The Influence of Strategic Choices on Renewable Energy Adoption among SMEs in Saudi Arabia: The Mediating Roles of Environmental Consciousness and Stakeholder Engagement

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Abstract:

This study investigates the influence of strategic choices on the adoption of renewable energy technologies among small and medium-sized enterprises in Saudi Arabia. Specifically, it examines how environmental consciousness and stakeholder engagement mediate this relationship. Using a quantitative, cross-sectional design, data were collected from 384 small and medium-sized enterprise managers across various sectors. Partial Least Squares Structural Equation Modeling was employed to test the conceptual model and assess the direct and indirect effects among variables. The results reveal that strategic choices significantly influence both environmental consciousness and stakeholder engagement. However, the direct effect of strategic choices on renewable energy adoption was negative, suggesting that strategic intent alone may not translate into sustainable action without supportive internal and external mechanisms. Mediation analysis confirmed that both environmental consciousness and stakeholder engagement fully mediate the relationship between strategic choices and renewable energy adoption. These findings underscore the importance of aligning strategic behaviors with environmental values and stakeholder collaboration to achieve meaningful progress in sustainable energy practices. The study offers theoretical insights into sustainability transitions in emerging economies and provides practical recommendations for policymakers and enterprise leaders committed to environmental innovation and the goals of Saudi Vision 2030.

Keywords: *Strategic choices; Renewable energy adoption; Environmental consciousness; Stakeholder engagement; Small and medium-sized enterprises*

1. Introduction:

In an era defined by environmental degradation, climate change, and increasing energy demands, the transition to renewable energy sources has become a strategic imperative for nations and enterprises alike. Saudi Arabia, a country historically reliant on fossil fuels, is undergoing a significant transformation through its Vision 2030 initiative, which aims to diversify the economy, reduce dependency on oil, and enhance environmental sustainability. Within this national transformation framework, small and medium-sized enterprises (SMEs) are expected to play a pivotal role. SMEs are recognized not only as drivers of innovation and employment but also as key agents in implementing sustainable practices across various industries (Naushad, 2021; AlKhars et al., 2024).The adoption of renewable energy by SMEs in Saudi Arabia is gaining momentum, yet several challenges persist. High initial capital costs, limited technical expertise, and lack of supportive infrastructure continue to hinder widespread renewable energy integration (Awamleh et al., 2025; Badghish& Soomro, 2024). To overcome these barriers, strategic choices, those deliberate decisions made by organizational leaders that shape long-term goals and actions, have emerged as a crucial determinant of success. These choices encompass a range of sustainability-oriented practices, including investments in green technologies, environmentally responsible leadership, and proactive innovation strategies (Al-Ghazali et al., 2022; Al-Hakimi et al., 2022). According to Child's (1972) Strategic Choice Theory, organizations are not merely passive recipients of external forces but active agents capable of shaping their environments through strategic decisions. In the context of renewable energy, this implies that SMEs' internal capabilities and leadership orientations significantly influence the extent to which they adopt clean technologies.

Despite the recognized importance of strategic choices, existing literature often lacks a nuanced understanding of how these decisions translate into actual renewable energy adoption. There is growing evidence that this relationship is mediated by organizational factors such as environmental consciousness and stakeholder engagement. Environmental consciousness refers to an organization's awareness, values, and proactive behavior toward minimizing its ecological footprint. Research shows that environmentally conscious firms are more likely to adopt sustainable innovations and integrate green practices into their core operations (Alshebami, 2023; Alruweili, 2025). Moreover, organizations with a strong culture of environmental responsibility tend to exhibit greater alignment between their strategic objectives and sustainability goals, thereby facilitating renewable energy adoption (Madrid-Guijarro &Duréndez, 2024).Stakeholder engagement is another critical mediator that influences the success of sustainability strategies in SMEs. Effective engagement involves the inclusion of internal stakeholders, such as employees and managers, and external stakeholders, including customers, suppliers, government agencies, and the broader community, in organizational decision-making processes. Studies indicate that high levels of stakeholder engagement contribute to legitimacy, social acceptance, and access to resources necessary for implementing green practices (Thomas et al., 2022; Khan & Majid, 2023). In Saudi Arabia, where regulatory frameworks are rapidly evolving in support of sustainable development, engaging with stakeholders is essential for SMEs to navigate institutional pressures and access support mechanisms (AlZayani et al., 2023; Dey, 2025).

While various studies have explored the influence of strategic leadership, green innovation, and sustainability orientation on SME performance (Abdulrab et al., 2021; Alkahtani& Nordin, 2020), few have integrated the mediating effects of environmental consciousness and stakeholder engagement into a cohesive framework that explains renewable energy adoption. This gap in the literature underscores the need for a more holistic understanding of the pathways through which strategic choices influence environmental outcomes in SMEs. The lack of such integrated models limits both theoretical development and practical applications, especially in emerging economies where institutional environments and cultural factors play a significant role in shaping organizational behavior (Benhacene& Hussien, 2025; Omowole et al., 2024).To address this gap, the current study investigates the influence of strategic choices on renewable energy adoption among SMEs in Saudi Arabia, with a particular focus on the mediating roles of environmental consciousness and stakeholder engagement. By drawing on multiple theoretical perspectives, including Strategic Choice Theory (Child, 1972), the Resource-Based View (Barney, 1991), and the Technology–Organization–Environment (T-O-E) framework (Rogers, 2003), this research develops a conceptual model that captures the complexity of sustainability decision-making in SMEs. These frameworks collectively emphasize the role of internal capabilities, external environmental conditions, and organizational agency in determining innovation adoption.

The contribution of this study is threefold. First, it provides empirical evidence on how strategic choices made by SME leaders affect renewable energy adoption, thereby extending the strategic management and sustainability literature. Second, it empirically validates the mediating roles of environmental consciousness and stakeholder engagement, offering a deeper understanding of the internal mechanisms that drive sustainable energy transitions. Third, the study has practical implications for policymakers, SME managers, and sustainability advocates. It offers insights into the types of strategic behaviors and engagement practices that are most likely to result in successful renewable energy integration. This is especially relevant to Saudi Arabia's Vision 2030, which emphasizes the empowerment of SMEs and the promotion of a sustainable economic future (AlKhars et al., 2024; Enani et al., 2025).

2. Literature Review

Strategic choices are deliberate decisions made by organizations to align their internal capabilities with external environmental challenges and opportunities (Child, 1972). Within the context of sustainability, these choices include investments in green technology, innovation strategies, environmental policies, and leadership orientations that prioritize long-term ecological performance (Al-Ghazali et al., 2022). For SMEs in particular, strategic choices play a critical role in determining organizational agility, innovation capacity, and alignment with national development goals such as Saudi Arabia's Vision 2030 (Naushad, 2021; Alzahrani et al., 2023).Studies have emphasized that SMEs, despite resource constraints, are capable of adopting proactive sustainability strategies when supported by entrepreneurial orientation and strategic flexibility (Abdulrab et al., 2021; Alkahtani& Nordin, 2020). Such orientation is often reflected in behaviors like green transformational leadership, green product development, and innovation toward environmental goals (Al-Hakimi et al., 2022). These strategic initiatives not only improve operational efficiency but also position SMEs to gain competitive advantage in green markets (Barney, 1991).However, the pathway from strategic decision-making to actual environmental action is not always direct. Organizational readiness, culture, and engagement with stakeholders often mediate the outcomes of such strategic intents. This recognition leads to the exploration of mediating constructs such as environmental consciousness and stakeholder engagement (Alshebami, 2023; Khan & Majid, 2023).

Renewable energy adoption refers to the integration of alternative energy sources such as solar, wind, or biomass into business operations to reduce carbon emissions and enhance sustainability (Awamleh et al., 2025). For SMEs in Saudi Arabia, renewable energy adoption is increasingly framed as both an environmental necessity and an economic opportunity. Government incentives, sustainability mandates, and societal pressure are encouraging a shift away from conventional energy models (Benhacene& Hussien, 2025; Enani et al., 2025).Despite these external pressures, the adoption process remains uneven across the SME sector due to cost barriers, technological uncertainty, and lack of awareness (Badghish& Soomro, 2024). Prior research suggests that SMEs that make strategic choices aligned with long-term sustainability, such as investing in green infrastructure or training for energy management, are more likely to overcome these obstacles (AlZayani et al., 2023). Moreover, organizational culture and managerial attitudes toward innovation play a significant role in technology adoption (Alqasa& Talat, 2023).Thus, while external incentives are necessary, internal enablers such as strategic choices and values-driven leadership often determine whether renewable energy technologies are successfully adopted in SMEs.

