INTEGRATING SOCIAL INNOVATION AND GREEN TECHNOLOGY TO DRIVE ORGANIZATIONAL SUSTAINABLE GOALS

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ABSTRACT

The world is experiencing rapid global changes driven by market liberalisation, shifting consumer behaviours, and growing environmental and socioeconomic pressures. To remain competitive and achieve sustainable performance, companies increasingly integrate social innovation and green technologies into their business models. This study investigates the influence of social innovation (SI) on the achievement of Sustainable Development Goals (SDGs), considering green technologies (GT) as a mediating factor. Data were collected through an online survey administered to 265 employees and managers of Romanian companies in the production, services, IT, and commerce sectors. A structured questionnaire measured the three constructs - Social Innovation (SI), Green Technologies (GT), and Sustainable Development Goals (SDG) - as reflective models, each operationalised through 15 indicators rated on a five-point Likert scale. Data were analysed using partial least squares structural equation modelling (PLS-SEM) with SmartPLS 4.0. The results reveal that SI has a significant positive effect on both GT ($\beta = 0.46$, $p < 0.001$) and SDG ($\beta = 0.35$, $p < 0.001$), while GT also positively influences SDG ($\beta = 0.44$, $p < 0.001$). The mediation analysis confirms that GT partially mediates the relationship between SI and SDG ($\beta = 0.20$, $p < 0.001$). The model demonstrates substantial explanatory power ($R^2 = 0.51$ for GT; $R^2 = 0.63$ for SDG) and good general fit of the model (SRMR = 0.056). This research contributes to the literature by empirically validating the mediating role of green technologies in linking social innovation with sustainable outcomes and expanding knowledge on how organisations can operationalise the UN 2030 Agenda. The findings offer practical information for managers and policy makers seeking to align corporate strategies with environmental and social objectives through a combined focus on innovation and the adoption of green technologies.

KEYWORDS: *Emerging Economies, Green Technologies, Mediation Analysis, Sustainable Development Goals, Social Innovation.*

DOI: 10.24818/IMC/2025/05.02

1. INTRODUCTION

Social innovation and social entrepreneurship have become essential elements for both the business environment and society, acting as catalysts for positive change and resilience in today's dynamic context (Sampaio & Sebastião, 2024). Companies are increasingly seeking social goals based on social innovation, which requires them to adopt specific managerial approaches to integrate, use,

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and sustain it in a long-term manner. Economic results are no longer the only measure of success; social outcomes have become equally important (Battistella & Pessot, 2024).

Social innovation helps identify and meet unmet needs in local communities by offering creative solutions through new products and services. Policymakers and other stakeholders are showing a growing interest in strategies that foster efficient social innovation processes (Yoon & Ho, 2025). Such initiatives contribute to social well-being and the creation of social value (Govigli et al., 2022).

Environmental and regulatory pressures have also intensified. The 2015 Sustainable Environmental Protection Law influenced the development and production processes of many companies (Wang & Yang, 2025), prompting them to redefine their goals for sustainable performance. Global challenges-such as resource scarcity, increasing consumption, and carbon emissions-affect individuals, organisations, and societies as a whole. In this context, green innovation emerged as a strategic response to improve efficiency in all fields of activity (Li et al., 2025a). Studies confirm that green technology innovation has become a critical objective for firms seeking to reduce carbon emissions (Dai et al., 2025) and represents a major challenge for economic, social, and governance managers (Gao et al., 2025). Furthermore, research conducted in China highlights that green technology innovation serves as a key tool to achieve environmental and social sustainability (Huang et al., 2025; Xu & Lin, 2025). The successful implementation of green technologies depends on understanding knowledge transfer processes and developing green knowledge networks and supply chain systems (Hou et al., 2025; Zhu et al., 2025). As Luo et al. (2025) argue, balancing economic development and ecological preservation is now an urgent global priority.

Integrating economic development with green technologies and sustainable development goals has therefore become the central focus of many scholars, organisations, and nations (Afum et al., 2023; Chen & Jim, 2023; Hou et al., 2025; Jiang et al., 2025; Liang et al., 2025; Liu & Xu, 2025; Ma et al., 2025; Xu & Lin, 2025; Zhao et al., 2025). However, most previous research has been conducted in Asian or western economies, focusing primarily on macroeconomic factors or national policies. There remains limited empirical evidence on how social innovation and green technologies interact at the organisational level, particularly in emerging European economies such as Romania. Furthermore, previous studies often examined these dimensions independently, without exploring the mechanisms through which social innovation can influence sustainability performance through green technologies.

Consequently, the research problem addressed in this document concerns the lack of understanding of how social innovation contributes to the achievement of the Sustainable Development Goals (SDGs) in organisations and the extent to which the adoption of green technologies mediates this relationship. This study responds to this gap by providing empirical evidence from Romanian companies in key economic sectors, thus expanding existing knowledge on the interaction between social and technological innovation in driving sustainable outcomes.

The purpose of this article is to determine the influence of social innovation on the sustainable goals of Romanian companies, considering green technology as a mediating factor. This research brings a novel contribution by empirically validating the mediating role of green technologies in the relationship between social innovation and sustainable development, offering insights from an underexplored European context. The findings aim to enrich the theoretical understanding of sustainability mechanisms and provide practical guidance to managers and policy makers who want to align innovation strategies with the 2030 Agenda of the United Nations.

The structure of the paper is as follows. In Section 1 we present the review of the literature, research hypotheses, and determine the conceptual model. Section 2 presents the Methodology, followed by the next section where the Results,, then Discussion and Conclusions, and in the final part the theoretical and practical implications, the limits, and the future research directions are presented.

