

# SUSTAINABILITY-DRIVEN DETERMINANTS OF SMES' EFFECTIVENESS: EVIDENCE FROM THE GREEN TRANSITION IN THE WESTERN BALKANS

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## Abstract

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Small and medium-sized enterprises (SMEs) play a central role in the Western Balkans as the region advances its green transition and alignment with European Union (EU) sustainability frameworks. Under increasing environmental and regulatory pressures, SMEs must strengthen managerial capabilities, strategic planning, and technological investment to remain competitive. This study examines the sustainability-driven determinants of SME effectiveness by analyzing managerial education, prior experience, business planning, research and development (R&D) investment, and innovation activities. Using cross-sectional survey data from 336 SMEs in Kosovo, the study applies binary logistic regression to estimate the likelihood of sustainability-oriented effectiveness under 2025 green transition conditions. The results show that managerial education, experience, structured planning, and R&D investment significantly increase the probability of improved performance, while product and service innovation remain statistically insignificant. These findings suggest that in transition economies, innovation alone may not generate sustainability outcomes without adequate institutional and financial support. Unlike prior studies focusing primarily on financial performance, this research reframes SME effectiveness through a sustainability-readiness perspective. The study contributes empirical evidence to the limited literature on SME sustainability in the Western Balkans and highlights the importance of strengthening green finance instruments and governance mechanisms to support a successful green transition.

**Keywords:** Sustainability, SME Effectiveness, Green Transition, Western Balkans, Eco-Innovation, R&D Investment, Logistic Regression

**Authors' individual contribution:** Conceptualization — A.T. and G.D.; Methodology — A.T.; Formal Analysis — A.T.; Investigation — A.T., F.B., and I.M.; Data Curation — A.T. and F.B.; Writing — Original Draft — A.T.; Writing — Review & Editing — A.T., G.D., and A.B.; Visualization — A.T.; Supervision — A.T. and G.D.; Project Administration — A.T.

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## 1. INTRODUCTION

Small and medium-sized enterprises (SMEs) represent more than 99% of active firms in Kosovo and play a critical role in employment creation, market stability, and overall economic development. As the Western Balkans advance their green transition and Kosovo accelerates alignment with European Union (EU) environmental frameworks, SMEs face growing pressure to integrate sustainable practices, adopt energy-efficient technologies, and manage resources more responsibly (Hope, 2022). These structural changes have made sustainability an increasingly decisive factor shaping firm competitiveness in 2025.

Globally, sustainability has emerged as a core determinant of business performance, influencing consumer preferences, regulatory obligations, and supply chain requirements. Although SMEs typically operate with fewer resources than large firms, their agility, adaptability, and faster decision-making processes can provide strategic advantages in transitioning toward greener business models (Gancarczyk & Gancarczyk, 2018). However, in emerging economies such as Kosovo, this transition is complicated by limited financial capacity, insufficient technical expertise, and restricted access to clean technologies.

Kosovo's shift toward sustainability has accelerated due to rising energy costs, the need for stronger energy security, and increased donor-supported environmental initiatives. As a result, SMEs must adapt to a policy landscape in which practices such as energy efficiency, waste reduction, circular economy strategies, and eco-innovation are becoming prerequisites for long-term competitiveness (Zhang & Li, 2022). These developments underscore the need to reassess traditional SME performance determinants by embedding sustainability considerations within theoretical and empirical frameworks.

This study re-evaluates five key determinants — managerial education, prior experience, formal business planning, research and development (R&D) investment, and product/service innovation — through a sustainability-driven perspective. While previous research has primarily examined these factors in relation to financial or operational performance (Krasniqi et al., 2022), the current study investigates how they shape SME effectiveness within the broader context of Kosovo's ongoing green transition. The analysis is based on survey data from 336 SMEs collected in 2022, reinterpreted to reflect the socio-economic and environmental conditions of 2025.