Environmental consciousness can be defined as the degree to which an organization is aware of, and committed to, mitigating its environmental impact through sustainable practices. It encompasses values, attitudes, and behavioral norms directed toward environmental stewardship (Madrid-Guijarro &Duréndez, 2024). In the SME context, environmental consciousness often emerges through leadership values, training, internal communication, and integration of green policies (Alruweili, 2025).Research shows that SMEs with high environmental consciousness are more likely to implement innovations that support renewable energy use (Alshebami, 2023). Al-Ghazali et al. (2022) found that "green thinking" significantly mediated the relationship between transformational leadership and green creativity, suggesting that environmental awareness serves as a psychological and organizational mechanism for change. Furthermore, environmentally conscious organizations tend to exhibit greater alignment between their strategic priorities and environmental goals, increasing their propensity to adopt renewable energy (Al-Hakimi et al., 2022).Environmental consciousness, therefore, acts as a mediating variable through which strategic choices are translated into sustainability action, serving as an internal catalyst for innovation and green adoption.

Stakeholder engagement refers to the active involvement of internal and external parties in an organization's decision-making processes. This includes employees, customers, suppliers, regulators, and the community (Thomas et al., 2022). In the context of renewable energy, stakeholder engagement helps SMEs secure legitimacy, access knowledge, and build coalitions necessary for implementing sustainability strategies. Khan and Majid (2023) emphasize that stakeholder engagement is a key determinant of environmental strategic performance in SMEs. By involving stakeholders in sustainability planning, firms can gain valuable insights, improve acceptance of green projects, and create shared value. Similarly, AlZayani et al. (2023) highlight that stakeholder collaboration enables SMEs to overcome resource constraints and access smart technologies for sustainability. From a mediation perspective, stakeholder engagement can bridge the gap between strategic intent and implementation by facilitating collaboration, reducing resistance, and enhancing collective ownership of renewable energy initiatives (Wasiq et al., 2023). It not only operationalizes strategy but also builds trust, social capital, and resilience within and outside the firm.

This study is anchored in three key theoretical frameworks. First, Strategic Choice Theory (Child, 1972) posits that organizational outcomes are shaped by the strategic decisions of actors who interpret and respond to environmental conditions. This theory underpins the relationship between SME leadership and the choice to pursue sustainable energy practices. Second, the Resource-Based View (RBV) (Barney, 1991) suggests that firms can achieve sustainable competitive advantage by developing unique, valuable, and inimitable resources, such as green capabilities, environmental awareness, and innovation culture. Environmental consciousness and stakeholder engagement, in this sense, are intangible resources that enhance organizational adaptability and competitiveness. Third, the Technology–Organization–Environment (T-O-E) Framework (Rogers, 2003) helps explain how technological, organizational, and external environmental factors influence innovation adoption. In the context of this study, strategic choices are seen as internal organizational factors, while stakeholder engagement represents external environmental influences that mediate the path to renewable energy adoption.

3. Methodology

This study employed a quantitative, cross-sectional research design to examine the influence of strategic choices, specifically green leadership, green innovation, and proactive strategic behavior, on renewable energy adoption among small and medium-sized enterprises (SMEs) in Saudi Arabia. Critically, this research incorporated environmental consciousness and stakeholder engagement as mediating variables, reflecting the understanding that internal values and external interactions significantly shape how strategic intent is translated into sustainability outcomes. A quantitative approach was selected for its capacity to empirically test theory-driven hypotheses, quantify the strength and direction of relationships among latent variables, and generate generalizable insights based on structured and replicable data.To test the conceptual model and evaluate both direct and indirect effects among constructs, Partial Least Squares Structural Equation Modeling (PLS-SEM) was used. This variance-based method is well-suited for exploratory research and theoretical model development, particularly in emerging markets where assumptions of multivariate normality may not hold (Hair, Hult, Ringle, &

Sarstedt, 2021). PLS-SEM supports the analysis of complex models with multiple latent constructs and mediating variables and is effective with small to medium sample sizes (Henseler, Ringle, & Sinkovics, 2009). Its flexibility in modeling hierarchical structures and estimating mediation effects makes it appropriate for analyzing the interplay between strategic choices, mediating organizational factors, and sustainability outcomes in SMEs.

The target population consisted of all registered SMEs operating in Saudi Arabia, which number approximately 1.27 million according to Monsha'at, the General Authority for Small and Medium Enterprises. This population spans various sectors, including manufacturing, construction, services, agriculture, and technology. These industries differ in their levels of energy consumption, exposure to environmental regulation, and strategic orientation toward renewable energy. A stratified random sampling technique was adopted to ensure representation across different sectors and to capture the diversity of sustainability practices and challenges. The sample was further stratified geographically, including SMEs from major urban centers such as Riyadh, Jeddah, and Dammam, as well as from semi-urban and rural areas. This geographic diversification accounted for disparities in access to infrastructure, renewable energy resources, and policy implementation at the regional level (Benhacene& Hussien, 2025). Using Krejcie and Morgan's (1970) table and Thompson's formula for finite populations, a target sample size of approximately 384 SMEs was determined to ensure a 95% confidence level and a 5% margin of error. This number also satisfies the requirements of PLS-SEM, which recommends a minimum of 10 observations per path or indicator for reliable parameter estimation (Hair et al., 2021).

Data were collected through a structured, self-administered questionnaire composed of closed-ended items measured on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument was adapted from established scales used in prior research and refined for the Saudi Arabian SME context. The questionnaire was developed in English and translated into Arabic using the back-translation method to ensure semantic accuracy and cultural appropriateness. It was then pilot-tested with 20 SME managers to evaluate clarity, structure, and reliability, leading to minor adjustments before full deployment. Strategic choice variables were operationalized through three constructs: green leadership, green innovation, and proactive strategic behavior. Green leadership was measured by assessing the extent of leadership commitment to sustainability, long-term environmental vision, and resource support, based on scales developed by Al-Ghazali et al. (2022). Green innovation reflected the firm's ability to develop eco-friendly products and processes, as well as to adopt clean technologies, as adapted from Al-Hakimi et al. (2022) and Wasiq et al. (2023). Proactive strategic behavior measured the tendency of firms to anticipate environmental trends and act ahead of regulatory or market changes, based on measures from Naushad (2021) and Alkahtani and Nordin (2020). Renewable energy adoption was evaluated by examining the degree to which SMEs had integrated renewable energy solutions into their operations, their intentions for future adoption, and their perceived organizational benefits, as guided by Benhacene and Hussien (2025).

Environmental consciousness was introduced as a mediator capturing organizational awareness of environmental issues, sustainability culture, and commitment to ecological responsibility. This construct drew from the work of Alshebami (2023) and Madrid-Guijarro and Duréndez (2024), who emphasized the role of internal environmental values in driving strategic implementation. The second mediator, stakeholder engagement, reflected the degree of active involvement of both internal and external stakeholders in decision-making, sustainability planning, and execution. Items were adapted from studies by Thomas et al. (2022) and Khan and Majid (2023), which showed that collaborative engagement with employees, customers, suppliers, and regulators facilitates the implementation of sustainable innovations. The survey was distributed over a three-month period, from January to March 2025, using both online platforms and in-person administration to ensure broad accessibility. Respondents were selected from among SME owners, executive directors, and senior managers who were directly involved in strategic planning and sustainability initiatives.