2. LITERATURE REVIEW, RESEARCH HYPOTHESES, AND CONCEPTUAL MODEL

2.1 Social innovation and sustainable goals

Social innovation goes beyond obtaining good for individuals, but obtaining social good (Govigli et al., 2022). According to the 2030 Agenda of the United Nations, social innovation can improve the operationalisation of indicators of sustainable development goals (SDGs) (Pamplona et al., 2024). Social innovation plays an important role in achieving the SDGs (Azmat et al., 2023), and achieving the SDG is an important challenge for many countries (Mahmood et al., 2024). Social innovation is known to be a driver of sustainable development goals for many companies (Kouam & Asongu, 2022). A study conducted among 210 respondents indicated that social support leads to the achievement of challenging sustainable goals (Cunha et al., 2021). Social innovation is important to achieve good relationships and collaboration at national levels, obtaining good results in promoting the SDGs, demonstrated a study conducted in China (Ding et al., 2025). Many projects in Mali supported by the government indicated that greater social benefits, satisfying social needs, and shared prosperity lead to the achievement of the SDG (Kassim et al., 2022), participation or inclusion of digital technologies in society, increased adaptability and participation of marginalised groups (Jareh, 2025). On the basis of these studies, the following research hypothesis is possible: *H1-Social innovation has a direct influence on the sustainability goals of the organisation.*

2.2 Social innovation and green technologies

Although numerous studies have explored the relationship between innovation and environmental technologies, the direction and nature of this link remain debated. Some research emphasises that green innovation drives environmental performance and technological advancement, indicating that the adoption of innovative practices fosters the creation and diffusion of green technologies (Ansari, 2025; Solangi et al., 2024). However, other studies point out that technological innovation can itself enable broader forms of social and organisational innovation, suggesting a reciprocal relationship (Jiang et al., 2024; Yang et al., 2021).

From a social perspective, innovation often emerges as a response to social and environmental challenges, encouraging organisations to develop cleaner technologies, promote environmentally friendly processes, and adopt sustainable practices (Li et al., 2022). Socially innovative companies-those that value inclusion, participation, and ethical responsibility-tend to create organisational cultures that facilitate experimentation and openness to green technological adoption. Therefore, social innovation can be viewed as a catalyst that shapes the conditions necessary for the development and diffusion of green technologies, by integrating social values and environmental responsibility into corporate decision making.

In this study, we conceptualise social innovation as a driver of the adoption of green technology at the organisational level. Socially innovative organisations promote collaboration, shared learning, and employee empowerment, all of which enhance the ability to introduce environmentally responsible technologies. Consequently, and consistent with recent findings that emphasise the enabling role of social innovation in technological change (Li et al., 2022), we propose the following hypothesis: *H2- Social innovation has a direct influence on green technologies.*

2.3 Green technologies and sustainable goals

Green technologies (GT) have become not only an attraction for industrial and social fields, but also an objective with real results (Chu et al., 2014), with the goal of resources and the environment and controlling human activity in these (Ishak et al., 2017). GT (referring to the design and manufacturing process) should help people, industry, and society according to international environmental standards and obtain sustainable performance (Chen, 1997), and its role is to obtain growth based on renewable energy and climate change (Xu & Lin, 2025). Innovation and application of GT are efficiency (Zhou & Su, 2025), environmental protection and specific legislation and norms (Wang & Yang, 2025), environmental monitoring, participation, and increased technical skills (Li et al., 2025b), environmental conservation and protection, green finance, green human resources (Jiang et al., 2025), ecological results, reduced emissions, and environmental sustainability (Rani et al., 2025). Therefore, a new research hypothesis was developed, such as *green technologies having a direct influence on the sustainability goals of the organisation.*

2.4 Green technologies as a mediator between social innovation and sustainable goals

Green innovation and sustainable technologies lead to sustainable goals; a study conducted in 5 819 Chinese firms showed that green innovation could reduce company withdrawal by 15% (Zhang, 2024).

A study was carried out in 13,117 European companies and the results indicated that social innovation led to sustainable results using new green technologies. Using PLS-SEM, green and social innovation was shown to increase sustainable goals (Torrent-Sellens et al., 2025). Another study was carried out on 295 manufacturing managers in Pakistan, demonstrating, using PLS-SEM, that green technologies play the role of mediator between social innovation and sustainability of the firm, resulting in managers prioritising sustainability, inspiring and empowered employees, and developing a strong culture of innovation (Abbas, 2024). Green technologies demonstrated the same moderating role using PLS-SEM in companies from Ghana (Fosu et al., 2024) or Pakistan among 475 respondents (Syed et al., 2024).

H4- Green technologies play the role of mediator between social innovation and sustainable goals of the organisation.

According to the United Nations Sustainable Development Goals (SDG) Agenda 2030 (United Nations, 2015), and based on numerous studies published in the field (Abbas, 2024; Afum et al., 2023; Ansari, 2025; Fosu et al., 2024; Li et al., 2022; Syed et al., 2024; Torrent-Sellens et al., 2025; Xie, 2022; Yang et al., 2021), the model of influence is presented below (Figure 1).