Accordingly, the study addresses the following research questions:

*RQ1: How do managerial and organizational characteristics influence small and medium-sized enterprise effectiveness under sustainability-driven conditions?*

*RQ2: Do research and development activities and innovation capabilities enhance small and medium-sized enterprise performance within Kosovo's green transition?*

*RQ3: What sustainability-related gaps must be addressed to strengthen small and medium-sized enterprise competitiveness in 2025?*

By integrating sustainability considerations into SME performance analysis, this study contributes

to the expanding literature on green transitions in developing and transitional economies. The findings offer practical insights for policymakers designing sustainability-support mechanisms and for SME managers seeking to improve both environmental and economic resilience.

Despite the growing body of research on SME performance and innovation, limited empirical attention has been given to how traditional performance determinants operate under sustainability-driven and green transition pressures in transition economies. Existing studies in the Western Balkan context largely focus on financial or operational performance indicators, without explicitly embedding sustainability readiness within the analytical framework. This gap is particularly relevant as SMEs increasingly face institutional alignment with EU environmental standards and evolving governance mechanisms.

By integrating managerial human capital, organizational planning, and R&D investment into a sustainability-oriented effectiveness model, this study extends prior SME performance research and contributes to the emerging literature on sustainability transitions in developing economies. From a practical perspective, the findings provide evidence-based guidance for policymakers designing green finance instruments, institutional support mechanisms, and capacity-building initiatives aimed at strengthening SME competitiveness in the context of Kosovo's green transition.

The rest of the paper is structured as follows. Section 2 reviews the literature on the topic. Section 3 explains the methodology of the research. Section 4 presents the results, and Section 5 discusses them. Section 6 concludes the paper.

## 2. LITERATURE REVIEW

### 2.1. Theoretical framework on SME sustainability

#### 2.1.1. Sustainability in the SME context

Sustainability in SMEs refers to the integration of environmental responsibility, economic resilience, and social value into strategic and operational decisions. Despite resource limitations, SMEs often adopt sustainability measures efficiently due to their flexibility and proximity to local communities (Baumgartner & Rauter, 2017). In emerging economies like Kosovo, sustainability is increasingly vital due to energy constraints, EU regulatory alignment, and market pressures toward cleaner production. Evidence shows that sustainability-oriented SMEs benefit from increased resource efficiency, improved risk management, and enhanced competitiveness (Liao & Liu, 2021).

#### 2.1.2. Managerial determinants

Managerial determinants represent a central pillar in the sustainability transformation of SMEs. Human capital at the managerial level influences strategic orientation, risk perception, and the firm's ability to respond to environmental and regulatory pressures.

- *Managerial education.* Managerial education strengthens the adoption of sustainability by enhancing awareness of environmental risks, regulatory demands, and long-term strategic

implications of environmental compliance. Managers with higher levels of formal education are more likely to integrate sustainability systematically into business strategies, adopt eco-efficient practices, and pursue innovation aligned with green transition objectives (Lee et al., 2021). Education improves analytical capabilities and facilitates informed decision-making in complex and evolving institutional environments.

- *Managerial experience.* Managerial experience improves decision-making under uncertainty and supports long-term environmental planning, particularly in transition economies characterized by regulatory volatility and market instability. Experienced managers tend to demonstrate stronger adaptive capacity, better resource allocation skills, and greater strategic foresight when implementing sustainability-oriented initiatives (Avery & Bergsteiner, 2011). Practical experience also enhances the ability to navigate institutional constraints and exploit emerging green opportunities.

### 2.1.3. Business planning and sustainability

Structured business planning enables SMEs to embed environmental objectives in strategic decisions, allocate resources efficiently, and anticipate regulatory risks. Evidence shows that firms with formal planning processes adopt sustainability practices more effectively and comply more easily with environmental requirements (Hahn et al., 2014). Such planning also improves access to green financing and EU sustainability programs.

### 2.1.4. Research and development, eco-innovation, and competitiveness

Research and development investment is fundamental for sustainable competitiveness, enabling SMEs to develop eco-efficient technologies, reduce waste, and improve energy performance. Eco-innovation enhances market differentiation and compliance with environmental standards (Cainelli et al., 2020). However, SMEs often face financial and technological constraints that limit advanced green innovation.