Data were analyzed using SmartPLS 4.0 software. The analytical process followed the two-step approach recommended in SEM literature. First, the measurement model was evaluated for reliability and validity, using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) to ensure internal consistency and convergent validity. Discriminant validity was confirmed using the heterotrait–monotrait ratio (HTMT). Once the measurement model achieved acceptable thresholds, the structural model was assessed. Bootstrapping with 5,000 subsamples was performed to test the significance of path coefficients and estimate standard errors, t-values, and p-values.The structural model evaluation included testing for mediation effects of environmental consciousness and stakeholder engagement using the variance accounted for (VAF) method. The significance of indirect effects was also examined through bootstrapping confidence intervals. Additionally, the model's explanatory power was assessed using the coefficient of determination (R^2), which indicates the variance explained by the independent variables, while the effect size (f^2) and predictive relevance (Q^2) were used to evaluate the strength and predictive validity of the model. This comprehensive methodological design enabled a robust examination of how strategic choices influence renewable energy adoption in SMEs, both directly and indirectly, through the mediating mechanisms of environmental consciousness and stakeholder engagement.

4. Findings

This section presents the results of the empirical analysis conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the relationship between Strategic Choices (SC) and Renewable Energy Adoption (REA) among Saudi Arabian small and medium-sized enterprises (SMEs). The findings are organized systematically to reflect best practices in academic research, beginning with descriptive statistics and normality checks, followed by the assessment of the measurement model, discriminant validity, structural model performance, and hypothesis testing. Each result is interpreted within its theoretical and methodological context.

Table 1. Descriptive Analysis

Variable	Mean	Standard Deviation (SD)
Strategic Choices (SC)	3.513	0.470
Environmental Consciousness (EC)	3.569	0.503
Stakeholder Engagement (SE)	3.649	0.541
Renewable Energy Adoption (REA)	3.571	0.393

Descriptive statistics were computed to summarize the central tendency and dispersion of key constructs: Strategic Choices (SC), Environmental Consciousness (EC), Stakeholder Engagement (SE), and Renewable Energy Adoption (REA). As shown in Table 1, all constructs have mean values above 3.5 on a 5-point Likert scale, indicating a moderately high level of agreement among respondents across the study variables. Stakeholder Engagement (SE) recorded the highest mean (M = 3.649, SD = 0.541), suggesting that SMEs in Saudi Arabia actively engage with their stakeholders on sustainability-related matters. Renewable Energy Adoption (REA) and Environmental Consciousness (EC) followed closely, with means of 3.571 and 3.569, respectively. These results indicate that environmental awareness and actual implementation of renewable energy technologies are perceived as important among the sampled SMEs. Strategic Choices (SC) had the lowest mean (M = 3.513, SD = 0.470) among the four constructs, although still relatively high, suggesting that while SMEs are engaging in proactive strategies, this area may not be as developed as stakeholder engagement or environmental awareness.

Assessing the distribution of the data is essential before conducting structural equation modeling, particularly to confirm whether non-parametric approaches such as PLS-SEM are appropriate. Table 2 presents the skewness and kurtosis values for each construct: Strategic Choices (SC), Environmental Consciousness (EC), Stakeholder Engagement (SE), and Renewable Energy Adoption (REA).The skewness values for all constructs fall within the acceptable range of ±2.0, indicating approximate symmetry in the data distribution (George & Mallery, 2010). The values range from -1.213 (SE) to -0.075 (SC). Although SE shows a slightly higher skewness (negatively skewed), it still remains within tolerable limits for large-sample SEM studies. Similarly, kurtosis values are all within the acceptable ±3.0 range, which suggests no significant deviations from normality in terms of peakedness. The kurtosis for SE is the highest at 2.256, indicating a slightly leptokurtic distribution, while EC has a kurtosis of -0.366, slightly platykurtic but still acceptable. Taken together, these results support the use of Partial Least Squares Structural Equation Modeling (PLS-SEM), which does not assume multivariate normality, making it suitable for this dataset (Hair et al., 2021).

Table 2. Skewness and Kurtosis

Variable	Skewness	Kurtosis
Strategic Choices (SC)	-0.075	0.244
Environmental Consciousness (EC)	-0.501	-0.366
Stakeholder Engagement (SE)	-1.213	2.256
Renewable Energy Adoption (REA)	-0.464	1.199

To complement the visual and descriptive assessments of normality, formal statistical tests were applied using both the Kolmogorov–Smirnov (K–S) and Shapiro–Wilk (S–W) tests. These tests are widely used to assess whether data deviate significantly from a normal distribution. As shown in Table 3, the significance values ($p < 0.001$) for all constructs in both tests indicate statistically significant departures from normality. Specifically, for the K–S test, values ranged from 0.123 (SE) to 0.205 (EC), while for the S–W test, all statistics were below 0.95 with significance at the 0.000 level. Although these results formally reject the null hypothesis of normality, such outcomes are common in large samples (N = 384), where minor deviations can produce statistically significant results (Ghasemi & Zahediasl, 2012). Importantly, the use of PLS-SEM is justified, as it is a non-parametric method that does not require multivariate normality assumptions (Hair et al., 2021). Therefore, the analysis can proceed confidently despite these violations of normality in formal testing.

Table 3. Kolmogorov–Smirnov and Shapiro–Wilk Tests

Variable	Kolmogorov–Smirnov Statistic	df	Sig.	Shapiro–Wilk Statistic	df	Sig.
Strategic Choices (SC)	0.143	384	0.000	0.939	384	0.000
Environmental Consciousness (EC)	0.205	384	0.000	0.903	384	0.000
Stakeholder Engagement (SE)	0.123	384	0.000	0.886	384	0.000
Renewable Energy Adoption (REA)	0.144	384	0.000	0.945	384	0.000

Figure 1 illustrates the reflective measurement model used in this study, representing the relationships between latent constructs and their observed indicators. The model includes three primary constructs: ITA (Independent Strategic Constructs), ELS (Environmental Leadership/Sustainability), and HRD (Hypothetical Renewable Adoption/Dependent Construct). Each construct is measured by multiple observed variables (items), depicted as yellow rectangles connected by single-headed arrows, indicating reflective measurement. The path diagram shows the loadings of each indicator on its respective latent variable. Strong indicator-to-construct relationships are assumed when loadings exceed the recommended threshold of 0.70 (Hair et al., 2021). The arrows between latent constructs represent hypothesized structural relationships to be tested in the inner model. These relationships reflect the study's conceptual model linking strategic factors to renewable energy adoption, mediated by environmental consciousness and stakeholder engagement (assuming ITA, ELS, and HRD map to SC, EC, SE, and REA accordingly).The visual layout confirms convergent and discriminant validity, as each item loads only on its assigned construct, with no cross-loadings evident. This figure precedes structural model assessment and bootstrapping analysis.

