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The Influence of Sustainable Raw Material Availability and Environmentally Friendly Image on Competitive Advantage: The Mediating Role of Product Innovation

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ABSTRACT
This research takes a look at how product innovation acts as a mediator between the availability of sustainable raw materials, green brand image, and competitive advantage. One of the top distributors of cosmetic raw materials with worldwide sustainability certification, PT. Redachem Indonesia was the site of this investigation. One hundred people working in the cosmetics sector in the Jabodetabek region were surveyed using a standardized questionnaire. In order to analyze the data, the research used Structural Equation Modeling with the Partial Least Square (SEM-PLS) method. Product innovation is positively impacted by the availability of sustainable raw materials and a green brand image, according to the research. While the availability of raw sustainable raw materials does not significantly affect competitive advantage, an green brand image can. Product innovation not only mediates the connection between the two factors but also has a substantial effect on competitive advantage. These findings highlight how the cosmetics sector may increase its competitive positioning via innovation and environmental responsibility.

Keywords: Sustainable Raw Materials, Green Brand Image, Product Innovation, Competitive Advantage, SEM-PLS.

I. Introduction

The cosmetics industry in Indonesia is experiencing rapid growth, supported by increasing awareness of self-care and environmental safety. According to the Food and Drug Supervisory Agency (BPOM), the number of registered cosmetic products and industry players has grown significantly each year. This growth is driven by digital transformation as well as consumers' rising environmental awareness, leading them to place greater value on the quantity, quality, and ecological friendliness of the resources used in production. In line with the global trend toward "eco-friendly consumption," consumers now expect cosmetic products that not only provide aesthetic value but are also socially and environmentally safe. Cosmetic companies must adopt environmentally friendly supply chain procedures and engage in sustainable sourcing to minimize environmental impact. Consequently, the availability of certified sustainable raw materials has become a crucial factor in the cosmetics industry. Suppliers are no longer viewed merely as resource providers but as strategic partners in innovation and sustainability.

ISSN [Online]: 2776-6411

Furthermore, to build long-term relationships with clients, it is essential for companies to project an environmentally responsible image. According to Green Marketing Theory, businesses perceived as environmentally responsible tend to gain higher levels of consumer trust and loyalty, particularly among millennials and Gen Z consumers. Companies that embrace these values are well-supported by these generations, who are highly attentive to environmental issues. However, the benefits of sustainable raw materials and an environmentally friendly brand image may not directly result in competitive advantage unless mediated through product innovation. Product innovation plays a critical role in transforming sustainability inputs into marketable outcomes. This may include reformulation, the use of new active ingredients, the adoption of clean beauty trends (such as vegan and cruelty-free products), and the application of advanced technologies that are mindful of environmental impact.

This study focuses on PT. Redachem Indonesia, a leading distributor of cosmetic raw materials that collaborates with internationally certified sustainable suppliers (with certifications such as Ecocert, COSMOS, RSPO, and others). The company has positioned itself as a progressive and adaptive player in the industry, integrating innovation and environmental values into its product offerings. Based on the foregoing discussion, this research aims to investigate the effect of sustainable raw material availability and environmentally friendly image on competitive advantage, with product innovation as a mediating variable. In addition, this study contributes theoretically by enriching the literature on sustainable supply chains and innovation in marketing. Practically, it seeks to provide insights for stakeholders in the cosmetics industry to formulate strategies that enhance sustainability and competitiveness.

