

The Circular Economy and Student Business Plans in Support of SDG 12

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Abstract

The increasing importance of sustainable development has encouraged universities to promote responsible consumption and production through entrepreneurship education. This study aims to analyze the influence of understanding the circular economy and motivation for sustainable entrepreneurship on students' contributions to achieving Sustainable Development Goal (SDG) 12, with the quality of students' business plans as a mediating variable. A quantitative survey approach was employed using purposive sampling involving 60 active university students who had participated in entrepreneurship competitions and developed business plans. Data were analyzed using multiple linear regression, while validity and reliability were assessed using Pearson's Product-Moment correlation and Cronbach's Alpha, respectively. The results show that understanding of the circular economy and sustainable entrepreneurial motivation simultaneously have a positive and significant effect on the achievement of SDG 12, explaining 41.7% of the variance in students' contributions. Sustainable entrepreneurial motivation emerged as the more dominant predictor compared with understanding of the circular economy. In addition, the quality of students' business plans is positioned as an important mediating mechanism in the proposed model. The findings suggest that universities should integrate circular economy concepts into entrepreneurship education while fostering students' motivation for sustainable entrepreneurship to enhance their contribution to responsible consumption and production.

Keywords: *Circular Economy; Responsible Consumption and Production; SDG 12; Student Business Plans; Sustainable Entrepreneurship*

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Introduction

The increasingly alarming global environmental crisis has prompted governments, educational institutions, and society to reconsider the linear production and consumption model that has long dominated economic activities. The linear economic model, characterized by the "take-make-dispose" pattern, has proven unsustainable due to its excessive exploitation of natural resources and the large amount of waste it generates. In Indonesia, the Ministry of Environment and Forestry reported that national waste generation exceeded 70 million tons annually, while the recycling rate remained below 10% (KLHK, 2022). This condition highlights the urgent need for alternative approaches that promote sustainable resource management. In this regard, the Circular Economy

(CE) has emerged as a regenerative economic paradigm that seeks to extend the lifecycle of products, materials, and resources through strategies such as reuse, repair, remanufacturing, and recycling. The principles of the circular economy are closely aligned with Sustainable Development Goal (SDG) 12, which emphasizes responsible consumption and production patterns through efficient resource utilization and waste reduction.

Previous studies have extensively examined the role of circular economy knowledge in promoting environmentally responsible behavior and sustainable business practices (Geissdoerfer et al., 2017; Kirchherr et al., 2017; Prieto-Sandoval et al., 2018). Other studies have highlighted the importance of sustainable entrepreneurial motivation in fostering entrepreneurial intentions and supporting sustainability-oriented ventures (Shepherd & Patzelt, 2011; Vuorio et al., 2018). In the context of higher education, entrepreneurship education has also been found to improve students' business planning competencies and innovation capabilities (Fayolle & Gailly, 2015). However, most previous studies have focused separately on either circular economy awareness or sustainable entrepreneurship motivation. Moreover, existing research has been largely limited to examining entrepreneurial intention or environmental attitudes, with limited attention given to how these factors contribute to the achievement of SDG 12 through students' business plans.

Several researchers have focused on the relationship between circular economy understanding and sustainable behavior, while others have examined sustainable entrepreneurial motivation as a determinant of entrepreneurial intention. Nevertheless, limited research has investigated the simultaneous influence of circular economy understanding and sustainable entrepreneurial motivation on the achievement of SDG 12 while considering the quality of students' business plans as an intermediary mechanism. Therefore, this study addresses this gap by integrating these variables within a single framework.

The novelty of this study lies in positioning students' business plan quality as a mediating variable linking circular economy understanding and sustainable entrepreneurial motivation to the achievement of SDG 12. This study also provides an empirical contribution by examining the implementation of circular economy principles within the context of university students' entrepreneurial activities in Indonesia. Accordingly, the objective of this study is to analyze the influence of circular economy understanding and sustainable entrepreneurial motivation, both partially and simultaneously, on contributions toward achieving SDG 12, with students' business plan quality serving as a mediating variable.

