of firms by allowing them to differentiate and be flexible in the competitive markets (Prajogo, 2016; Hermundsdottir and Aspelund, 2022). Thus, the more an organization invests in innovative strategic practices, the higher the performance results it will be able to obtain. In this way H1 is affirmed.

H2: SI → SS

The findings reveal that SI has a positive and highly significant impact on SS ($\beta = 0.419$, C.R. = 3.207, p = 0.001). This implies that the organizations that practice strategic innovation tend to embrace sustainability-based activities such as environmental responsibility, resource efficiency, and social activities. The fairly high coefficient indicates that SI is very important in inculcating sustainability into organizational processes. Companies that capitalize on innovation can more easily adopt sustainable technologies and practices in their operations. This result aligns with the current body of literature, which indicates that innovation capabilities have a strong positive impact on sustainability performance (Tseng et al., 2019; Le, 2022).In this way H2 is affirmed.

H3: SS → BP

The findings indicate that the effect of SS on BP is high and statistically significant (0.932, C.R. = 3.903, $p < 0.001$). It shows that sustainability practices significantly enhance the business performance, which means that SS is a powerful predictor in the model. The value of the coefficient indicates that companies that engage into sustainability activities are rewarded with positive efficiency, reputation of the company, lower costs and profitability in the long run. These results are consistent with earlier research which reveals that sustainability-based strategies result in the best firm performance and competitive advantage (Fernando et al., 2019; Kneipp et al., 2019).In this way, H3 is supported.

Table III – Mediation results – H4

Effect Type	Value	Significance Value
Direct Effect (SI → BP)	0.10	0.000
Indirect Effect (SI → SS → BP)	0.244	0.000
Total Effect	0.345	0.000

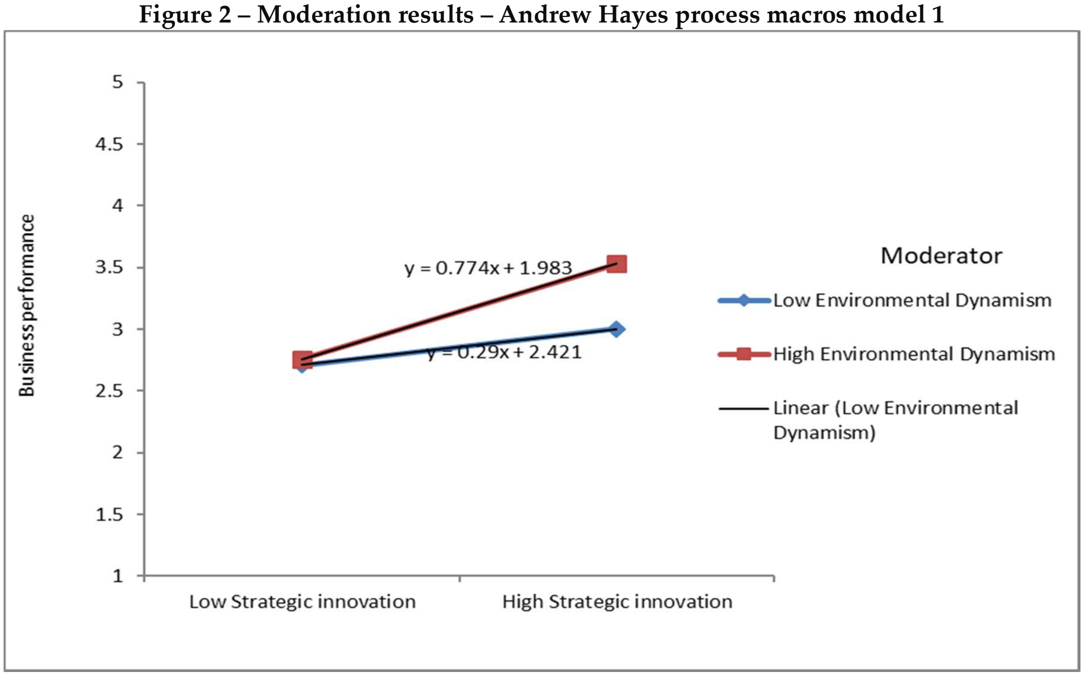
Table III presents the results of mediation analysis