### 2.1.5. Institutional drivers

Institutional frameworks — including regulations, incentives, and market standards — play a key role in sustainability adoption. Strong environmental governance, financial incentives, and technological support reduce compliance costs and encourage SME participation in clean-technology initiatives. Effective institutional environments have been shown to accelerate sustainability transitions in both developing and EU-aligned economies (del Río et al., 2015).

### 2.1.6. Synthesis

The theoretical framework identifies four categories shaping SME sustainability:

1. Managerial human capital: education and experience.
2. Organizational readiness: strategic business planning.
3. Technological capacity: R&D and eco-innovation.

4. Institutional context: regulations and green incentives.

These elements together form the basis for the empirical analysis presented in the following chapter.

## 2.2. Literature review on green transition and SME performance

### 2.2.1. Global green transition

The global shift toward sustainability has accelerated as governments adopt climate mitigation policies, invest in clean technologies, and promote circular economy principles. The European Green Deal, in particular, requires firms to reduce emissions, enhance energy performance, and align with increasingly stringent environmental standards. Research demonstrates that companies integrating sustainability practices achieve greater long-term resilience and competitive advantage (Caragliu & Del Bo, 2019). Despite resource constraints, SMEs are central actors in the transition due to their adaptability and capacity for localized innovation (Trianni et al., 2016).

### 2.2.2. SME sustainability performance

Empirical studies consistently show that sustainability adoption improves SME performance. Environmental management practices — such as resource efficiency, waste reduction, and pollution control — lower operational costs and strengthen market appeal. Evidence further indicates that sustainability-oriented SMEs demonstrate higher productivity and stronger stakeholder trust (Zhao & Lee, 2023). In competitive markets, sustainability thus functions not only as regulatory compliance but as a strategic differentiator.

### 2.2.3. Eco-innovation and competitiveness

Eco-innovation, defined as innovation aimed at reducing environmental impact, is a critical driver of SME competitiveness. It enables firms to reduce energy use, minimize waste, and produce cleaner products and services. Eco-innovative SMEs are better positioned to meet regulatory requirements, attract environmentally conscious consumers, and participate in international value chains (Demirel & Danisman, 2019). However, SMEs in emerging economies frequently face barriers — including limited financing, inadequate technological capacity, and insufficient expertise — that constrain eco-innovation outcomes.

### 2.2.4. Research and development in the green transition

Research and development investment is a key enabler of sustainable transformation, supporting the development of green technologies and improvements in environmental performance. Studies show that R&D-intensive SMEs adapt more effectively to environmental regulations and transition more quickly toward low-carbon production systems (Lee et al., 2021). In developing economies, the success of R&D activities depends heavily on

collaboration with universities and research centers, which provide access to specialized knowledge and laboratory infrastructure.

### 2.2.5. Business planning for sustainability

Strategic business planning supports SME sustainability by identifying environmental risks, aligning resources with long-term sustainability goals, and facilitating operational adaptation. SMEs with formal planning processes are more likely to integrate sustainability measures, qualify for green financing instruments, and comply with environmental standards (Tang et al., 2019). Business planning also enhances organizational learning and facilitates the adoption of circular economy models.

### 2.2.6. Institutional and regulatory drivers

Institutional and regulatory frameworks play a decisive role in shaping SME sustainability practices. Environmental regulations, incentives, and standards act as external pressures that encourage sustainability adoption. Countries with strong environmental governance exhibit higher SME participation in green initiatives (Zhao et al., 2023). In transition economies such as the Western Balkans, however, weak enforcement, limited green finance, and inconsistent policy implementation remain substantial barriers to sustainability advancement.

### 2.2.7. Summary of findings

The literature identifies four major drivers influencing SME sustainability performance:

- Eco-innovation, resource efficiency, and R&D improve both environmental and economic outcomes.
- Managerial capabilities and structured business planning enhance organizational readiness for sustainability adoption.
- Institutional environments determine the scale and speed of sustainability uptake.
- Emerging economies face distinct constraints, including limited green finance, technological gaps, and regulatory shortcomings.

These insights form the conceptual foundation for the empirical model developed in the subsequent chapters.