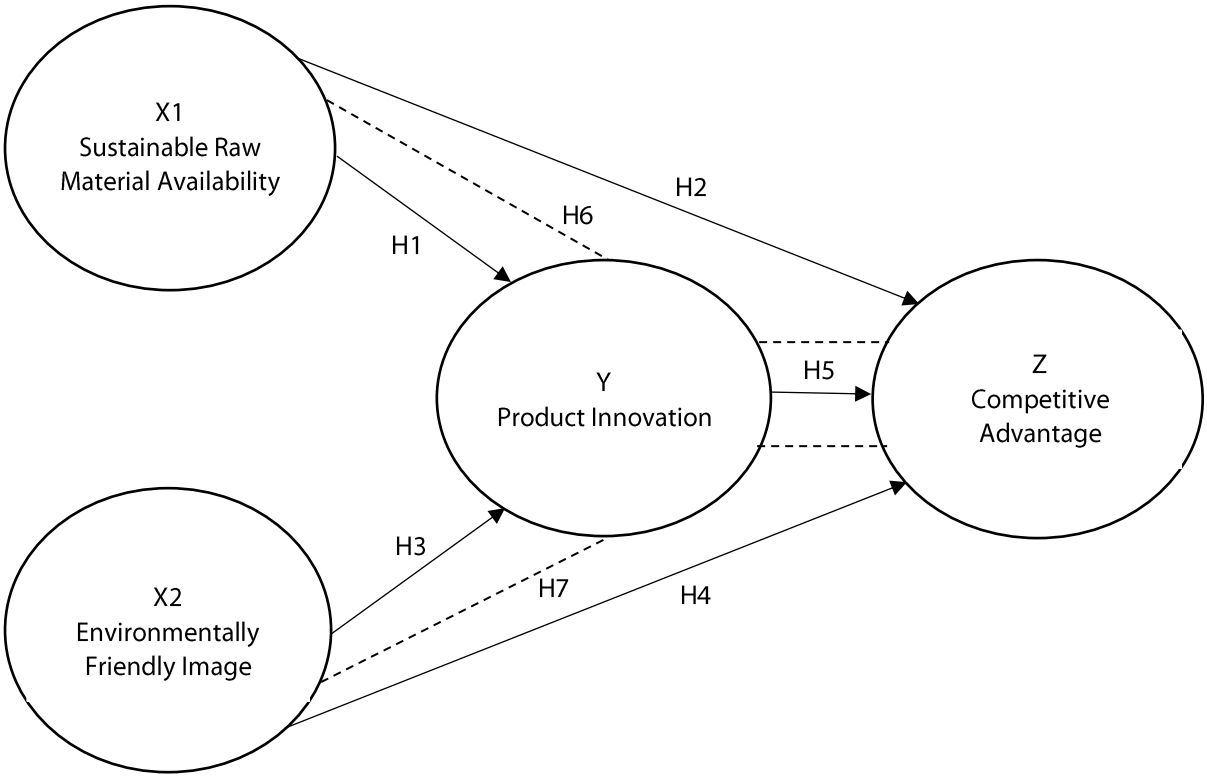

Figure 1. Conceptual Framework

Sustainable raw material availability plays a crucial role in driving product innovation, particularly in industries that rely heavily on natural resources. Research by Retnawati & Irmawati (2020) shows that MSMEs producing handicrafts from natural raw materials in Semarang were able to generate significant product innovations by utilizing the availability of sustainable local raw materials. These innovations included new

ISSN [Online]: 2776-6411

design development, product variation, and improvement of production processes that align with market trends and sustainability values. Thus, sustainable raw material availability not only supports production continuity but also serves as a catalyst for innovations that enhance product competitiveness in the market. According to Yenny Maya Dora & Nugraha Saefudin (2024), their study analyzed how supply chain and inventory management affect product development in pharmaceutical companies. The results revealed that effective raw material availability supports sustainable product innovation. Similarly, Walk et al. (2023) discussed the use of artificial intelligence, particularly computer vision, to improve sustainability in smart product-service systems. This study highlights how technology can help manage raw materials and foster sustainable product innovation. Fadli (2025) explored the use of rattan as an alternative material in product development, emphasizing its potential to create sustainable and eco-friendly product innovations.

H1 : Sustainable raw material availability has a significant effect on product innovation.

Sustainable raw material availability significantly enhances a company's competitive advantage by ensuring supply chain stability, fostering innovation, improving brand image, and enabling compliance with environmental regulations. Companies that prioritize sustainable resources are better positioned to avoid disruptions from resource scarcity or legal constraints, while often benefiting from increased consumer trust and loyalty. Sustainable practices also promote operational efficiency and open access to environmentally conscious markets. As noted by Hart (1995) in A Natural-Resource-Based View of the Firm (Academy of Management Review), leveraging environmental strategies and sustainable resource management serves as a fundamental source of competitive advantage through innovation and reputation building. Hermawan et al. (2023) discussed strategies for product development using environmentally friendly materials as an effort to enhance competitiveness and meet growing market demands for sustainability. Similarly, Jumady et al. (2020) revealed that green supply chain management has a positive and significant effect on company competitiveness. The implementation of eco-friendly practices within the supply chain improves both competitiveness and overall firm performance. Furthermore, an analysis of the relationship between Green Supply Chain Management (GSCM), sustainable performance, and competitive advantage in manufacturing companies in Padang demonstrates that GSCM has a positive and significant effect on competitive advantage (Linda et al., 2025).

H2 : Sustainable raw material availability has a significant effect on competitive advantage.