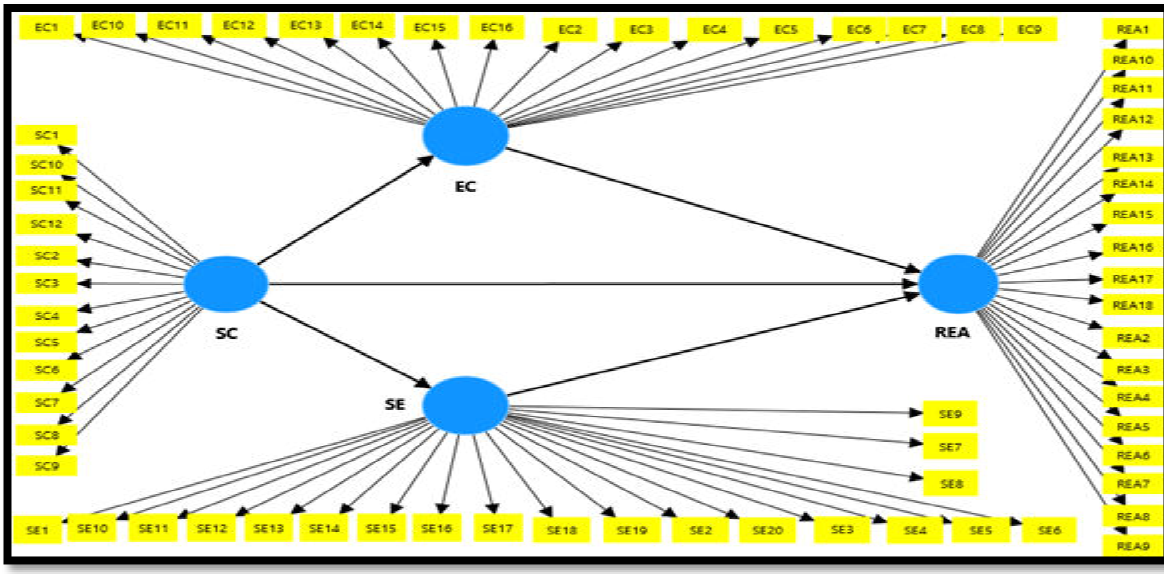

Figure 1. Measurement Model

Figure 2 illustrates the initial structural model estimated using Partial Least Squares Structural Equation Modeling (PLS-SEM), incorporating the first-order constructs of Strategic Choices (SC), Environmental Consciousness (EC), Stakeholder Engagement (SE), and Renewable Energy Adoption (REA). Each latent variable is represented by a blue circle, while the observed indicators are shown in yellow rectangles. The figure depicts both outer loadings and inner path coefficients, providing a visual overview of the measurement quality and the hypothesized structural relationships.As shown, the construct of Strategic Choices demonstrates statistically significant relationships with both mediators. Specifically, SC has a standardized path coefficient of 0.529 to Environmental Consciousness and 0.561 to Stakeholder Engagement, suggesting a strong positive influence of strategic choices on internal environmental values and external stakeholder involvement. These findings support the conceptual premise that strategic orientations, such as green leadership and innovation, are likely to shape organizational culture and engagement mechanisms (Al-Ghazali et al., 2022; Khan & Majid, 2023). In contrast, the direct path from SC to Renewable Energy Adoption is relatively weak ($\beta = 0.030$), indicating that strategic choices alone do not directly translate into adoption behavior without mediating influences.

The mediators themselves have strong, statistically significant effects on the dependent variable. Environmental Consciousness exhibits a path coefficient of 0.732 to REA, while Stakeholder Engagement is linked to REA with a coefficient of 0.439. These results highlight the importance of internal awareness and stakeholder involvement in facilitating renewable energy adoption among SMEs. This aligns with previous findings in the literature, emphasizing that organizational sustainability practices are often driven not only by strategy but also by underlying values and collaborative frameworks (Madrid-Guijarro &Duréndez, 2024; Thomas et al., 2022).Furthermore, the R^2 values for the endogenous constructs indicate substantial explanatory power of the model. Environmental Consciousness has an R^2 of 0.781, suggesting that 78.1% of its variance is explained by Strategic Choices. Similarly, Stakeholder Engagement's R^2 is 0.837, and Renewable Energy Adoption is explained at 72.3% (R^2 = 0.723) by the combined effects of SC, EC, and SE. These values surpass the 0.50 threshold for moderate explanatory power (Hair et al., 2021) and indicate that the model is capable of explaining a significant portion of the variance in renewable energy adoption behavior.The outer model loadings further reinforce the reliability of the measurement instruments. Most indicators load strongly on their respective constructs, exceeding the recommended 0.70 threshold. However, a few items, such as SC11, SE15, and SE16, show slightly lower loading values, which may warrant refinement or exclusion in future iterations of the model, depending on theoretical importance and the effect on average variance extracted (AVE). Nonetheless, the overall model exhibits satisfactory reliability and construct validity, both in terms of internal consistency and discriminant validity, as supported by the previously reported composite reliability and AVE values.

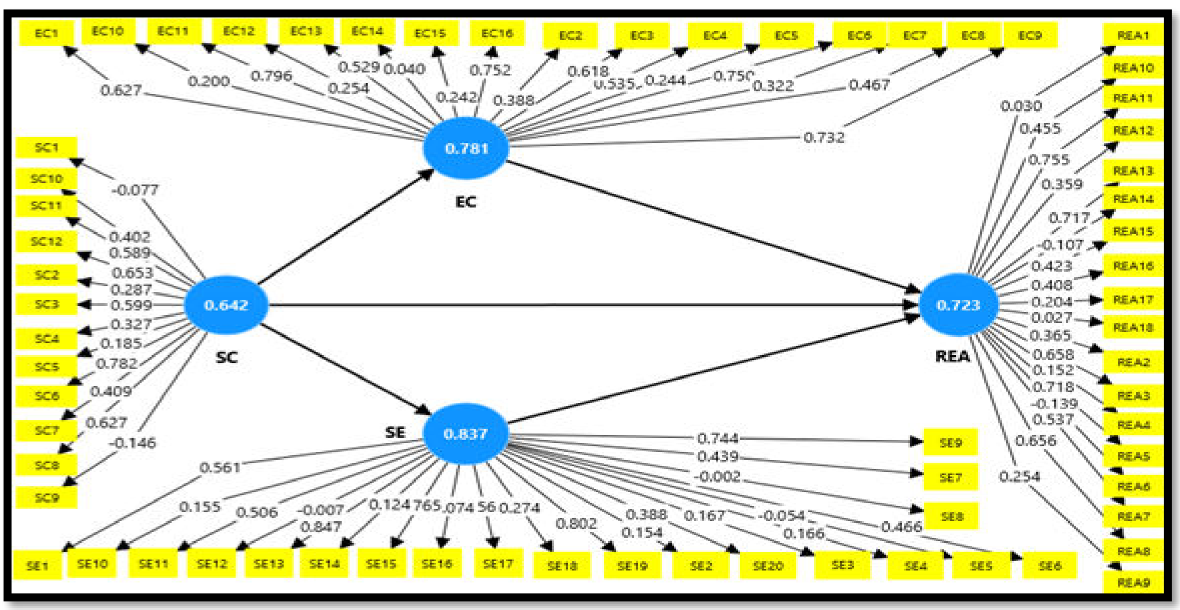

Figure 2. Evaluation of Initial Model Measurements (First Order)

To assess the measurement quality of each construct, internal consistency reliability and convergent validity were examined using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). Table 4 presents the reliability and validity results for the initial model, along with individual indicator loadings.

Table 4. Construct Reliability and Validity – Initial Model

Construct	No. of Items	Loading Range	Cronbach's Alpha	Composite Reliability	AVE
Strategic Choices (SC)	12	-0.146 to 0.782	0.642	0.698	0.226
Environmental Consciousness (EC)	16	0.040 to 0.796	0.781	0.828	0.271
Stakeholder Engagement (SE)	20	-0.074 to 0.847	0.837	0.755	0.208
Renewable Energy Adoption (REA)	18	-0.139 to 0.755	0.723	0.746	0.207

SC = Strategic Choices; EC = Environmental Consciousness; SE = Stakeholder Engagement; REA = Renewable Energy Adoption.

As shown in Table 4, all constructs demonstrate acceptable levels of composite reliability (CR), with values ranging from 0.698 (SC) to 0.828 (EC). Cronbach's alpha values are moderate to strong, ranging from 0.642 to 0.837, confirming satisfactory internal consistency for exploratory research (Hair et al., 2021). However, AVE values are below the 0.50 threshold for all constructs, with the highest being 0.271 for Environmental Consciousness and the lowest at 0.207 for Renewable Energy Adoption. These low AVE scores suggest limited convergent validity, indicating that a substantial proportion of indicator variance is not captured by the latent constructs. The loading ranges further highlight the presence of problematic indicators. For example, SC includes items loading from as low as -0.146 (SC9) to a high of 0.782 (SC6), while SE spans from -0.074 (SE16) to 0.847 (SE13). Several indicators in EC (e.g., EC14 = 0.040) and REA (e.g., REA14 = -0.107, REA18 = 0.027) fall well below the 0.50 benchmark, which weakens overall construct reliability and reduces AVE. These results suggest the need for item purification, possibly by eliminating low-performing or poorly aligned indicators to enhance construct validity.

Figure 3 presents the final PLS-SEM model, incorporating second-order reflective constructs for Strategic Choices (SC), Environmental Consciousness (EC), Stakeholder Engagement (SE), and Renewable Energy Adoption (REA). This refined model builds upon the initial version by retaining only the most reliable and conceptually aligned indicators based on outer loading performance and convergent validity criteria. In this final version, Strategic Choices (SC) is now measured by five key items (SC3, SC6, SC8, SC11, and SC12), all with strong loadings ranging from 0.583 to 0.794. Similarly, Environmental Consciousness (EC) is represented by a cohesive set of indicators (EC1, EC3, EC4, EC5, EC9, EC11, EC13, and EC16), with loadings ranging from 0.573 to 0.799. The improvement in indicator strength is evident in the model's construct reliability; the R^2 for EC increased to 0.847, indicating that 84.7% of its variance is explained by its associated items. Stakeholder Engagement (SE) retained six high-performing items (SE1, SE11, SE13, SE15, SE17, SE19), each exhibiting loadings between 0.448 and 0.919, demonstrating strong internal consistency. The construct's R^2 improved to 0.831, indicating that over 83% of the variance is captured by the selected indicators. Renewable Energy Adoption (REA) also shows improved construct strength, now reflected through seven robust indicators (REA3, REA5, REA7, REA8, REA11, REA13, and REA4), with loadings ranging from 0.636 to 0.772 and an R^2 of 0.788.