## 3. RESEARCH METHODOLOGY

### 3.1 Data source and sampling design

The empirical analysis is based on a cross-sectional dataset of 336 SMEs operating in Kosovo. The data were originally collected in 2022 and re-examined in 2025 to reflect evolving institutional and sustainability-related pressures associated with Kosovo's green transition. The reanalysis does not involve new data collection but reinterprets existing responses within an updated sustainability-oriented analytical framework.

The sampling frame was constructed using the official registry of active firms provided by the Tax Administration of Kosovo. According to official national statistics (Tax Administration of Kosovo, 2025), Kosovo has approximately 131,699 active SMEs in the reference year. The final

sample of 336 firms represents approximately 0.26% of the total SME population. Although the percentage share appears modest, the sample size satisfies statistical adequacy requirements for logistic regression analysis and ensures sectoral and regional representativeness through stratified sampling.

A stratified sampling design ensured representation across manufacturing, trade, and service sectors; SME size categories defined by EU standards; and Kosovo's seven economic regions. Data were collected through structured face-to-face interviews with firm owners or senior managers. The questionnaire included 52 items covering firm characteristics, managerial profiles, business planning practices, innovation activities, and performance expectations.

The sectoral composition of the sample reflects the structural distribution of SMEs in Kosovo. Out of the total 336 firms included in the analysis, 70 firms (20.8%) operate in manufacturing, 161 firms (47.9%) in trade, and 105 firms (31.3%) in the services sector.

The predominance of trade and service activities is consistent with the broader structure of Kosovo's SME sector, where commerce and service-oriented businesses represent the largest share of registered enterprises. The inclusion of manufacturing firms ensures sectoral balance and allows for cross-sectoral comparison in sustainability-oriented effectiveness.

### 3.2. Dependent variable

The dependent variable captures whether SMEs expect improved performance under increasing sustainability-related pressures anticipated for 2025, including rising energy costs, alignment with EU environmental regulations, and growing market demand for environmentally responsible products and services.

The variable is operationalized as a binary indicator:

- 1 = SME expects higher effectiveness in 2025;
- 0 = SME expects the same or lower effectiveness.

Based on the dataset, 61.6% of managers expect improved performance, while 38.4% anticipate no improvement. The binary nature of the dependent variable justifies the use of logistic regression to estimate the probability that sustainability-oriented determinants increase expected SME effectiveness under green transition conditions.

### 3.3. Independent variables and operationalization

Independent variables are derived from the theoretical framework outlined in Section 2 and reflect three key dimensions influencing sustainability-oriented SME effectiveness: managerial human capital, organizational readiness, and technological capacity. The operationalization follows established SME and sustainability research (Wildnerova et al., 2024; United Nations Development Programme [UNDP], 2024).

#### 3.3.1. Managerial and organizational determinants

Managerial education and experience represent human capital characteristics that influence strategic orientation and sustainability readiness.

The presence of a formal business plan captures organizational preparedness and long-term planning

capacity, both of which are associated with improved sustainability performance.

**Table 1.** Managerial and organizational determinants

Variable	Description	Coding
GEN	Manager gender	1 = Female, 2 = Male
EDU	Education level	1 = Secondary, 2 = Bachelor, 3 = Master+
PE	Managerial experience	1 = ≥5 years, 2 = <5 years
BP	Business plan availability	1 = Yes, 2 = No

**3.3.2. Sustainability-related innovation variables**

In the context of 2025 sustainability pressures, R&D includes green process optimization, energy efficiency improvements, and circular-economy innovation. Innovation activity reflects the firm's ability to introduce new or improved products and services that potentially support environmental and competitive performance.

**Table 2.** Sustainability-related innovation variables

Variable	Description	Coding
IR&D	Investment in R&D (including green R&D)	1 = Yes, 2 = No
DNP&I	New product/innovation activity	1 = Yes, 2 = No

**3.4. Descriptive statistics**

The above-mentioned table presents the descriptive characteristics of the 336 SMEs included in the analysis. The sample is predominantly male-led, with 74.4% of managers being male, while 25.6% are female. In terms of educational attainment, 70.2% of managers hold a bachelor's degree, and a smaller share possess postgraduate qualifications.