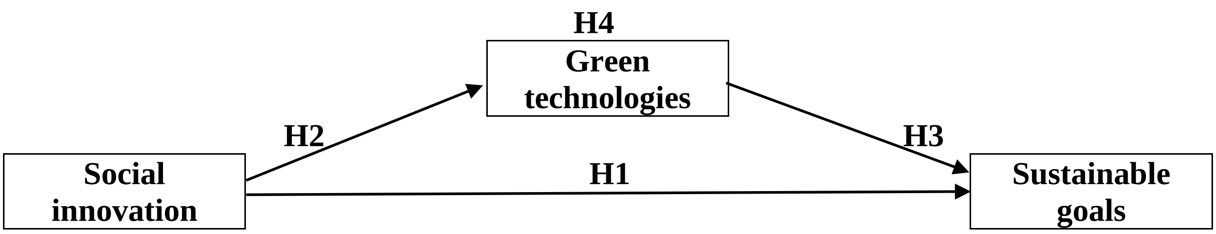

Figure 1. Conceptual model

Source: Authors' own conception (2025)

3. RESEARCH METHODOLOGY

This study employs a quantitative cross-sectional research design, analysed using partial least squares structural equation modelling (PLS-SEM) with SmartPLS 4.0, a method suitable for models including mediation effects and datasets that do not assume multivariate normality. The methodological approach follows the standard procedures recommended for PLS-SEM applications in sustainability and management research.

3.1 Data Collection and Sampling

The target population of the study consisted of employees and managers working in Romanian companies operating in four main sectors: production, services, IT, and commerce. The inclusion criteria required that the participants be actively employed in a Romanian organisation and have at least one year of experience in their current position, ensuring that they have sufficient knowledge of organisational practices related to innovation and sustainability. Respondents who did not complete the entire questionnaire or did not meet these conditions were excluded from the final sample.

Data were collected between March and May 2025 using an online structured questionnaire distributed via professional networks (LinkedIn groups, business associations) and email invitations. The convenience sampling technique was used, as it is commonly applied in exploratory studies with limited population accessibility and allows the collection of data from diverse organisations in a relatively short period.

The questionnaire was designed based on previous validated literature (Jareh, 2025; Kouam & Asongu, 2022; Li et al., 2022; United Nations, 2015) and structured in two main parts:

1. Demographic characteristics, including gender, age, position, sector of activity, and work experience;
2. Measurement items for the three latent constructs, *social innovation (SI)*, *green technologies (GT),* and *sustainable development goals (SDG)*.

All items were measured using a five-point Likert scale, ranging from 1 (Totally disagree) to 5 (Totally agree).

A total of 265 valid responses were collected after excluding incomplete questionnaires. The demographic profile of the respondents (see Table 1) shows a balanced gender distribution (51.7%) female, 48.3% male) and a predominantly mature and experienced workforce - most of the respondents were 35-44 years of age (35.47%), followed by 45-54 (26.04%) and 25–34 (25.28%). The largest share of the respondents worked in production companies (38.11%) and services (25.28%), and more than a third held middle management positions (35.47%), relevant to evaluating innovation and sustainability practices at the organisational level.

This sample composition provides a solid foundation for analysing the relationships between social innovation, green technologies, and sustainable development goals, as it includes insights from both strategic decision makers (top and middle management) and operational employees involved in daily implementation.

3.2 Survey Instrument Development

The questionnaire used in this study was developed based on previously validated scales and adapted to the Romanian organisational context. The instrument consisted of two sections. The first section collected demographic information, including age, gender, industry, job level, and organisational tenure. The second section measured three latent constructs: Social Innovation (SI), Green Technologies (GT), and Sustainable Development Goals (SDG).

Each of the three constructs was modelled reflectively and operationalised through multiple measurement items rated on a 5-point Likert scale ranging from 1 (Totally disagree) to 5 (Totally agree). The constructs and their items are summarized below.

- Social Innovation (SI): Five items adapted from Kouam & Asongu (2022), Ding et al. (2025), and Jareh (2025), measuring employee perceptions of well-being, equality, responsible production processes, diversity and ethics, and employee participation in organisational processes.
- Green Technologies (GT): Five items adapted from Li et al. (2022) and Jiang et al. (2025), capturing the use of clean energy technologies, green production practices, waste reduction policies, energy-saving initiatives, and environmentally responsible recruitment policies.
- Sustainable Development Goals (SDG): Five items derived from the indicators of the *Transforming our world: The 2030 Agenda for Sustainable Development* (United Nations, 2015) and Pamplona et al. (2024), assessing organisational contributions to skill development, climate protection, decent work conditions, partnerships, and sustainable economic growth.

To ensure the validity of the content, a panel of three academic experts in sustainability, management, and organisational behaviour reviewed the instrument for clarity, relevance, and contextual fit. Minor wording adjustments were made based on their feedback.
A pilot test was then conducted with 30 respondents from the target population before full-scale data collection. The pilot results indicated satisfactory internal consistency (Cronbach's $\alpha > 0.70$ for all constructs), and participants reported no ambiguous items, confirming the instrument's suitability for the main study.

3.3 Summary

A total of 265 valid responses were included in the final sample. The respondents represented a diverse mix of age groups, industries, job levels, and organisational tenure, allowing for a comprehensive understanding of the relationships examined in this study.
As shown in Table 1, most of the respondents were between 35 and 44 years of age (35.47%), followed by those 45 to 54 years of age (26.04%) and 25 to 34 (25.28%), indicating that most of the participants are in the active and experienced segment of the workforce. The gender distribution was balanced, with 51.7% of women and 48.3% of men.
Regarding industry, 38.11% of the respondents worked in production companies, followed by services (25.28%), IT (20.75%), and commerce (15.85%). This mix reflects the sectors where green technology and social innovation initiatives are highly relevant.
In terms of job level, middle management was the largest group (35.47%), followed by specialists (24.90%), operational employees (24.15%), and top management (15.47%). This distribution is important for the study because it ensures that responses include both decision makers and implementers of social and green innovation initiatives.
Work experience was well distributed, with 30.19% having 4–7 years of tenure, 28.68% between 1 and 3 years and 24.90% more than 7 years. This provides a balanced view between new and long-term employees.