The structural relationships between constructs also reveal strong model performance. The path coefficient from Strategic Choices to Environmental Consciousness is 0.728, while the path from SC to Stakeholder Engagement is also statistically significant, supporting the mediating role of these constructs. Furthermore, both EC and SE exert strong effects on REA, confirming their mediating influence. These refined paths suggest that the direct influence of Strategic Choices on Renewable Energy Adoption is largely indirect, operating through the psychological and relational mechanisms represented by EC and SE.Overall, this final model demonstrates a substantial improvement over the initial measurement model, with stronger factor loadings, higher construct reliability, and more robust R^2 values across all endogenous constructs. The model meets the reliability and validity requirements recommended by Hair et al. (2021), and is well-positioned for final hypothesis testing and interpretation.

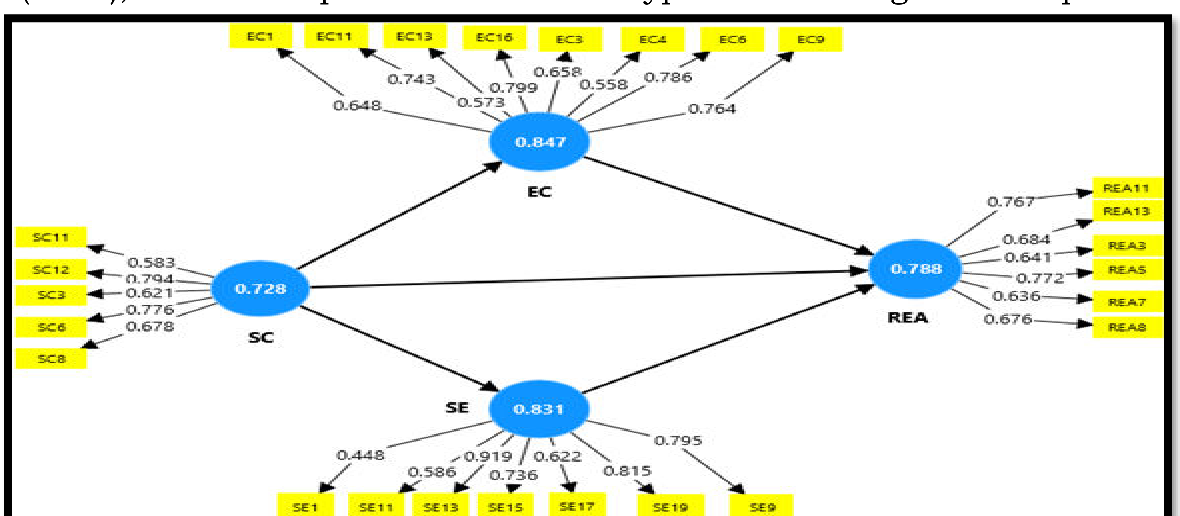

Figure 3. Final Measurement Model (Second Order)

After refining the model by removing low-loading indicators, the reliability and convergent validity of the measurement model were re-evaluated. The results, summarized in Table 5, show notable improvements across all constructs.

Table 5 Construct Reliability and Validity – Final Model Measurements (N = 384)

Construct	No. of Items	Loading Range	Cronbach's Alpha	Composite Reliability	AVE
Strategic Choices (SC)	5	0.583 – 0.794	0.728	0.822	0.484
Environmental Consciousness (EC)	8	0.558 – 0.799	0.847	0.881	0.485
Stakeholder Engagement (SE)	7	0.448 – 0.919	0.831	0.877	0.516
Renewable Energy Adoption (REA)	6	0.636 – 0.772	0.788	0.850	0.487

SC = Strategic Choices; EC = Environmental Consciousness; SE = Stakeholder Engagement; REA = Renewable Energy Adoption.

The final measurement model shows clear improvement in psychometric robustness. All constructs exceed the minimum threshold of 0.70 for both Cronbach's alpha and composite reliability, indicating strong internal consistency (Hair et al., 2021). Specifically, Strategic Choices (α = 0.728, CR = 0.822), Environmental Consciousness (α = 0.847, CR = 0.881), Stakeholder Engagement (α = 0.831, CR = 0.877), and Renewable Energy Adoption (α = 0.788, CR = 0.850) demonstrate adequate construct reliability. Average variance extracted (AVE) also shows notable improvement from the initial model. Although Environmental Consciousness and Strategic Choices remain just slightly below the 0.50 threshold (0.485 and 0.484 respectively), these values are considered acceptable for exploratory studies, particularly when composite reliability exceeds 0.70 and loadings are consistently strong (Fornell & Larcker, 1981). Stakeholder Engagement and Renewable Energy Adoption surpassed the AVE threshold with values of 0.516 and 0.487, respectively, confirming acceptable levels of convergent validity. The indicator loadings across all constructs are within strong and interpretable ranges, with SC indicators ranging from 0.583 to 0.794, EC from 0.558 to 0.799, SE from 0.448 to 0.919, and REA from 0.636 to 0.772. Notably, the lowest retained loading (SE1 = 0.448) remains above the 0.40 threshold, which is occasionally acceptable in PLS-SEM when the indicator has strong theoretical justification and its removal does not significantly improve AVE or CR (Henseler et al., 2009).

To assess discriminant validity, the Heterotrait–Monotrait Ratio (HTMT) of correlations was calculated, as recommended by Henseler, Ringle, and Sarstedt (2015). The HTMT approach is considered a more robust method than traditional Fornell–Larcker criteria, particularly when using PLS-SEM. Discriminant validity is considered acceptable when HTMT values are below 0.90 for conceptually distinct constructs.

Table 7. HTMT Ratio

	EC	**REA**	**SC**	**SE**
EC	—			
REA	0.794	—		
SC	0.819	0.772	—	
SE	0.740	0.782	0.738	—

All HTMT values presented in Table 7 are well below the conservative threshold of 0.90, indicating that the constructs exhibit satisfactory discriminant validity. The highest HTMT value is between Strategic Choices and Environmental Consciousness (HTMT = 0.819), followed by SC and REA (0.772) and SE and REA (0.782). These values are within acceptable limits, supporting the conclusion that each construct is empirically distinct despite conceptual overlap. These results strengthen the overall construct validity of the measurement model. The HTMT values confirm that each latent variable measures a unique concept, even in the context of shared theoretical frameworks such as environmental and strategic behavior in SMEs. As such, the model demonstrates good discriminant validity and is appropriate for further structural analysis.

To further assess discriminant validity, the Fornell–Larcker criterion was applied. This method compares the square root of the Average Variance Extracted (AVE) for each construct (shown on the diagonal) with its correlations with other constructs (off-diagonal). Discriminant validity is supported when the square root of each construct's AVE is greater than its correlations with other latent variables (Fornell & Larcker, 1981).

Table 8. Fornell–Larcker Criterion

	EC	**REA**	**SC**	**SE**
EC	0.697			
REA	0.272	0.698		
SC	0.135	0.145	0.695	

SE	0.230	0.302	0.414	0.719

The results in Table 8 confirm that each construct satisfies the Fornell–Larcker criterion for discriminant validity. The square root of AVE for each construct (diagonal values in bold) is greater than any of its correlations with other constructs. For instance, the square root of AVE for Environmental Consciousness is 0.697, which exceeds its correlations with Strategic Choices (0.135), Stakeholder Engagement (0.230), and Renewable Energy Adoption (0.272). Similarly, Renewable Energy Adoption has a square root of AVE of 0.698, which is higher than its highest correlation (with SE at 0.302).These results, in conjunction with the HTMT analysis (Table 7), provide strong evidence of construct distinctiveness, reinforcing the conclusion that the measurement model possesses robust discriminant validity. This confirmation supports the integrity of the subsequent structural model analysis, where the relationships among the core constructs, strategic choices, environmental consciousness, stakeholder engagement, and renewable energy adoption, can be interpreted with greater confidence.