Regarding managerial experience, 74.7% of respondents report at least five years of experience, indicating a relatively experienced managerial base. Concerning sustainability-related practices, 53.6% of firms report investment in R&D activities, including green-oriented improvements, while 45.8% maintain a formal business plan.

These descriptive patterns are broadly consistent with SME demographic and structural characteristics observed in Western Balkan economies (World Bank, 2025). The variation across managerial, organizational, and innovation-related variables provides sufficient heterogeneity for subsequent regression analysis.

The descriptive statistics presented in the above-mentioned table confirm sufficient variation across managerial, organizational, and innovation-related variables, supporting the appropriateness of subsequent logistic regression analysis.

**3.5. Analytical strategy**

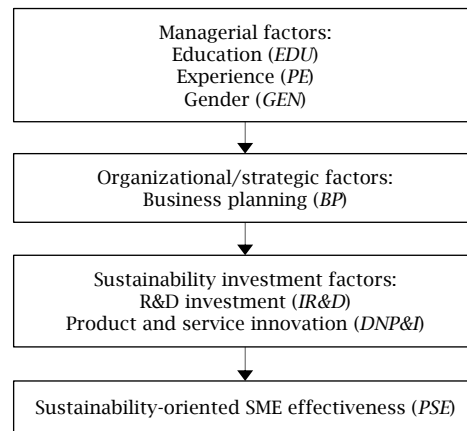
The analytical strategy follows a structured approach designed to evaluate the determinants of sustainability-oriented SME effectiveness under 2025 green transition pressures. Consistent with the theoretical framework presented in Section 2,

the model examines how managerial human capital, organizational readiness, and sustainability-related innovation activities influence the probability of improved expected performance.

The empirical analysis proceeds in four stages. First, descriptive statistics are employed to summarize key characteristics of the sample. Second, Pearson correlation analysis is conducted to examine bivariate relationships and assess potential multicollinearity concerns. Third, binary logistic regression is applied to estimate the likelihood that the identified determinants increase expected SME effectiveness. Finally, diagnostic and model-fit tests are conducted to ensure robustness and statistical validity.

The use of logistic regression is appropriate given the binary nature of the dependent variable and aligns with methodological standards in sustainability-focused SME research (Zhao & Lee, 2023).

**Figure 1.** Conceptual framework of sustainability-driven SME effectiveness



Note: This diagram visually illustrates relationships among managerial factors, organizational factors, sustainability investments, and perceived SME effectiveness.

**3.6. Econometric model specification**

To estimate the determinants of sustainability-oriented SME effectiveness, a binary logistic regression model is employed. Let  $Y_i = 1$  denotes that SME  $i$  expects improved effectiveness under 2025 sustainability pressures, and  $Y_i = 0$  otherwise.

The probability that SME  $i$  expects improved effectiveness is denoted by  $\pi_i$ , and the logistic regression model is specified as:

$$\ln\left(\frac{\pi_i}{1 - \pi_i}\right) = \beta_0 + \beta_1 GEN_i + \beta_2 EDU_i + \beta_3 PE_i + \beta_4 BP_i + \beta_5 IRD_i + \beta_6 DNP_i + \varepsilon_i \tag{1}$$

where,

- $\beta_0$  is the intercept term;
- $\beta_1, \dots, \beta_6$  are represent estimated coefficients;
- $\varepsilon_i$  is the error term.

The coefficients are interpreted in terms of log-odds, while the exponentiated coefficients (odds ratios) indicate how changes in explanatory variables affect the probability of improved sustainability-oriented effectiveness. This modeling approach is widely applied in SME and sustainability research when the dependent variable is dichotomous.

### 3.7. Diagnostic tests

To ensure the robustness and statistical validity of the estimated model, several diagnostic procedures were conducted. First, the dataset was examined for missing values, and no incomplete observations were identified. This confirms the internal consistency of the dataset used in the regression analysis.

Second, Pearson correlation coefficients among the independent variables were assessed to evaluate potential multicollinearity concerns. All correlation values remained below 0.60, indicating no strong linear relationships among explanatory variables.