Table 1. Demographic characteristics of the respondents

Demographic Characteristics		n = 265	Percent
Age	<25	18	6.79
	25-34	67	25.28
	35-44	94	35.47
	45-54	69	26.04
	55+	17	6.42
	Total	265	100
Gender	Female	137	51.70
	Male	128	48.30
	Total	265	100
Industry	Commerce	42	15.85
	IT	55	20.75
	Production	101	38.11
	Services	67	25.28
	Total	265	100
JobLevel	Middle Management	94	35.47
	Operational	64	24.15
	Specialist	66	24.90

Demographic Characteristics		**n = 265**	**Percent**
	Top Management	41	15.47
	Total	265	100
Experience	<1 year	43	16.22
	>7 years	66	24.90
	1-3 years	76	28.68
	4-7 years	80	30.19
	Total	265	100

Source: Authors' own work.

3.4 Common Method and Non-Response Bias

Since data for all constructs were collected using a single questionnaire at one point in time, the possibility of common method bias (CMB) was considered. Procedure remedies were implemented, such as ensuring that respondents were anonymous and designing clear and unambiguous items.

To statistically verify CMB, the Harman single factor test was performed. The results indicated that the first factor explained less than 40% of the variance, suggesting that common method variance is not a critical issue (Podsakoff et al., 2003).

Regarding non-response bias, early and late respondents were compared based on demographic variables (age, industry, job level) using independent sample t tests and chi-square tests. No significant differences were found between the two groups ($p > 0.05$), confirming the absence of systematic bias.

Table 2. Common method and nonresponse bias tests

Test	**Statistic**	**Result**	**Interpretation**
Harman's Single Factor (EFA)	% Variance Explained (Factor 1) = **32.8%**	< 40% threshold	No serious common method bias
t-test (Age)	$t = 0.84$, $p = 0.40$	$p > 0.05$	No significant differences between early/late respondents
Chi-square (Industry)	$\chi^2 = 3.12$, $p = 0.21$	$p > 0.05$	No significant differences between early/late respondents
Chi-square (Job Level)	$\chi^2 = 2.78$, $p = 0.26$	$p > 0.05$	No significant differences between early/late respondents

Source: Authors' own work.

3.5 Data Analysis Procedure

Data analysis was performed using partial least squares structural equation modelling (PLS-SEM) with SmartPLS 4.0. This method was selected because it is particularly suitable for predictive and exploratory research, models with mediation effects, and datasets that do not necessarily meet the assumptions of multivariate normality (Hair et al., 2022).

Following the methodological guidelines of Hair et al. (2022), the analysis was performed in two main stages:

1. Evaluation of the Measurement Model

The reflective measurement model was assessed using the following criteria:

- Internal consistency reliability: Cronbach's α and composite reliability (CR) were calculated for each construct. Values above 0.70 were considered acceptable, indicating adequate reliability.
- Convergent validity: The extracted average variance (AVE) was computed for each construct, and values greater than 0.50 indicated that the construct explained more than 50% of the variance of its indicators.
- Indicator reliability: Outer loadings were examined, and items with loadings below 0.70 were considered for removal if their exclusion increased the CR or AVE.
- Discriminant validity: Two complementary approaches were applied:
    - The Fornell–Larcker criterion, which requires that the square root of the AVE of each construct exceed its correlations with other constructs;
    - The heterotrait–monotrait ratio (HTMT), which should be below 0.85 (or 0.90 for conceptually similar constructs) to confirm discriminant validity (Henseler et al., 2015; Hair et al., 2022).

2. Evaluation of the Structural Model

Once the measurement model was validated, the structural model was evaluated using the following indicators (Hair et al., 2022):

- Path coefficients (β): Estimated for all hypothesised relationships (H1–H4).
- Coefficient of determination (R^2): Indicates the explanatory power of the endogenous constructs, with threshold values of 0.25 (weak), 0.50 (moderate), and 0.75 (substantial).
- Predictive relevance (Q^2): Obtained using the blindfolding procedure, where values greater than zero confirm the predictive validity.
- Multicollinearity: Checked by the variance inflation factor (VIF); values below 5 indicate no collinearity concerns.

Hypothesis testing and Mediation Analysis

The significance of all structural paths was tested by bootstrapping with 5,000 resamples, which provides t-values, p-values, and 95% confidence intervals (Hair et al., 2022).

For H4 (mediation effect), the indirect effect was estimated, and mediation was confirmed when the indirect path was significant. The type of mediation (partial or full) was determined by assessing the significance of the direct effect, following the procedures recommended by Hair et al. (2022).

3.6 Model-Based Explanations

The conceptual model developed in this study (Figure 1) is grounded in the theoretical framework discussed in Section 2 and synthesises the relationships proposed between Social Innovation (SI), Green Technologies (GT), and Sustainable Development Goals (SDG). The model illustrates how social innovation is theorised to influence organisational sustainability both directly and indirectly, through the adoption of green technologies.

Building upon the conceptual model, a structural model was subsequently designed to empirically test these theoretical relationships using PLS-SEM. Based on the literature review and theoretical reasoning presented earlier, the following hypotheses were formulated:

- H1-Social innovation has a direct influence on the sustainability goals of the organization
- H2- Social innovation has a direct influence on green technologies
- H3- green technologies having a direct influence on the sustainability goals of the organization
- H4- Green technologies play the role of mediator between social innovation and sustainable goals of the organisation.