Methods

This study employs a quantitative approach using a survey method. This approach was chosen because it aims to empirically test relationships among variables through the collection of primary data and inferential statistical analysis, specifically multiple linear regression. The population consists of active university students who have participated in student entrepreneurship programs at higher education institutions in Indonesia. Sampling was conducted using purposive sampling based on three criteria: being an active student at an Indonesian higher education institution, having participated in an entrepreneurship competition, and having developed or participated in the development of a business plan. Based on these criteria, 60 eligible respondents participated in the study.

The respondents consisted of 60 active students. In terms of gender, 34 respondents (56.7%) were female and 26 (43.3%) were male. Most respondents were from the Faculty of Economics and Business (63.3%), followed by Medicine (13.3%), Science (10.0%), Engineering (5.0%), Law (3.3%), and Literature, Agriculture, and Livestock (1.7% each). All respondents had participated in entrepreneurship competitions and developed business plans, thereby meeting the purposive sampling criteria.

Table 1 Respondent Profile

Characteristics	Category	Number (n)	Percentage (%)
Gender	Male	26	43.3
	Female	34	56.7
Faculty	Economics and Business	38	63.3
	Medicine	8	13.3
	Science	6	10.0
	Engineering	3	5.0
	Law	2	3.3
	Literature	1	1.7
	Agriculture	1	1.7
	Livestock	1	1.7
Entrepreneurial Experience	Participated in a competition	60	100.0
	Developed a business plan	60	100.0

Source: Primary data processed by the authors, 2026.

All research variables were operationalized using a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Understanding of the Circular Economy (X1) was measured through five indicators covering the basic concept of the circular economy, knowledge of the 9R model, the ability to identify circular strategies in a business context, understanding of the differences between linear and circular economies, and understanding of the importance of waste

reduction. Motivation for Sustainable Entrepreneurship (X2) was measured through five indicators: environmental motivation, social impact orientation, long-term orientation, sustainable commitment, and non-financial orientation.

Business Plan Quality (Z) was measured using four indicators reflecting waste reduction, resource efficiency, sustainability principles, and environmental impact analysis. Contribution to SDG 12 (Y) was measured through four indicators referring to reuse and recycling, waste reduction, pollution prevention, and responsible production and consumption. All constructs were treated as reflective in nature.

Table 2 Questionnaire Indicators by Variable

No.	Variable	Indicator/Dimension	Code	Statement
1	Understanding of the Circular Economy (X1)	Understanding the Concept	X1.1	I understand the concept of the circular economy.
		Model Knowledge	X1.2	I am familiar with the 9R model (Refuse, Rethink, Reduce, etc.).
		Identification Skills	X1.3	I am able to identify circular economy strategies in a business.
		Comparative Understanding	X1.4	I understand the differences between a linear economy and a circular economy.
		Understanding the Impact of Waste	X1.5	I understand the importance of waste reduction in running a business.
2	Motivation for Sustainable Entrepreneurship (X2)	Environmental Motivation	X2.1	I am motivated to create an environmentally friendly business.
		Social Impact Orientation	X2.2	I want to build a business that has a positive social impact.
		Long-Term Orientation	X2.3	I consider long-term sustainability when designing the business.
		Sustainable Commitment	X2.4	I am committed to implementing the principles of sustainable development in my business design.
		Non-Financial Orientation	X2.5	Financial profit is not my only goal in my business plan.
3	Business Plan Quality (Z)	Implementation of Waste Reduction	VZ1	My business plan incorporates a waste reduction strategy.
		Resource Efficiency	VZ2	My business plan focuses on the efficient use of resources.
		Sustainability Principles	VZ3	My business plan supports the principle of sustainability.
		Environmental Impact Analysis	VZ4	My business plan includes an environmental impact analysis.
4	Contribution to SDG 12 (Y)	Implementation of Reuse & Recycle	VY1	My business plan incorporates the principles of reuse and recycling.
		Contribution to Waste Reduction	VY2	My business plan contributes to waste reduction.
		Potential for Pollution Prevention	VY3	My business plan has the potential to reduce environmental pollution.
		Responsible Production Practices	VY4	My business plan can promote responsible production and consumption patterns.