Model adequacy was evaluated using the -2 log likelihood statistic and McFadden's pseudo- $R^2$ . The reported values indicate satisfactory explanatory power and overall model stability. Given the binary nature of the dependent variable, logistic regression provides an appropriate and statistically consistent estimation framework.

Overall, the diagnostic results confirm that the model is statistically sound and suitable for examining sustainability-driven determinants of SME effectiveness under green transition conditions.

### 3.8. Summary

This chapter outlined the data source, sampling design, variable operationalization, and econometric specification used to evaluate sustainability-driven SME effectiveness. The methodological framework provides the foundation for the empirical results presented in the following chapter.

## 4. RESEARCH RESULTS

### 4.1. Descriptive overview

This section presents the results of the logistic regression analysis used to examine sustainability-driven determinants of SME effectiveness in Kosovo under 2025 green transition conditions. Key descriptive indicators include:

- 61.6% of SMEs expect improved performance;
- 70.2% of managers hold a bachelor's degree;
- 53.6% invest in R&D;
- 50.3% engage in product or service innovation.

These figures provide an overview of managerial characteristics, organizational preparedness, and innovation activity within the sampled SMEs.

### 4.2. Correlation analysis

Table 3 presents the Pearson correlation matrix among the dependent and independent variables. The results indicate positive correlations between sustainability-oriented SME effectiveness (*PSE*) and education (*EDU*), managerial experience (*PE*), business planning (*BP*), and R&D investment (*IR&D*). The strongest correlation is observed between the *IR&D* and product and service innovation (*DNP&I*) (0.521).

**Table 3.** Pearson correlations

Variables	<i>PSE</i>	<i>GEN</i>	<i>EDU</i>	<i>PE</i>	<i>BP</i>	<i>IR&amp;D</i>	<i>DNP&amp;I</i>
<i>PSE</i>	1	0.074	0.158**	0.131*	0.144*	0.196**	0.052
<i>GEN</i>	0.074	1	-0.091	-0.119*	0.028	0.014	0.009
<i>EDU</i>	0.158**	-0.091	1	0.083	0.169**	0.147**	0.038
<i>PE</i>	0.131*	-0.119*	0.083	1	0.202**	0.046	0.017
<i>BP</i>	0.144*	0.028	0.169**	0.202**	1	0.184**	0.089
<i>IR&amp;D</i>	0.196**	0.014	0.147**	0.046	0.184**	1	0.521**
<i>DNP&amp;I</i>	0.052	0.009	0.038	0.0170	0.089	0.521**	1

Notes: \*\*  $p < 0.05$ ; \*  $p < 0.01$ ;  $N = 336$  SMEs.

All correlation coefficients remain below 0.60, suggesting that multicollinearity is not a concern in the regression analysis. The correlation structure supports the inclusion of the selected variables in the logistic regression model.

### 4.3. Logistic regression results

Table 4 presents the results of the binary logistic regression model estimating the determinants of sustainability-oriented SME effectiveness.

**Table 4.** Binary logistic regression output

Variable	$\beta$ (Coefficient)	Std. error	Wald	Sig.	Exp( $\beta$ )
<i>GEN</i>	0.298	0.176	2.86	0.091*	1.347
<i>EDU</i>	0.721	0.213	11.461	0.001***	2.056
<i>PE</i>	0.506	0.201	6.331	0.012**	1.658
<i>BP</i>	0.452	0.185	5.972	0.015**	1.571
<i>IR&amp;D</i>	0.762	0.232	10.759	0.001***	2.143
<i>DNP&amp;I</i>	0.142	0.197	0.517	0.472	1.153
Constant	-1.702	0.488	12.146	0.000***	0.182

Notes: \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ ; dependent variable — sustainability-oriented SME effectiveness (*PSE*);  $N = 336$  SMEs.