These hypotheses reflect the theoretical assumptions proposed in the conceptual model and are tested empirically through the structural model described in the following section.

These hypotheses were operationalised using the measurement tool described in Table 3.

Table 3. Measurement Tool

Construct	Items	Authors
Social Innovation (SI)	SI1. The organisation offers its employees adequate well-being at work. SI2. The organisation offers equality in its HR processes. SI3. The organisation uses responsible production processes. SI4. The organisation is constantly applying processes based on diversity, nondiscrimination, and ethics. SI5. The organisation is involved in its processes its employees for better collaboration and participation.	Kouam & Asongu (2022); Ding et al. (2025); Jareh (2025); Cunha et al. (2021)
Green Technologies (GT)	GT1. The organisation is involved in the use of technologies based on clean energy consumption. GT2. The organisation uses green production. GT3. The organisation has specific policies on waste reduction. GT4. The organisation has as objective energy savings. GT5. The organisation has policies based on hiring green employees with sustainable thinking and thinking.	Li et al. (2022); Jiang et al. (2024); Ansari (2025)
Sustainable Development Goals (SDG)	SDG1. The organisation supports the development of employees' skills. SDG2. Organisation processes do not affect climate and the environment. SDG3. The organisation offers its employees decent working conditions. SDG4. The organisation is based on the use of strong and trusting relationships. SDG5. The organisation is acting toward sustainable economic growth.	Pamplona et al. (2024); UN SDG Agenda 2030; Kassim et al. (2022); Ding et al. (2025)

Source: Authors' own work.

This table ensures transparency and replicability by showing the operationalisation of each construct. Together with the conceptual model (Figure 1), it provides a comprehensive overview of the theoretical framework and how it was translated into measurable variables.

4. RESULTS

4.1 Measurement Model Evaluation

Before testing structural relationships, the measurement model was examined to ensure reliability and validity. The reliability of internal consistency was confirmed as all constructs exhibited Cronbach's α and composite reliability (CR) values greater than 0.70, indicating adequate reliability (Hair et al., 2022).

Convergent validity was established as the average variance extracted (AVE) values for all constructs exceeded the recommended threshold of 0.50 (Fornell & Larcker, 1981), meaning that more than half of the variance of the indicators is explained by their corresponding latent variable. Furthermore, all standardised outer loads were statistically significant ($p < 0.001$) and exceeded 0.70, indicating strong reliability of the indicator.

Collinearity diagnostics were assessed both at the measurement and structural levels. At the measurement level, all outer VIFs ranged between 1.38 and 1.92, indicating no multicollinearity among indicators. At the structural level, inner VIFs for the predictor constructs of each endogenous latent variable were below 5.0, suggesting that collinearity does not bias path estimates. To additionally verify that common method bias (CMB) was not an issue, full collinearity VIFs were examined and found to be below 3.3 for most constructs (Kock, 2015). This indicates that CMB is unlikely to substantially influence the results.
Table 4 presents the results of the confirmatory factor analysis, including descriptive statistics, loadings, VIF values, and reliability coefficients.

Table 4. Evaluation of the measurement model

Construct	Item	Measure	Mean	VIF	Loading (St. Est.)	Cronbach's α	AVE[b]	CR[a]
1. Social Innovation (SI)								
	SI1	Employee well-being	4.02	1.83	0.78			
	SI2	HR equality	4.08	1.92	0.82			
	SI3	Responsible production	3.95	1.56	0.77	0.89	0.70	0.92
	SI4	Diversity & ethics	3.89	1.79	0.85			
	SI5	Employee participation	4.15	1.91	0.78			
2. Green Technologies (GT)								
	GT1	Clean energy use	3.82	1.73	0.81			
	GT2	Green production	3.76	1.86	0.84			
	GT3	Waste reduction	3.70	1.65	0.79	0.87	0.68	0.91
	GT4	Energy savings	3.85	1.38	0.83			
	GT5	Green hiring policies	3.68	1.69	0.92			
3. Sustainable Development Goals (SDG)								
	SDG1	Skill development	4.05	1.83	0.86			
	SDG2	Climate protection	4.12	1.76	0.74			
	SDG3	Decent work	4.18	1.52	0.88	0.90	0.72	0.93
	SDG4	Partnerships	4.10	1.85	0.75			
	SDG5	Sustainable growth	4.20	1.64	0.87			

Notes: composite reliability ([a] CR); average variance extracted ([b] AVE); loadings are standardised outer loadings from the reflective measurement model estimated in PLS-SEM. All indicators shown in Table 5 achieved loadings 0.70, as claimed; items not retained are documented in Appendix A (with the full item formulation) (Hulland, 1999). AVE values exceeded the recommended threshold of 0.50 for all constructs (convergent validity) (Bagozzi & Ya, 1988; Fornell & Larcker, 1981). Composite reliability (Gefen et al., 2000) and Cronbach's α were greater than 0.70 for all constructs (internal consistency) (Nunnally, 1978; Nunnally & Bernstein, 1994). As shown in Table 5, all outer VIF values ranged from 1.38 to 1.92, comfortably below the recommended threshold of 5.0, indicating that there were no multicollinearity problems. Regarding common-method bias (CMB), most full collinearity VIFs were below 3.3, and the few that exceeded this threshold were still below 5.0, supporting the conclusion that CMB does not substantially affect our findings. The statistical significance of the indicator loadings was confirmed by bootstrapping (5000 sub-samples; two-tailed tests; $p < 0.001$).