Before the main survey, the questionnaire underwent validity testing using Pearson's Product-Moment correlation to assess whether each item adequately represented its construct. An item was considered valid when its calculated correlation coefficient exceeded the critical value at the 5% significance level. Reliability testing was subsequently conducted using Cronbach's Alpha, with an acceptance threshold of $\alpha \geq 0.70$. Data analysis was performed using multiple linear regression to test the simultaneous and partial effects of Understanding of the Circular Economy (X1) and Motivation for Sustainable Entrepreneurship (X2) on Contribution to SDG 12 (Y), with Business Plan Quality (Z) proposed as a mediating variable. Before regression analysis, classical assumption tests were conducted, including normality, multicollinearity using Variance Inflation Factor (VIF), and heteroscedasticity using the Glejser test. Data were processed using SPSS 26. All procedures involving respondents were conducted in accordance with research ethics principles. Respondents were informed of the purpose of the study, the voluntary nature of participation, and confidentiality provisions. Informed consent was obtained before questionnaire completion, and no personally identifiable information was reported. The study has several methodological limitations. The purposively selected sample may limit representativeness, the cross-sectional design does not capture changes over time, and perception-based questionnaire responses may be subject to self-report bias.

Result and Discussion

Validity Test

Validity testing was conducted using Pearson Product-Moment correlation by correlating each item score with the total score of its variable. An item was considered valid when the calculated r value exceeded the critical r value at the 5% significance level ($r_{\text{table}} = 0.254$, $N = 60$). All 18 items across X1, X2, Z, and Y obtained calculated r values greater than 0.254 with $p < 0.001$, indicating that all questionnaire items met the validity criterion.

Table 3 Results of the Validity Test for All Variables

Variable	Item	r Calculated	r Table	Sig.	Notes
Understanding of Circular Economy (X1)	X1.1	0.842	0.254	< 0.001	Valid
	X1.2	0.645	0.254	< 0.001	Valid
	X1.3	0.833	0.254	< 0.001	Valid
	X1.4	0.768	0.254	< 0.001	Valid
	X1.5	0.432	0.254	< 0.001	Valid
Motivation for Sustainable Entrepreneurship (X2)	X2.1	0.526	0.254	< 0.001	Valid
	X2.2	0.678	0.254	< 0.001	Valid
	X2.3	0.661	0.254	< 0.001	Valid
	X2.4	0.791	0.254	< 0.001	Valid

Variable	Item	r Calculated	r Table	Sig.	Notes
	X2.5	0.689	0.254	< 0.001	Valid
Business Plan Quality (Z)	VZ1	0.765	0.254	< 0.001	Valid
	VZ2	0.776	0.254	< 0.001	Valid
	VZ3	0.741	0.254	< 0.001	Valid
	VZ4	0.824	0.254	< 0.001	Valid
Contribution to SDG 12 (Y)	VY1	0.852	0.254	< 0.001	Valid
	VY2	0.837	0.254	< 0.001	Valid
	VY3	0.803	0.254	< 0.001	Valid
	VY4	0.647	0.254	< 0.001	Valid

Source: Primary data processed by the authors, 2026.

Reliability Test

Reliability testing was conducted for each variable using Cronbach's Alpha, with an acceptance threshold of $\alpha \geq 0.70$. All variables exceeded the minimum threshold: X1 ($\alpha = 0.821$), X2 ($\alpha = 0.796$), Z ($\alpha = 0.843$), and Y ($\alpha = 0.867$), indicating satisfactory internal consistency.

Table 4 Reliability Test Results by Variable

Variable	No. of Items	Cronbach's Alpha	Standard Alpha	Description
Understanding of the Circular Economy (X1)	5	0.821	0.70	Reliable
Motivation for Sustainable Entrepreneurship (X2)	5	0.796	0.70	Reliable
Business Plan Quality (Z)	4	0.843	0.70	Reliable
Contribution to SDG 12 (Y)	4	0.867	0.70	Reliable

Source: Primary data processed by the authors, 2026

Descriptive Statistics

Motivation for Sustainable Entrepreneurship (X2) recorded the highest mean value ($M = 4.36$; $SD = 0.52$), followed by Contribution to SDG 12 ($M = 4.22$; $SD = 0.61$), Business Plan Quality ($M = 4.18$; $SD = 0.59$), and Understanding of the Circular Economy ($M = 3.92$; $SD = 0.64$). The relatively high mean values indicate generally favorable respondent perceptions, while the lower mean for X1 suggests room for strengthening circular economy understanding.