H4: Mediating Role of SS (SI → SS → BP)

The mediation analysis reveals that SS plays an important role in mediating the relationship between SI and BP. The direct effect (DE = 0.101) is significantly lower as compared to the indirect effect (IE = 0.244), and the total effect (TE = 0.345) is used to validate the overall impact of SI on BP via SS. This indicates that a significant part of the effect of SI on BP is via sustainability practices. The mediation is partial mediation since both the direct and indirect effects are significant. This means that although SI has a direct impact on BP, it has a much greater effect when mediated by SS. This observation can be explained by the previous studies, which emphasize the fact that innovation boosts the performance of firms mainly because it allows them to operate sustainably and change the business model (Klein et al., 2021; Rubio-Andrés et al., 2025). Therefore, SS is an important mechanism that connects SI to better BP. In this way, H4 is justified (Partial Mediation).

H5: Moderation of ED (SI × ED → BP)

Figure 2 – Moderation results – Andrew Hayes process macros model 1



In order to test the moderating role of ED between SI and BP, a moderation analysis was carried out using regression. The findings as presented in Figure 2 show that SI positively influences BP (= 0.266) and ED also positively influences BP (= 0.144). More to the point, the interaction term (SI × ED) is positive (= 0.121), which proves the existence of a moderating effect. The interaction term is positive indicating that ED enhances the relationship between SI and BP. This means that the greater the dynamism in the environment, the higher the effect of SI on BP. That is, companies in very dynamic and uncertain environments have a higher chance of transforming strategic innovation into better performance results than companies in stable environments. This result is supported by the interaction plot. The slope of high ED (= 0.774) is much steeper than that of low ED (= 0.29) and this indicates that the impact of SI on BP is much more pronounced when the environmental dynamics are high. This shows that the high rate of the change in technology, change in customer preferences, and competitive pressures increase the efficiency of innovation strategies to improve performance.

This finding is also supported by previous research, which suggests that environmental turbulence enhances the association between innovation and firm performance (Prajoko, 2016; Ch'ng et al., 2021). Moreover, Rauter et al. (2019) claim that dynamic environments enhance the importance of innovation because the ability to react to the emerging opportunities and challenges is made more effective by the firm.

5 Discussion

The current research analyzed the connection between SI, SS, BP and ED, with a special emphasis on the mediating effect of sustainability and the moderating effect of environmental dynamism. The results are highly empirical evidence of the given framework and contribute to the increasing body of knowledge that innovation-based sustainability is one of the main channels to improved business performance.

Results reveal a positive and significant impact of SI on BP with a relatively small direct effect. This implies that SI leads to the improvements in performance but not to the full extent of the performance when it is applied in isolation. This is aligned with the existing research that highlights that innovation augments performance of firms by enhancing efficiency, competitiveness, and responsiveness to environmental changes (Prajogo, 2016; Kalay and Lynn, 2015). Nevertheless, the comparatively lesser direct impact found in the present study can be used to prove that the results of innovation are usually conditional on supportive organizational practices and strategic alignment (Klein et al., 2021). Accordingly, SI might not be effective in generating significant performance improvements by itself unless it is combined with sustainability-focused efforts.

The research also indicates that SI is influential to a great degree on SS, and it is important to note that innovation plays a crucial role in facilitating sustainable practices. Companies which are actively involved in SI tend to be more inclined towards the adoption of environmentally and socially responsible practices hence enhancing their sustainability performance. This result is consistent with previous research that highlights the importance of innovation capabilities in the attainment of sustainability objectives and improvement of environmental performance (Tseng et al., 2019; Le, 2022). In addition, there is evidence that sustainability-based innovation enables companies to use fewer resources, become more efficient, and be more proactive in response to regulatory and societal demands (Boons et al., 2013; Wijethilake et al., 2018). SI, therefore, is a basic source of SS.