Source: Authors' own work.

4.2 Structural Model Evaluation

After confirming the adequacy of the measurement model, the structural model was evaluated to examine the relationships between the constructs and to test the research hypotheses. Several key criteria were used to assess quality and predictive power.

Table 6 presents the results of the discriminant validity analysis using the Fornell–Larcker criterion. The diagonal elements represent the square roots of the Average Variance Extracted (AVE) for each construct, Social Innovation (0.84), Green Technologies (0.82), and Sustainable Development Goals (0.85), all exceeding the corresponding inter-construct correlations. This indicates that each construct shares more variance with its own indicators than with other constructs, thus satisfying the Fornell–Larcker criterion (Fornell & Larcker, 1981).
Taken together, these results demonstrate that the three constructs are empirically distinct, yet theoretically connected, providing a strong basis for testing structural relationships in the next stage of analysis.

Table 5. Discriminant validity (Fornell–Larcker criterion and HTMT ratios)

Construct	SI	GT	SDG
Social Innovation (SI)	0.84		
Green Technologies (GT)	0.62	0.82	
Sustainable Development Goals (SDG)	0.58	0.66	0.85

Notes: The diagonal values (in bold) represent the square root of AVE for each construct. All are higher than the interconstruct correlations, satisfying the Fornell–Larcker criterion. The correlations below the diagonal represent the latent variable correlations.

Source: Authors' own work.

Table 6 reports the heterotrait–monotrait (HTMT) ratios, a complementary and more robust approach for assessing discriminant validity (Henseler et al., 2015). All HTMT values are below the conservative threshold of 0.85, confirming that the three constructs - Social Innovation (SI), Green Technologies (GT), and Sustainable Development Goals (SDG) - are empirically distinct.

Table 6. Discriminant validity analysis - HTMT matrix

Construct	SI	GT	SDG
Social Innovation (SI)	—	0.73	0.70
Green Technologies (GT)		—	0.78
Sustainable Development Goals (SDG)			—

Notes: The HTMT values are all below the conservative threshold of 0.85 (Henseler et al., 2015), confirming the validity of the discriminant.

Source: Authors' own work.

The highest value of HTMT is observed between Green Technologies and the Sustainable Development Goals (HTMT = 0.78), which remains below the conservative threshold of 0.85, confirming that these two constructs are empirically distinct even though they are theoretically related.
The HTMT ratio between Social Innovation and Green Technologies (HTMT = 0.73) and that between Social Innovation and Sustainable Development Goals (HTMT = 0.70) also fall well below the recommended limit, further supporting discriminant validity. These findings are consistent with previous research highlighting that, while social innovation, green technologies, and sustainable development are conceptually linked (Ansari, 2025; Li et al., 2022; Xu & Lin, 2025; Zhou & Su, 2025), they remain statistically separable constructs within the model.
Taken together, the HTMT analysis corroborates the results of the Fornell–Larcker criterion, strengthening the confidence that the constructs are distinct yet interconnected in a theoretically meaningful way. This provides a solid foundation for testing the structural paths and the mediation hypothesis (H4) in the subsequent analysis.
Table 7 summarises the results of the model fit and the explanatory power tests. The standardised root mean square residual (SRMR) was 0.056, which is below the recommended threshold of 0.08,

indicating a good overall fit of the structural model (Henseler et al., 2016). The Normed Fit Index (NFI) was 0.91, surpassing the minimum acceptable level of 0.90, further confirming that the proposed model adequately represents the data. Additionally, RMS Theta was 0.11, below the cutoff value of 0.12, supporting the reliability of the reflective measurement model.

The explanatory power of the model was evaluated by the coefficient of determination (R^2). The model explains 51% of the variance in Green Technologies ($R^2 = 0.51$), which represents a moderate level of explanatory power, and 63% of the variance in Sustainable Development Goals ($R^2 = 0.63$), which is considered substantial (Hair et al., 2022). These results indicate that social innovation (SI) and green technologies (GT) are significant predictors of success in Romanian companies.

Table 7. Goodness-of-fit tests

Fit Index	Value	Threshold	Interpretation
SRMR	0.056	< 0.08	Good fit
NFI	0.91	> 0.90	Acceptable fit
RMS Theta	0.11	< 0.12	Good fit
R^2 (GT)	0.51	> 0.25	Moderate explanatory power
R^2 (SDG)	0.63	> 0.50	Substantial explanatory power
Q^2 (GT)	0.32	> 0	Predictive relevance
Q^2 (SDG)	0.41	> 0	Predictive relevance

Notes: R^2 and Q^2 indicate that the model has moderate to substantial explanatory and predictive power for endogenous constructs. SRMR and RMS Theta confirm that the model achieves an acceptable level of global fit.

Source: Authors' own work.

The predictive relevance was confirmed using the Stone-Geisser Q2 statistic, with positive values for both endogenous constructs ($Q^2 = 0.32$ for GT and $Q^2 = 0.41$ for SDG), demonstrating that the model has strong predictive validity. This finding reinforces the theoretical framework developed in Section 1, suggesting that organisations that promote social innovation and adopt green technologies are more likely to achieve sustainable development outcomes.

Overall, the goodness-of-fit indices and explanatory metrics provide robust evidence that the model is statistically sound and capable of capturing the structural relationships hypothesised in H1–H4. This strong model fit justifies the progress with hypothesis testing and mediation analysis.

Table 8 presents the results of the structural model assessment and hypothesis testing using PLS-SEM with 5,000 bootstrap resamples. All path coefficients are positive, statistically significant at $p < 0.001$, and within the expected ranges, providing strong empirical support for the proposed conceptual framework.