Education ( $\beta = 0.721$ ,  $p < 0.01$ ) and R&D investment ( $\beta = 0.762$ ,  $p < 0.01$ ) are statistically significant at the 1% level. Managerial experience

( $\beta = 0.506$ ,  $p < 0.05$ ) and business planning ( $\beta = 0.452$ ,  $p < 0.05$ ) are significant at the 5% level. Gender is marginally significant at the 10% level ( $\beta = 0.298$ ,

$p < 0.10$ ). In contrast, product and service innovation (DNP&I) does not exhibit statistical significance ( $p = 0.472$ ).

In terms of odds ratios, R&D investment increases the likelihood of improved sustainability-oriented effectiveness by a factor of 2.143, while higher education increases the likelihood by a factor of 2.056. Managerial experience and business planning increase the likelihood by factors of 1.658 and 1.571, respectively.

These results indicate that managerial and technological factors play a statistically significant role in explaining variations in expected sustainability-oriented effectiveness among SMEs.

#### 4.4. Model diagnostics

Table 5 presents the model fit statistics for the logistic regression analysis. The -2 log likelihood value is 347.83. The pseudo- $R^2$  measures indicate satisfactory explanatory power, with Cox and Snell  $R^2$  equal to 0.238, Nagelkerke  $R^2$  equal to 0.341, and McFadden  $R^2$  equal to 0.277.

**Table 5.** Model fit summary

<i>Indicator</i>	<i>Value</i>
-2 log likelihood	347.83
Cox & Snell $R^2$	0.238
Nagelkerke $R^2$	0.341
McFadden $R^2$	0.277
Hosmer-Lemeshow test (p-value)	0.412
Overall classification accuracy	73.50%

The Hosmer-Lemeshow goodness-of-fit test yields a p-value of 0.412, indicating that the model fits the data adequately. The overall classification accuracy of the model is 73.5%, suggesting a satisfactory level of predictive performance.

These diagnostic indicators confirm the statistical adequacy and stability of the estimated model.

#### 4.5. Predicted probabilities

Predicted probabilities were calculated to illustrate the effect of education on sustainability-oriented SME effectiveness. The estimated probabilities indicate that firms led by managers with secondary education have an approximate 48% probability of reporting improved effectiveness. This probability increases to approximately 63% for managers holding a bachelor's degree and to approximately 78% for those with postgraduate education.

These predicted values demonstrate a progressive increase in the likelihood of sustainability-oriented effectiveness as managerial education levels rise.

### 5. DISCUSSION OF THE RESULTS

#### 5.1. Discussion of key findings

The empirical findings provide important insights into the determinants of sustainability-oriented SME effectiveness under the 2025 green transition pressures. The descriptive indicators suggest that Kosovo's SME sector is moderately prepared for sustainability challenges but remains constrained in innovation capacity. This pattern is consistent with evidence from other emerging economies undergoing green transition pressures (Zhao et al., 2023).

The results highlight managerial human capital as a critical driver of sustainability-oriented effectiveness. Both education and experience significantly increase the likelihood that SMEs expect improved performance under environmental and regulatory pressures. Higher educational attainment enhances analytical capacity, strategic awareness, and the ability to interpret evolving sustainability requirements. Similarly, managerial experience strengthens decision-making under uncertainty and improves firms' readiness to navigate policy shifts and energy cost fluctuations. These findings align with prior research emphasizing the role of human capital in facilitating sustainability adoption and technological upgrading (Hojnik & Ruzzier, 2016).

Strategic business planning also emerges as a significant determinant. SMEs with formal business plans demonstrate greater preparedness for sustainability challenges, as structured planning supports long-term alignment, resource allocation, and risk anticipation. This finding reinforces existing literature suggesting that organizational readiness is essential for successful sustainability integration (Benato, 2022).

Among all predictors, R&D investment appears as the strongest determinant of sustainability-driven effectiveness. Firms investing in R&D are substantially more likely to report improved expected performance. This confirms the central role of technological capability in fostering adaptive capacity, green competitiveness, and environmental innovation (Calza et al., 2023). In contrast, product and service innovation does not show statistical significance. This result suggests that innovation activities in Kosovo's SMEs may remain incremental or insufficiently aligned with sustainability objectives. Similar patterns have been documented in developing economies where limited institutional support and technological infrastructure constrain the translation of innovation into measurable sustainability outcomes (Amankwah-Amoah, 2024).