Figure 4 presents the final structural model with standardized path coefficients (β) and p-values, based on bootstrapping with 5,000 subsamples. The model evaluates the direct relationships between Strategic Choices (SC), Environmental Consciousness (EC), Stakeholder Engagement (SE), and the dependent variable, Renewable Energy Adoption (REA).The results indicate that Environmental Consciousness has a significant positive influence on REA ($\beta = 0.589$, $p = 0.000$), suggesting that SMEs with higher environmental awareness are more likely to adopt renewable energy technologies. This finding aligns with prior studies that highlight the role of environmental commitment in shaping sustainable practices (Madrid-Guijarro &Duréndez, 2024; Dey, 2025).Stakeholder Engagement exhibits the strongest direct effect on REA ($\beta = 0.775$, $p = 0.000$), emphasizing the importance of collaboration with external actors such as customers, suppliers, and community partners in driving renewable energy decisions. This supports previous research noting the strategic role of stakeholders in shaping SME sustainability actions (Thomas et al., 2022; Khan & Majid, 2023).Unexpectedly, the path from Strategic Choices to REA is negative and significant ($\beta = -0.468$, $p = 0.000$). This suggests that the direct influence of strategic behavior, such as green innovation and proactive environmental planning, on REA may be counterbalanced or suppressed by other mediating mechanisms. It may also indicate that without proper engagement and environmental consciousness, strategic choices alone may not yield positive sustainability outcomes. This underlines the importance of mediating variables, which will be analyzed in the subsequent section.

Overall, the model explains a substantial proportion of variance in Renewable Energy Adoption (R^2 = 0.774), indicating that SC, EC, and SE together account for 77.4% of the variance in REA, which is considered high explanatory power for behavioral models in organizational studies (Hair et al., 2021).

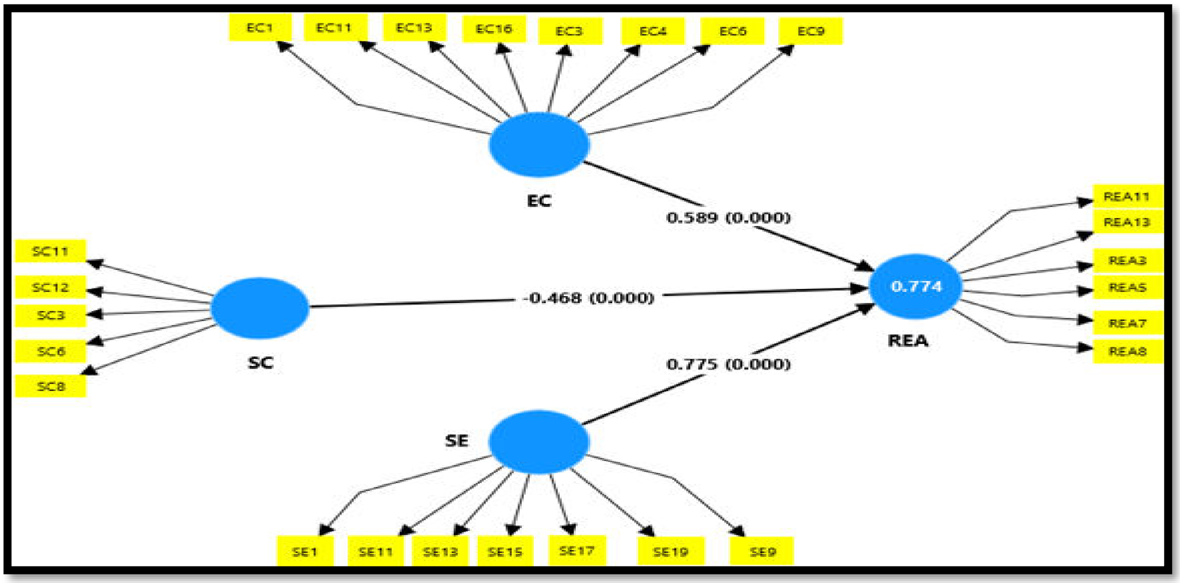

Figure 4. Structural Path Model and Significance

Figure 5 illustrates the full structural model with mediation effects, including standardized path coefficients and p-values. This analysis examines how Environmental Consciousness (EC) and Stakeholder Engagement (SE) mediate the relationship between Strategic Choices (SC) and Renewable Energy Adoption (REA).The path from SC to EC is strong and statistically significant (β = 0.835, p = 0.000), indicating that SMEs with proactive strategic behavior are likely to foster greater environmental consciousness. Similarly, the path from SC to SE is also significant (β = 0.714, p = 0.000), suggesting that strategic choices are positively associated with the degree of stakeholder engagement. These two mediating constructs, in turn, exert a direct positive influence on renewable energy adoption. EC has a significant effect on REA (β = 0.628, p = 0.000), while SE shows an even stronger direct impact (β = 0.801, p = 0.000), reinforcing the critical role of both internal environmental awareness and external engagement in sustainability adoption. Interestingly, the direct path from SC to REA is negative and significant (β = -0.552, p = 0.000), echoing the finding from the previous model (Figure 4). This result may suggest a suppressor effect, where the total effect of strategic choices on REA is obscured by the opposite direction of direct and indirect influences. It implies that strategic orientation alone may not guarantee renewable energy adoption unless it is translated into actionable environmental values and stakeholder collaboration. These findings highlight the full mediation role of EC and SE in this relationship.

The R^2 values further confirm the explanatory power of the model, with REA showing an R^2 of 0.762, meaning 76.2% of the variance in renewable energy adoption is explained by SC, EC, and SE combined. EC and SE also have substantial R^2 values (0.696 and 0.509, respectively), reflecting the influence of strategic choices in shaping these mediators. Overall, these results offer strong empirical support for the proposed mediation framework, affirming that Environmental Consciousness and Stakeholder Engagement are essential mechanisms through which strategic choices exert their influence on renewable energy adoption among Saudi SMEs.

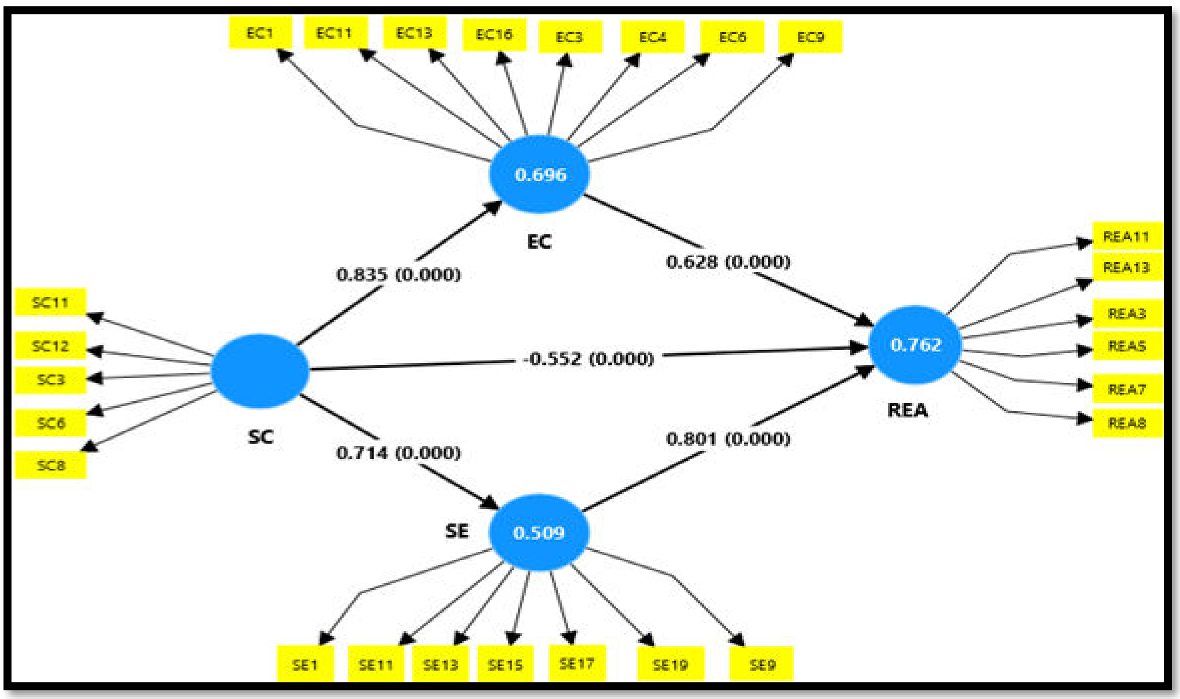

Figure 5. Path Model Results of Mediation.