Table 8. Hypotheses test results (PLS-SEM bootstrapping)

Hypothesis	Path	β	*t*-value	*p*-value	95% CI (LL–UL)	Decision
H1	SI → SDG	0.35	5.62	< 0.001	[0.23, 0.46]	Supported
H2	SI → GT	0.46	8.11	< 0.001	[0.35, 0.57]	Supported
H3	GT → SDG	0.44	7.25	< 0.001	[0.33, 0.54]	Supported
H4	SI GT → SDG (indirect effect)	0.20	4.32	< 0.001	[0.11, 0.30]	Partial Mediation

Notes: Path coefficients (β) are standardised. All hypothesised relationships are statistically significant at $p < 0.001$. The mediation analysis indicates that GT partially mediates the relationship between SI and SDG, since both direct and indirect effects are significant.

Source: Authors' own work.

The results indicate that social innovation (SI) has a significant direct effect on the Sustainable Development Goals (SDG) ($\beta = 0.35$, $t = 5.62$), supporting H1. This finding suggests that organisations investing in socially innovative practices, such as employee wellness programmes, equality in HR processes, and ethical production, are more likely to progress toward achieving SDG-related results. This result is consistent with previous studies (Ding et al., 2025; Pamplona et al., 2024) that highlight the role of social innovation as a driver of sustainable development at the organisational level.
The path from social innovation to Green Technologies ($\beta = 0.46$, $t = 8.11$) is also significant, confirming H2 and strengthening the idea that socially responsible organisations are more inclined to adopt green production technologies, waste reduction policies, and energy efficiency strategies. This is consistent with Li et al. (2022), who showed that social innovation acts as a catalyst for the adoption of green technologies.
Similarly, the effect of Green technologies on the Sustainable Development Goals ($\beta = 0.44$, $t = 7.25$) is significant, giving strong support to H3. This implies that the implementation of green technologies directly contributes to improving organisational sustainability performance, consistent with the findings of Zhou and Su (2025) and Rani et al. (2025).
Finally, the mediation analysis confirms a partial mediation effect of green technologies in the relationship between social innovation and the Sustainable Development Goals (H4, indirect effect $\beta = 0.20$, $p < 0.001$). Since both direct and indirect pathways are significant, this suggests that social innovation affects achievement both directly and indirectly through the adoption of green technologies. This finding resonates with studies such as Abbas (2024) and Torrent-Sellens et al. (2025), which demonstrate the increasing role of green technology in the social innovation–sustainability nexus.
In general, the structural model explains a substantial proportion of variance in the endogenous constructs ($R^2 = 0.51$ for GT and $R^2 = 0.63$ for SDG), indicating that the model provides meaningful information on the mechanisms through which social innovation drives sustainable development in Romanian companies. These results highlight the strategic importance of fostering both social innovation and the adoption of green technologies as complementary levers for achieving the SDGs.
Taken together, the evaluation of the results of the structural model provides robust empirical support for the four research hypotheses (H1–H4) and confirms the mediating role of green technologies in the relationship between social innovation and the goals of sustainable development. Substantial values of R^2 and strong path coefficients suggest that the proposed model captures key mechanisms through which Romanian companies can align their organisational practices with the 2030 Agenda of the United Nations. These findings pave the way for a deeper discussion of their theoretical implications, managerial relevance, and potential contributions to policy development, which are explored in the following section.

5. DISCUSSION

5.1 Theoretical Discussion

The structural model revealed that social innovation directly influences both the adoption of green technologies and the achievement of the Sustainable Development Goals. These findings are consistent with previous studies (Ding et al., 2025; Li et al., 2022; Pamplona et al., 2024), but current research advances theory by demonstrating these relationships in a developing European context. This expands the external validity of existing models predominantly tested in Asian economies (Xu & Lin, 2025; Zhou & Su, 2025).
A key theoretical insight concerns the mediating role of green technologies. The evidence of partial mediation suggests that social innovation drives sustainability not only by fostering ethical and inclusive practices, but also by facilitating technological transformation. This aligns with Abbas

(2024) and Torrent-Sellens et al. (2025) while revealing a dual mechanism that integrates social and technological innovation into a unified sustainability framework.

Compared to previous conceptual models that treated innovation dimensions separately, this study empirically supports an integrative model in which *social innovation acts as a social driver* and *green technologies serve as the operational enabler* of the achievement of the SDGs.

Therefore, the study contributes to the theory by reinforcing the notion that sustainable outcomes emerge from interdependent innovation systems, rather than isolated managerial actions. Future theoretical developments could explore how contextual factors, such as organisational culture, leadership, or institutional support, moderate these relationships.

5.2 Managerial Implications

From a managerial point of view, the findings translate into actionable strategies for companies aiming to align with the 2030 UN Agenda.

First, the positive SI→SDG link suggests that embedding social innovation into business strategy-through programmes promoting employee inclusion, ethical governance, and social responsibility-creates a foundation for sustainable competitiveness.

Second, the SI→GT relationship implies that socially innovative cultures accelerate technology adoption. Therefore, managers must cultivate openness, collaborative learning, and employee empowerment to facilitate green transitions.

Third, because GT→SDG effects are significant, investments in clean technologies yield measurable environmental and social benefits, strengthening both reputation and performance. Finally, the partial mediation effect underscores the need for integrated innovation management, where social and technological initiatives reinforce each other. This perspective shifts sustainability from a compliance-orientated activity to a strategic differentiator capable of improving firm resilience and market legitimacy.