An environmentally friendly image significantly influences product innovation by encouraging companies to develop eco-friendly products aligned with consumer values and expectations. A study by Jalu et al. (2024) found that environmentally friendly brand innovation positively affects eco-brand loyalty, with perceived value serving as an important mediator in this relationship. This suggests that when consumers perceive a brand as environmentally responsible, they are more likely to value and remain loyal to its eco-friendly innovative products. According to Lin & Zhou (2022), their research highlights that green brand positioning, supported by utilitarian environmental benefits and connectedness to nature, can enhance green brand image through the mediation of perceived green value and green brand innovation. Xie et al. (2019) showed that green brand image moderates the relationship between green product innovation and new product success. Companies with a strong green brand image are more likely to succeed in launching eco-friendly innovative products since consumers already hold positive perceptions of their environmental commitment. Zhou et al. (2021) examined the influence of institutional pressure on green product success, considering the role of green transformational leadership, green innovation, and green brand image. Their findings indicated that green brand image plays a critical role in green product success, and green innovation significantly contributes to the formation of a strong green brand image.

H3 : Environmentally friendly image has a significant effect on product innovation.

ISSN [Online]: 2776-6411

The influence of an environmentally friendly image on competitive advantage has gained increasing attention as companies adopt sustainable practices. A strong eco-friendly image can enhance a company's reputation and attract environmentally conscious consumers. Research by Ainun Najib & Damayanti (2020) found that Indomilk in Surakarta remained competitive due to its environmentally friendly marketing strategies. Karmel Toryanto & Indriani (2022) analyzed the implementation of Green Marketing Orientation in non-food SMEs in Java, Indonesia. Their findings revealed that strategic green marketing orientation positively impacts competitive advantage and marketing performance. Similarly, Zameer et al. (2020) found that green production and green creativity directly strengthen green competitive advantage, with this influence becoming stronger when mediated by green brand image. This highlights the crucial role of green brand image in strengthening competitiveness through eco-friendly production and innovation practices. Lastly, Moravcikova et al. (2017) noted that green marketing can serve as a source of competitive advantage for businesses. In the context of growing consumer awareness of environmental issues, companies integrating green marketing principles into their strategies can achieve sustainable competitive advantage.

H4 : Environmentally friendly image has a significant effect on competitive advantage.

In many ways, product innovation plays a vital role in enhancing competitive advantage by differentiating a company's offerings, responding to market changes, and meeting evolving consumer demands. Companies that continuously innovate tend to achieve stronger customer loyalty, greater efficiency, and superior performance compared to competitors. A study by Fajrina & Yamit (2022) showed that product innovation, along with product design and quality, significantly influences competitive advantage in cosmetic products such as Maybelline in Yogyakarta. Research by Rinaldi Djakaria et al. (2024) found that product innovation positively impacts the competitive advantage of the Karawo embroidery industry in Gorontalo. This confirms that innovation is not just a tool for creativity but a strategic necessity for sustaining competitiveness. Aprilia (2022) reported that product innovation significantly influences competitive advantage at Burger.Mac, contributing 51.5%. Similarly, Nurbintang & Siti Julaeha (2023) found that product innovation and sales promotion together contribute 62.9% to McDonald's competitive advantage in Jakarta.

H5 : Product innovation has a significant effect on competitive advantage.

In this study, product innovation serves as an important mediating factor between sustainable raw material availability and environmentally friendly image in achieving competitive advantage. Companies that consistently secure sustainable raw material supplies are better positioned to develop innovative and eco-friendly products, which in turn strengthen their green brand image and market differentiation. Empirical studies support this mediating role. Darojatin et al. (2016) found that resource-based strategies significantly influence innovation, which subsequently enhances competitive advantage in the wood furniture business in Pasuruan. Their study, titled The Effect of Resource-Based Strategy on Competitive Advantage through Innovation, emphasized product innovation as a mediator. Gürlek & Tuna (2018) found that green organizational culture positively affects green innovation and competitive advantage, with green innovation serving as a full mediator. Similarly, M. Fadli et al. (2022) reported that product innovation significantly mediates the effect of market orientation and entrepreneurial orientation on the competitive advantage of MSMEs in processed catfish in Koto Mesjid. Wahyono (2020) also found that product innovation significantly mediates the relationship between knowledge management and competitive advantage in food SMEs in Riau and Central Java.

H6 : Sustainable raw material availability has a significant effect on competitive advantage through product innovation.
H7 : Environmentally friendly image has a significant effect on competitive advantage through product innovation.

ISSN [Online]: 2776-6411

II. Research Method

This research was conducted in April 2025 and focused on the clients of PT. Redachem Indonesia located in the Jabodetabek area. This location was chosen because it hosts a large number of cosmetic companies, making it suitable for assessing the influence of sustainable raw material availability and environmentally friendly image on competitive advantage through product innovation. The study employed a quantitative approach with a descriptive-explanatory design. The main objective was to examine the effect of sustainable raw material availability and environmentally friendly image on competitive advantage, with product innovation serving as a mediating factor. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used for statistical analysis of the data collected from structured questionnaires aimed at generating measurable insights. The research population comprised individuals working in Indonesia's cosmetics industry. A purposive sampling technique was applied, focusing on staff to managerial levels directly involved in procurement, product development, or marketing functions. Based on SEM-PLS recommendations by Hair et al. (2021), a sample size of 100 to 200 respondents was considered sufficient. Each respondent was asked to complete a questionnaire consisting of 24 items measured on a 5-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5), evaluating the core research variables.