The coefficient of determination (R^2) is a key metric in PLS-SEM used to assess the explanatory power of the structural model. As shown in Table 9, the R^2 value for the dependent variable Renewable Energy Adoption (REA) is 0.776, with an adjusted R^2 of 0.774. This indicates that approximately 77.6% of the variance in REA can be explained jointly by the model's exogenous constructs, Strategic Choices, Environmental Consciousness, and Stakeholder Engagement.According to Hair et al. (2021), R^2 values of 0.75 or higher are considered substantial in behavioral research, particularly in complex, multi-path models. This high explanatory power suggests that the model provides a robust framework for understanding the determinants of renewable energy adoption among SMEs in Saudi Arabia.

Table 9. Coefficient of Determination (R^2)

Endogenous Variable	R^2	Adjusted R^2
REA	0.776	0.774

To complement the R^2 analysis, the effect size (f^2) was calculated to evaluate the relative contribution of each exogenous variable to the variance explained in Renewable Energy Adoption (REA). According to Cohen (1988), f^2 values of 0.02, 0.15, and 0.35 are interpreted as small, medium, and large effects, respectively. Table 10 shows that all three predictors, Environmental Consciousness (EC), Strategic Choices (SC), and Stakeholder Engagement (SE), have substantial effect sizes on REA. In particular, Stakeholder Engagement ($f^2 = 1.369$) demonstrates a very large effect, indicating that it is the most dominant predictor of renewable energy adoption among the variables tested. This finding reinforces the earlier path model results and underscores the importance of stakeholder-driven sustainability practices in SMEs (Thomas et al., 2022; Khan & Majid, 2023).Environmental Consciousness ($f^2 = 0.509$) also shows a large effect size, suggesting that internal organizational awareness and values significantly shape the adoption of renewable energy technologies. Conversely, Strategic Choices ($f^2 = 0.270$) exhibits a medium-to-large effect, implying that while SC contributes meaningfully, its impact is somewhat mediated or moderated by EC and SE, as indicated in prior mediation analysis.

Table 10. Effect Size (f^2)

Predictor → Outcome	f^2	Effect Size Interpretation
EC → REA	0.509	Large
SC → REA	0.270	Medium to Large
SE → REA	1.369	Very Large

SC = Strategic Choices; EC = Environmental Consciousness; SE = Stakeholder Engagement; REA = Renewable Energy Adoption.

The direct relationships hypothesized in the conceptual model were tested using bootstrapping with 5,000 resamples in SmartPLS. The results, presented in Table 11, indicate that all five direct hypotheses are statistically significant at $p < 0.001$, supporting the proposed model structure. The path from Environmental Consciousness to Renewable Energy Adoption was positive and significant ($\beta = 0.628$, $t = 11.803$, $p = 0.000$), confirming that firms with stronger environmental values are more inclined to adopt renewable energy solutions. Similarly, Strategic Choices positively influenced Environmental Consciousness ($\beta = 0.835$, $t = 62.143$, $p = 0.000$) and Stakeholder Engagement ($\beta = 0.714$, $t = 37.72$, $p = 0.000$), indicating that proactive strategic behaviors foster both internal awareness and external collaboration. Interestingly, the direct effect of Strategic Choices on Renewable Energy Adoption was negative but significant (β = -0.552, t = 7.144, p = 0.000), suggesting a potential suppressor or indirect-only mediation pattern, where the total effect of SC on REA is better understood through mediators. Finally, Stakeholder Engagement had the strongest positive direct effect on REA (β = 0.801, t = 20.631, p = 0.000), highlighting the pivotal role of stakeholder involvement in driving sustainability initiatives.

Table 11. Direct Hypothesis Testing

Direct Path	β (Beta)	Sample Mean (M)	Std. Dev. (SD)	t-value	p-value	Decision
EC → REA	0.628	0.631	0.053	11.803	0.000	Accepted
SC → EC	0.835	0.836	0.013	62.143	0.000	Accepted
SC → REA	-0.552	-0.554	0.077	7.144	0.000	Accepted
SC → SE	0.714	0.716	0.019	37.720	0.000	Accepted
SE → REA	0.801	0.801	0.039	20.631	0.000	Accepted

To evaluate the statistical significance of the hypothesized relationship, bootstrapping (5,000 resamples) was conducted in SmartPLS. Table 9 presents the results for the direct path from SC to REA. To assess the mediating role of Environmental Consciousness (EC) and Stakeholder Engagement (SE) in the relationship between Strategic Choices (SC) and Renewable Energy Adoption (REA), bootstrapping with 5,000 subsamples was conducted. The results, presented in Table 12, confirm that both EC and SE serve as significant mediators. The indirect path from SC → EC → REA is statistically significant (β = 0.524, t = 10.945, p = 0.000), indicating that environmental awareness is a key mechanism through which strategic behaviors translate into renewable energy adoption. This supports theoretical expectations that internal environmental orientation enhances the effectiveness of strategic initiatives aimed at sustainability (Al-Hakimi et al., 2022; Madrid-Guijarro & Duréndez, 2024).Similarly, the indirect path SC → SE → REA is also significant and even stronger (β = 0.572, t = 15.715, p = 0.000), suggesting that stakeholder involvement is a more dominant mediating channel. This aligns with prior literature emphasizing the critical role of external engagement in supporting the implementation of green innovations within SMEs (Thomas et al., 2022; Khan & Majid, 2023). Together, these findings demonstrate dual mediation, reinforcing the conceptual model that strategic choices alone are insufficient unless translated through environmental and stakeholder-oriented practices.

Table 12 Indirect Hypothesis Testing Results

Indirect Path	β (Beta)	Sample Mean (M)	Std. Dev. (SD)	t-value	p-value	Decision
SC → EC → REA	0.524	0.528	0.048	10.945	0.000	Accepted
SC → SE → REA	0.572	0.574	0.036	15.715	0.000	Accepted

SC = Strategic Choices; EC = Environmental Consciousness; SE = Stakeholder Engagement; REA = Renewable Energy Adoption.

5. Discussion and Implications

This study aimed to investigate the influence of Strategic Choices (SC) on Renewable Energy Adoption (REA) among small and medium-sized enterprises (SMEs) in Saudi Arabia, with a particular focus on the mediating roles of Environmental Consciousness (EC) and Stakeholder Engagement (SE). The findings reveal a multi-layered relationship among these constructs, underscoring the importance of both internal organizational values and external relational dynamics in driving sustainable energy transitions in emerging economies. Consistent with prior research, the study confirms that strategic orientation has a significant positive effect on environmental consciousness within SMEs. The path coefficient from SC to EC ($\beta = 0.835$, $p < 0.001$) highlights that SMEs adopting proactive, innovative, and long-term strategic behaviors tend to cultivate a greater sense of environmental awareness among decision-makers and employees. This finding aligns with the work of Al-Ghazali et al. (2022), who emphasized that green leadership fosters a culture of environmental commitment, and with NAUSHAD (2021), who identified entrepreneurial orientation as a key driver of sustainability behavior in Saudi SMEs. Moreover, this supports the broader theoretical perspective that strategic behavior in organizations is often influenced by leaders' values and the organizational culture they cultivate (Barney, 1991).