The results also show that SS significantly and significantly impacts BP and becomes the most predictive in the model. This implies that companies that effectively employ sustainability practices have better performance results, in terms of both financial performance, efficiency in operations, and satisfaction of stakeholders. This finding aligns with previous empirical findings that demonstrate that sustainable innovation practices contribute to organizational performance and competitiveness (Fernando et al., 2019; Kneipp et al., 2019). Also, it has been revealed that sustainability can help create long-term value through enhanced corporate image and allowing companies to stand out in the market (Maletič et al., 2016; Almeida and Wasim, 2023). Thus, SS is not an ethical or regulatory issue but a strategic BP driver.

One of the main contributions made by this research is the fact that SS partially mediates the association between SI and BP. The outcome of the mediation shows that much of the influence of SI on BP is mediated by SS, indicating that innovation promotes performance through allowing sustainability practices. The conclusion is consistent with the existing literature that indicates the mediating effect of sustainability and innovation between strategic initiatives and performance outcomes (Klein et al., 2021; Rubio-Andrés et al., 2025). The fact that there exists a partial mediation further suggests that although SI directly affects BP, the effect of SI is highly magnified when it becomes mediated by SS. This highlights the significance of considering sustainability as a part of the innovation strategies and not as individual organizational functions.

Moreover, the moderation analysis illustrates that ED reinforces the correlation between SI and BP, which means that the success of innovation depends on the external environmental factors. Firms operating in highly dynamic environments, where there are high rates of technological transformation, stiff competition, and shifting customer needs have higher chances of using SI to improve performance outputs. This result can be attributed to the fact that the previous literature indicates that environmental turbulence enhances the significance as well as efficacy of innovation strategies (Ch'ng et al., 2021; Rauter et al., 2019). Likewise, Prajogo (2016) highlights the fact that the compatibility of innovation strategy and environmental factors is a critical aspect of attaining high performance. On the contrary, in less volatile settings, the influence of SI on the BP might not be as strong since companies are not under such pressure to be innovative.

Combined, the results are indicative of an indirect, context-dependent relationship between SI and BP. SI not only adds to BP but more so, it improves performance with SS and this association is enhanced further in the presence of high ED. This combined view gives us a more sophisticated view of the role of innovation as a driver of performance and the significance of taking into account not only the external conditions (environmental dynamism) but also the internal processes (sustainability).

6 Conclusion

The results demonstrate good empirical evidence that SI plays a significant role in BP, either directly or indirectly via SS. Specifically, SS became a critical pathway, by which SI is converted into better performance outcomes, which underscores the significance of considering sustainability as a component of innovation strategies. Moreover, the findings reveal that ED enhances the relationship between SI and BP, meaning that enterprises that work in dynamic settings have more to gain through innovation-driven strategies. The research has significant theoretical and practical implications. Theoretically, it proposes an integrated framework, which integrates SI, SS, BP, and ED, and thus fills the gaps in the literature that tend to study these variables separately. The results support the notion that innovation and sustainability are not two distinct strategic priorities but two aspects that cannot be separated. As a manager, the findings imply that organizations ought to tie the sustainability objectives with innovation efforts to gain a competitive advantage in the long run. Companies also need to be flexible towards environmental changes since changing conditions positively influence the effectiveness of SI.

Although it has made its contributions, the study has some limitations that offer opportunities to further research. To begin with, the research is founded on cross-sectional data, and this restricts the capability of capturing dynamic changes over time. Longitudinal designs can be used in future studies to explore the dynamics in the relationships between SI, SS, and BP. Second, the study is narrowed down to a particular sample of enterprises, which can be a limitation to generalization. Future research can be broadened by considering various industries and geographical settings. Third, other moderating factors like organizational culture, digital transformation or regulatory pressure can be sought out to get more insight. Lastly, a qualitative research might also be introduced in the future to gain a better insight into how companies put SI into practice to achieve sustainability. Finally, the research points out that sustainability under the influence of SI is the main indicator of the best BP, especially in dynamic settings, and that integrated strategic responses are required in the realization of the business success of sustainability.

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