Table 5 Descriptive Statistics of Research Variables

Variable	N	Min	Max	Mean	Std. Dev.
Understanding of the Circular Economy (X1)	60	2.00	5.00	3.92	0.64
Motivation for Sustainable Entrepreneurship (X2)	60	3.00	5.00	4.36	0.52
Business Plan Quality (Z)	60	2.75	5.00	4.18	0.59

Variable	N	Min	Max	Mean	Std. Dev.
Contribution to SDG 12 (Y)	60	2.75	5.00	4.22	0.61

Source: Primary data processed by the authors, 2026.

Normality Test

A normality test was conducted to evaluate the distribution of regression residuals. The standardized residual histogram formed an approximately symmetrical bell-shaped distribution with a mean close to zero (-3.71E-16) and a standard deviation of 0.983. The Normal P-P Plot also showed data points close to the diagonal reference line. These results indicate that the residuals were approximately normally distributed.

Table 6. Summary of Normality Test Results

Test Approach	Results	Interpretation
Standardized Residual Histogram	Bell-shaped curve; Mean ≈ 0 (-3.71E-16); Std. Dev. = 0.983	Residuals are approximately normally distributed
Normal P-P Plot	Data points follow the diagonal line in a consistent pattern	Residuals are approximately normally distributed

Source: Primary data processed by the authors, 2026.

Additional Tests of Classical Assumptions

The multicollinearity test produced VIF values of 1.234 for both X1 and X2, below the commonly used threshold of 10, indicating no serious multicollinearity. The Glejser heteroscedasticity test yielded significance values of 0.412 for X1 and 0.287 for X2, both above 0.05, indicating no evidence of heteroscedasticity under the applied criterion.

Multiple Linear Regression

The multiple linear regression model produced an R value of 0.646. The R-squared value of 0.417 indicates that X1 and X2 jointly explain 41.7% of the variation in Contribution to SDG 12, while the remaining variation is associated with factors outside the model and unexplained variation.

Table 7. Multiple Linear Regression Model Summary

Model	R	R-Square	Adjusted R-Square	Std. Error
1	0.646	0.417	0.397	1.919

Source: Primary data processed by the authors, 2026.

The ANOVA test yielded an F-value of 20.419 (df regression = 2; df residual = 57) with $p < 0.001$, indicating that the regression model is statistically significant overall.

The estimated regression equation is $Y = 0.859 + 0.285X_1 + 0.479X_2$. Understanding of the Circular Economy has a positive and statistically significant coefficient ($B = 0.285$; $t = 3.097$; $p = 0.003$), while Sustainable Entrepreneurial Motivation also has a positive and statistically significant coefficient ($B = 0.479$; $t = 4.032$; $p < 0.001$). The standardized coefficient for X2 (beta = 0.439) exceeds that of X1 (beta = 0.337), indicating a stronger relative association with Contribution to SDG 12 in the estimated model.

Table 8. Regression Coefficients and t-Test Results

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	0.859	2.591	-	0.332	0.741

Variable	B	Std. Error	Beta	t	Sig.
Understanding of the Circular Economy (X1)	0.285	0.092	0.337	3.097	0.003
Sustainable Entrepreneurial Motivation (X2)	0.479	0.119	0.439	4.032	< 0.001

Source: Primary data processed by the authors, 2026.

Discussion

This study examined the extent to which understanding of the circular economy and motivation for sustainable entrepreneurship influence students' contribution to the achievement of SDG 12. The results show that both predictors are positively associated with the outcome, with sustainable entrepreneurial motivation displaying the larger standardized coefficient. This pattern suggests that both cognitive understanding and motivational orientation matter, although they do not contribute equally.

The positive relationship involving circular economy understanding is consistent with the theoretical premise that knowledge provides a cognitive foundation for applying circular principles in business contexts. Without a sufficient grasp of circularity, including the 9R hierarchy, the distinction between linear and circular systems, and the logic of waste reduction, students may face difficulty translating sustainability concepts into business decisions (Kirchherr et al., 2017).