Overall, the findings indicate that sustainability-driven SME effectiveness in Kosovo is primarily shaped by managerial capacity, structured organizational planning, and technological investment, rather than innovation activity alone.

#### 5.2. Policy implications

The empirical findings carry important implications for Kosovo's green transition strategy. First, the significant role of managerial education and experience underscores the importance of strengthening human capital development. Policymakers should prioritize sustainability-oriented training programs, executive education initiatives, and environmental management certification schemes tailored to SME managers. Strengthening managerial capacity is essential for improving compliance with EU sustainability standards and enhancing long-term strategic adaptation.

Second, the strong effect of R&D investment highlights the need to expand green innovation financing and technology transfer mechanisms. Public policy should focus on facilitating access to sustainability-linked loans, innovation grants, and credit guarantees that reduce financial barriers to green investment. Promoting structured collaboration between SMEs and universities, including joint

research initiatives and innovation voucher programs, would further accelerate technological upgrading and sustainability-oriented competitiveness.

Third, structured business planning emerged as a significant determinant of sustainability effectiveness, indicating the importance of organizational readiness. Institutional support mechanisms should encourage formal strategic planning through advisory services, digital tools, and conditional eligibility requirements linked to public funding schemes. Clear regulatory guidance and simplified compliance instruments can further assist SMEs in adapting to evolving environmental standards.

Finally, the limited impact of general innovation activity suggests that Kosovo's SME ecosystem requires stronger institutional coordination. Developing green clusters in priority sectors, enhancing regulatory consistency, and integrating digital sustainability tools can improve the effectiveness of innovation policies. A coordinated governance framework combining financial incentives, regulatory clarity, technological support, and human capital development is therefore critical for accelerating Kosovo's alignment with EU sustainability pathways.

## 6. CONCLUSION

This study examined the sustainability-driven determinants of SME effectiveness in Kosovo using a logistic regression model applied to data from 336 firms, interpreted within the context of the 2025 green transition. The findings demonstrate that managerial education, experience, structured business planning, and R&D investment significantly increase the likelihood that SMEs perceive improved sustainability-oriented performance. Among these factors, R&D investment emerged as the strongest predictor, highlighting the central role of technological capability and green-readiness in shaping competitive adaptation.

The results further confirm that human capital plays a critical role in facilitating sustainability integration. Higher educational attainment and managerial experience enhance strategic awareness, regulatory understanding, and adaptive capacity in uncertain policy environments. Structured business

planning strengthens organizational preparedness and long-term alignment with environmental objectives. In contrast, general product and service innovation did not exhibit statistical significance, suggesting that innovation efforts in Kosovo's SMEs may remain insufficiently aligned with sustainability requirements or constrained by institutional and financial limitations.

These findings contribute to the literature by integrating sustainability and green transition perspectives into SME performance models relevant to emerging economies. The study reinforces human capital theory by empirically validating education and experience as key determinants of sustainability-oriented effectiveness, while also reconceptualizing R&D as both an innovation mechanism and a pathway to environmental compliance and resource efficiency. By providing empirical evidence from Kosovo, the research offers valuable insights into sustainability dynamics within the Western Balkan context.

From a practical perspective, the results underscore the importance of strengthening green finance instruments, expanding R&D incentives, and investing in managerial capacity-building programs. Enhancing institutional coordination, supporting technology transfer, and improving access to sustainable technologies will be essential for accelerating Kosovo's alignment with EU sustainability frameworks and increasing SME competitiveness in regional and international markets.

Several limitations should be acknowledged. The cross-sectional nature of the dataset restricts causal inference, and the measurement of SME effectiveness relies on managerial perceptions rather than objective environmental indicators. In addition, the innovation variable does not differentiate between green and non-green innovation activities. Future research could address these limitations by employing longitudinal data, incorporating objective environmental performance metrics, distinguishing eco-innovation from general innovation, and conducting comparative analyses across Western Balkan economies. Exploring the interaction between digital transformation and sustainability performance may also provide further insights into emerging green competitiveness mechanisms.

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