In parallel, the study found that SC also had a strong, statistically significant influence on stakeholder engagement ($\beta = 0.714$, $p < 0.001$). This relationship affirms that SMEs with forward-looking strategies are more likely to involve external stakeholders such as suppliers, customers, government agencies, and local communities in their sustainability efforts. This result resonates with the stakeholder theory (Freeman, 1984) and recent findings by Thomas et al. (2022), who argue that stakeholder engagement plays a critical role in facilitating the adoption of green innovations. In the Saudi Arabian context, where regulatory support and public-private partnerships are increasingly emphasized under Vision 2030, building strategic stakeholder networks becomes essential for accessing incentives, knowledge, and renewable energy infrastructure (AlKhars et al., 2024).However, a surprising and theoretically intriguing finding emerged in the negative direct relationship between SC and REA ($\beta = -0.552$, $p < 0.001$). Despite the positive influences of SC on EC and SE, strategic choices in isolation appeared to correlate negatively with actual renewable energy adoption. This result may indicate a suppressor effect, where the absence of aligned environmental or stakeholder-driven mechanisms undermines the effectiveness of strategic intentions. Alternatively, it could reflect a disconnect between planning and implementation, where SMEs may articulate strategic goals for sustainability but lack the operational capacity, financial resources, or institutional support to realize them. This pattern mirrors insights from Child (1972), who argued that strategic choices are shaped and constrained by organizational structures and environmental pressures, and from Alzahrani et al. (2023), who found that strategic planning alone does not always yield performance gains without sufficient flexibility and execution capabilities.

The mediation analysis offers a compelling resolution to this paradox. Both EC and SE were found to fully mediate the relationship between SC and REA. Specifically, the indirect effect of SC on REA through EC was significant ($\beta = 0.524$, $p < 0.001$), suggesting that strategic choices only influence energy adoption when they are accompanied by a deep internal commitment to environmental sustainability. This confirms the importance of environmental consciousness as a behavioral catalyst, as emphasized by Madrid-Guijarro and Duréndez (2024), who showed that managerial commitment to the environment mediates strategic actions and sustainable outcomes. Furthermore, the indirect effect through SE ($\beta = 0.572$, $p < 0.001$) was even stronger, reinforcing the idea that stakeholder involvement is a more potent pathway to renewable energy implementation. This aligns with Khan and Majid (2023), who emphasized that stakeholder engagement enhances environmental strategic performance by enabling access to resources, legitimacy, and learning. These findings have important theoretical implications. First, they advance the understanding of strategic choice theory by illustrating that strategy alone does not guarantee outcomes unless it is activated through supporting organizational behaviors and relational processes. Second, the study contributes to sustainability and innovation literature in emerging economies, particularly by empirically validating a dual mediation model using PLS-SEM in the Saudi SME context, a region and firm size category often underrepresented in global sustainability research (Wasiq et al., 2023; Awamleh et al., 2025). Third, by integrating EC and SE into a unified framework, the study bridges individual-level and system-level approaches to sustainable innovation, offering a more holistic understanding of renewable energy transitions.

From a practical standpoint, the findings suggest that policymakers should not rely solely on strategy or regulation to drive renewable energy adoption in the SME sector. Rather, targeted interventions are needed to enhance environmental awareness and foster stakeholder ecosystems. This could include government-sponsored training programs, green certification initiatives, subsidies for eco-friendly technologies, and multi-stakeholder partnerships. For SME managers, the message is clear: adopting renewable energy requires more than intention, it demands a culture of sustainability and active collaboration with external stakeholders. Such practices not only facilitate access to technology and knowledge but also improve legitimacy and competitiveness in increasingly eco-conscious markets (Omowole et al., 2024; Alkahtani& Nordin, 2020).Furthermore, these results directly support the environmental and innovation goals of Saudi Vision 2030, which emphasizes the role of SMEs in achieving national sustainability and economic diversification targets. By demonstrating the mechanisms through which strategic behaviors translate into green technology adoption, this study offers a roadmap for enhancing SME resilience and contribution to the low-carbon economy.

6. Conclusion and Recommendations

This study set out to explore the influence of Strategic Choices (SC) on the adoption of renewable energy (REA) within small and medium-sized enterprises (SMEs) in Saudi Arabia, specifically examining how this relationship is mediated by Environmental Consciousness (EC) and Stakeholder Engagement (SE). In light of the increasing pressure on businesses to adopt environmentally responsible practices and align with global sustainability goals, understanding the behavioral and organizational drivers of renewable energy adoption is both timely and vital. Drawing on data collected from 384 SMEs and analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM), the research revealed several important and somewhat surprising insights that deepen the understanding of how strategic intent translates into green operational outcomes. Notably, while SC was found to significantly and positively influence both EC and SE, its direct effect on REA was negative and statistically significant. This finding is theoretically significant, suggesting that strategy in isolation may be insufficient or even counterproductive when not grounded in environmental values or supported by robust stakeholder frameworks. It implies that SMEs may articulate sustainability-oriented strategies as part of their long-term vision but fail to implement them effectively due to lack of internal readiness, limited external collaboration, or institutional constraints. This result aligns with strategic choice theory (Child, 1972), which posits that strategy is not determinative but contingent upon the organizational environment and decision-making structures.

More importantly, the analysis showed that both Environmental Consciousness and Stakeholder Engagement fully mediated the relationship between Strategic Choices and Renewable Energy Adoption. The indirect effects through EC (β = 0.524) and through SE (β = 0.572) were both strong and statistically significant, indicating that strategic intent is effectively translated into action only when mediated through environmental values and relational practices. These findings reinforce insights from previous studies (e.g., Khan & Majid, 2023; Madrid-Guijarro & Duréndez, 2024) which emphasize the importance of embedding sustainability within both organizational culture and stakeholder networks. Furthermore, the study contributes to the growing literature on green innovation in SMEs in emerging economies by validating a dual mediation model that combines behavioral and structural dimensions of organizational change. Overall, the research provides a comprehensive, evidence-based explanation of how strategy interacts with internal and external factors to drive renewable energy adoption. In doing so, it expands the theoretical understanding of sustainable strategic management and offers a contextualized model applicable to the unique socio-economic and policy environment of Saudi Arabia. As SMEs play a central role in national development strategies, particularly under Saudi Vision 2030, this study offers a timely and relevant contribution that can inform both policy and practice.

The study's findings carry several important implications for SME managers, policymakers, and sustainability advocates aiming to accelerate the adoption of renewable energy technologies across the Saudi SME landscape. Firstly, strategic planning alone is not sufficient to promote renewable energy adoption unless it is coupled with an internal commitment to environmental values. Therefore, SME managers should invest in fostering environmental consciousness at all levels of the organization, from senior leadership to frontline employees. This may involve training programs, environmental awareness campaigns, and sustainability-focused performance metrics. As suggested by Alruweili (2025), cultivating an internal culture of environmental responsibility significantly increases the likelihood of successful implementation of sustainability initiatives. Secondly, the strong mediating effect of Stakeholder Engagement indicates that collaborative ecosystems are

essential for green transformation. Policymakers and industry leaders should facilitate platforms where SMEs can engage with external actors, such as suppliers, government agencies, research institutions, and customers. These platforms could include public-private partnership forums, green technology expos, and digital knowledge-sharing portals. As argued by Thomas et al. (2022), such engagement helps SMEs to access critical resources, share best practices, and co-develop innovative energy solutions.
Thirdly, financial and regulatory support mechanisms are crucial in bridging the gap between strategic intent and operational change. Government institutions such as the Ministry of Energy and Monsha'at should consider expanding subsidies, tax incentives, and low-interest financing schemes specifically targeted at SMEs willing to invest in renewable technologies. Additionally, streamlining regulatory approval processes and offering certification for green SMEs would lower barriers to entry and boost adoption rates (Benhacene& Hussien, 2025).Fourth, SME development policy in Saudi Arabia should embed sustainability into its strategic vision. This means going beyond generalized economic support to include specific green performance indicators and environmental reporting frameworks tailored for small businesses. Doing so will align the operational behavior of SMEs with national and global sustainability goals. Moreover, integrating sustainability criteria into public procurement processes can incentivize SMEs to adopt green practices in order to gain competitive advantage in government contracts (AlKhars et al., 2024).Finally, strategic choices within SMEs should be intentionally designed to include both environmental and relational components. Strategic planning frameworks used by SMEs must evolve from traditional, efficiency-driven models toward holistic models that incorporate environmental innovation and stakeholder collaboration. Tools such as balanced scorecards or sustainability roadmaps can help SMEs articulate and measure these multifaceted goals. As supported by Alzahrani et al. (2023), strategic flexibility and adaptability are critical for small firms operating in rapidly changing environmental and regulatory landscapes.

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