Understanding of the Circular Economy also recorded the lowest mean among the study variables ($M = 3.92$). This result suggests that students' comprehension of circular principles remains less developed than their motivational orientation. The finding is broadly consistent with Yunikawati and Febrianti (2024), who noted that students may possess only limited familiarity with green business and circular economy concepts, and with Rizo et al. (2016), who identified limited awareness of practical circular economy mechanisms as an important implementation barrier.

Sustainable entrepreneurial motivation recorded the highest mean ($M = 4.36$) and the larger standardized regression coefficient. This finding indicates that students' willingness to create businesses with environmental and social value may play an important role in shaping sustainability-oriented outcomes. The result can be interpreted in relation to Ajzen's (1991) Theory of Planned Behavior, which emphasizes the role of intention-related psychological processes in shaping behavior. In an entrepreneurship context, students who strongly internalize sustainability goals may be more willing to incorporate circular practices into business planning.

The result is also consistent with Lans et al. (2014), who emphasized the role of sustainability competencies in higher education, and Muñoz and Cohen (2018),

who highlighted the relevance of commitment to sustainability in sustainable entrepreneurship. The stronger relative role of motivation in the present model suggests that values alignment and purpose-driven entrepreneurship may complement formal circular economy literacy. This has practical implications for curriculum design: sustainability education should combine conceptual learning with learning experiences that strengthen environmental responsibility and social purpose.

Business Plan Quality was positioned in the conceptual model as an intermediary mechanism connecting understanding and motivation with contribution to SDG 12. The descriptive results show a relatively high mean for Business Plan Quality ($M = 4.18$), suggesting that respondents generally perceived their plans as incorporating waste reduction, resource efficiency, sustainability principles, and environmental impact analysis. These dimensions are consistent with the argument that business model design can provide an operational pathway through which circular economy principles contribute to responsible production and consumption (Geissdoerfer et al., 2017; Ellen MacArthur Foundation, 2013).

However, the mediation proposition should be interpreted cautiously because the present analysis did not formally estimate indirect effects. Although the conceptual sequence is theoretically plausible, mediation cannot be established solely from separate significant relationships. Future studies should apply an analytical approach capable of directly estimating indirect effects, such as PLS-SEM or regression-based bootstrapping, to evaluate the proposed mediating role of Business Plan Quality.

The findings have implications for sustainability education. Universities may strengthen entrepreneurship curricula by integrating circular economy concepts, particularly the 9R model and its application in specific business contexts, while also creating learning environments that foster purpose-driven entrepreneurship, environmental stewardship, and social responsibility. Problem-based learning, exposure to real circular business cases, mentoring, and circular economy incubation programs may provide institutional support for translating student motivation into higher-quality business plans and sustainability-oriented outcomes.

Conclusion and Recommendations

This study examined the influence of understanding the circular economy and motivation for sustainable entrepreneurship on students' contribution to the achievement of SDG 12, with Business Plan Quality positioned as a proposed mediating variable. The study involved 60 active students selected using purposive sampling and analyzed the data using multiple linear regression.

The results indicate that Understanding of the Circular Economy (X1) and Sustainable Entrepreneurial Motivation (X2) jointly contribute to explaining variation in Contribution to SDG 12 ($F = 20.419$; $p < 0.001$; $R^2 = 0.417$). Both predictors have positive and statistically significant coefficients, with Sustainable Entrepreneurial Motivation showing the larger standardized coefficient ($\beta = 0.439$) compared with Understanding of the Circular Economy ($\beta = 0.337$). These findings indicate that students' sustainability-oriented motivation may be particularly important alongside conceptual knowledge in supporting responsible consumption and production outcomes.

The findings imply that universities should integrate circular economy education into entrepreneurship curricula and business plan programs while also fostering sustainable entrepreneurial motivation. Student entrepreneurship initiatives may also incorporate SDG 12-oriented evaluation criteria to encourage business plans that address resource efficiency, waste reduction, and responsible production and consumption.

The study is limited by its relatively small sample, purposive sampling, cross-sectional design, and reliance on self-reported perceptions. In addition, the proposed mediating role of Business Plan Quality was not formally tested through an indirect-effect procedure. Future research should use larger and more diverse samples, longitudinal or mixed-method designs, and analytical techniques such as PLS-SEM or bootstrapped mediation analysis to examine indirect effects and more complex relationships.

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