5.3 Implications for Literature

The findings of this research contribute to enriching the theoretical framework linking social innovation, green technologies, and sustainable development goals (SDGs). By empirically validating a mediation model that integrates these dimensions, the study addresses a persistent gap identified in previous research, where social and technological innovation was often analysed separately rather than as interconnected processes shaping sustainability outcomes (Abbas, 2024; Torrent-Sellens et al., 2025).

From a theoretical point of view, the study advances the understanding of social innovation by demonstrating that its influence on sustainable outcomes operates through two complementary pathways: direct and indirect. The direct pathway confirms that socially innovative practices, such as employee inclusion, equality, and ethical production, inherently foster progress toward the SDGs. The indirect pathway, mediated by green technologies, reveals that social innovation also acts as a catalyst for technological transformation, providing the organisational context and motivation necessary for the adoption of environmentally responsible technologies. This dual mechanism deepens existing theories (Ding et al., 2025; Pamplona et al., 2024) by positioning social innovation not only as a cultural and behavioural force but also as a strategic enabler of technological change.

In addition, the results contribute to the literature on green innovation by clarifying the role of technology as a mediating mechanism between social and sustainability-oriented objectives. Previous research (Li et al., 2022) highlighted the importance of green technologies to improve organisational performance, but few studies have empirically shown how these technologies translate social values into measurable sustainability results. The present findings provide this missing empirical linkage, confirming that technological innovation operationalises the ethical and social commitments embedded within innovative organisational cultures.

Finally, this study extends the geographical and contextual scope of sustainability research by offering evidence from Romania—an emerging European economy where the intersection of social and technological innovation has received limited empirical attention. By situating the analysis within this context, the research adds a valuable regional perspective to a literature dominated by Asian and Western case studies (Xu & Lin, 2025; Zhou & Su, 2025).

In general, the results support the view that the sustainable development performance is the result of the synergy between social innovation and green technologies. This integrative perspective strengthens the theoretical foundation of sustainability research by bridging two streams of literature, social innovation and green technology, and by providing an empirically validated model that future studies can extend to other contexts or moderated by variables such as firm size, industry, or institutional environment.

6. CONCLUSIONS

6.1 Policy Implications

The results of this research provide important information for policymakers and public institutions seeking to accelerate progress towards the Sustainable Development Agenda 2030 of the United Nations. Evidence that social innovation exerts both direct and indirect effects on sustainability outcomes highlights the need for integrated public strategies that combine social inclusion, innovation, and environmental protection within the same policy framework.

Rather than focussing exclusively on technological or economic measures, public policy should encourage organisations to incorporate social innovation into their strategic and operational activities. Fiscal incentives, grant programmes, or public recognition schemes that reward companies for implementing inclusive HR practices, ethical production standards, and employee well-being initiatives can foster a culture of responsible innovation that aligns corporate objectives with broader societal goals.

The finding that green technologies mediate the relationship between social innovation and sustainable performance suggests that technological diffusion plays a central role in translating social values into measurable sustainability results. Therefore, policymakers should prioritise investments in green R&D, technology transfer, and capacity building initiatives that reduce the adoption gap, particularly among small and medium-sized enterprises (SMEs). Collaborative innovation ecosystems, linking universities, research institutes, and the private sector, can further accelerate this process by facilitating knowledge exchange and shared experimentation.

Moreover, regulatory frameworks should adopt a holistic approach, recognising that social and technological innovation are mutually reinforcing. This could be achieved by revising sustainability reporting standards to include both environmental and social dimensions, ensuring that corporate disclosures reflect an integrated view of responsible business practices.

Finally, by demonstrating that Romanian organisations can effectively leverage social innovation and green technologies to advance the SDGs, this study provides evidence that national policy strategies in emerging economies can simultaneously promote innovation, competitiveness, and inclusion. These findings can inform the design of sustainable industrial policies and education systems that support long-term, equitable, and environmentally responsible growth.

6.2 Limitations and Future Research Directions

Despite its contributions, this study is not without limitations, which also suggest several promising avenues for future research. The cross-sectional design limits causal inference; future studies could adopt longitudinal or panel methodologies to capture the evolution of social and green innovation dynamics over time and to identify potential feedback effects on sustainability outcomes.

Another limitation concerns the reliance on self-reported data collected through an online survey. Although procedural and statistical remedies were applied to mitigate common method bias, future research could triangulate perceptual data with objective indicators, such as sustainability metrics, emission statistics, or innovation performance data, to enhance the robustness of results.

The use of convenience sampling further constrains generalisability. Probability-based or stratified sampling strategies could provide more representative information, while comparative studies in industries or national contexts can reveal how institutional or cultural environments influence the interplay between social innovation, green technology, and sustainable development.

The conceptual framework, although parsimonious, focused on three constructs and one mediation path. Future extensions could integrate additional mediators-such as organisational culture, digital transformation, or stakeholder engagement-or moderators like firm size, industry, or regulatory intensity. These extensions could clarify the boundary conditions under which social and technological innovation contributes the most effectively to sustainability outcomes.

Finally, given that this study focused on Romania, replicating the model in other emerging and developed economies would enhance external validity and allow meaningful cross-country comparisons. Such research would not only test the universality of the proposed relationships but also uncover context-specific factors that shape the pathways toward achieving the Sustainable Development Goals.

In summary, by addressing these limitations and extending the current model, future research can deepen understanding of how social and green innovation jointly drive sustainable development, thereby offering more nuanced theoretical insights and practical guidance for managers and policymakers.

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