The instrument was developed as a structured questionnaire, with items derived and adapted from previous studies to fit the context of raw material distribution in the cosmetics industry. Indicators were carefully selected to measure sustainable raw material availability, environmentally friendly image, product innovation, and competitive advantage. Prior to distribution, a pilot test was conducted to ensure clarity, reliability, and validity of the items. Primary data were collected through an online survey, enabling broad and efficient distribution to target respondents. The use of online tools ensured convenience for participants and facilitated faster data processing. The Likert-scale responses allowed for consistent measurement and comparison across constructs. Data analysis was carried out using SmartPLS software, enhancing the credibility of the PLS-SEM approach. This method is particularly suitable for predictive models, non-normally distributed data, and medium-to-small sample sizes. The strategy enabled simultaneous evaluation of the measurement (outer) model and the structural (inner) model.

In evaluating the measurement model, both reliability and validity of indicators were tested. For reflective constructs, indicator reliability (outer loadings ≥ 0.7), internal consistency (Cronbach's Alpha and Composite Reliability ≥ 0.7), and convergent validity (Average Variance Extracted ≥ 0.5) were assessed. Discriminant validity was evaluated using the Fornell-Larcker criterion and cross-loadings. For formative constructs, variance inflation factor (VIF < 5) and the significance of indicator weights were examined using bootstrapping. The structural model was then assessed to test the hypothesized relationships among latent variables. Key evaluation metrics included inner VIF (to check multicollinearity), path coefficients (with significance tested via bootstrapping), coefficient of determination (R^2) for predictive accuracy, effect size (f^2), and predictive relevance (Q^2). Where applicable, model fit was evaluated using the standardized root mean square residual (SRMR), with a threshold of less than 0.08 indicating a good fit. Hypothesis testing was performed using the bootstrapping method in SmartPLS. A hypothesis was considered statistically supported if the p-value was less than 0.05 and the t-statistic exceeded 1.96 at the 95% confidence level. This process ensured that the conclusions drawn regarding the relationships among variables were statistically valid and reliable.

III. Result and Discussion

This section presents the results of the analysis and interprets them based on the research model. This study investigates the effect of sustainable raw material availability and environmentally friendly image on competitive advantage, with product innovation as a mediating variable. The research employed Structural Equation Modeling–Partial Least Squares (PLS–SEM). The statistical analysis revealed significant findings for the dependent variables, both directly and indirectly, based on the data collected from respondents in the

ISSN [Online]: 2776-6411

cosmetics industry in Indonesia. The descriptive results show that the majority of respondents were between 31 and 40 years old, held a bachelor's degree, and mostly worked in research and development. This demographic distribution indicates that the respondents possess the capacity to understand the context of innovation and sustainability, thereby supporting the validity of the research findings.

Table 1. Validity and Reliability Test

Variable	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
X1 (Sustainable Raw Material Availability)	0.874	0.876	0.909	0.666
X2 (Environmentally Friendly Image)	0.876	0.879	0.910	0.670
Y (Product Innovation)	0.919	0.921	0.935	0.674
Z (Competitive Advantage)	0.939	0.942	0.951	0.735

Table 2. Fornell–Larcker Criterion

Variable	X1 (Sustainable Raw Material Availability)	X2 (Environmentally Friendly Image)	Y (Product Innovation)	Z (Competitive Advantage)
X1 (Sustainable Raw Material Availability)	0.838			
X2 (Environmentally Friendly Image)	0.811	0.818		
Y (Product Innovation)	0.816	0.817	0.883	
Z (Competitive Advantage)	0.781	0.799	0.821	0.857

The outer model analysis shows that all indicators of each construct have outer loading values above 0.70, indicating strong convergent validity. The construct reliability evaluation using Cronbach's alpha and composite reliability also demonstrates excellent results (all above 0.87). Discriminant validity is also achieved based on the Fornell–Larcker criterion, which shows that each indicator is more strongly associated with its own construct compared to other constructs.

Table 3. Cross Loadings

Indicator	X1 (Sustainable Raw Material Availability)	X2 (Environmentally Friendly Image)	Y (Product Innovation)	Z (Competitive Advantage)
X1.1	0.844	0.697	0.700	0.671
X1.2	0.789	0.590	0.622	0.573
X1.3	0.828	0.704	0.710	0.665
X1.4	0.824	0.694	0.718	0.641
X1.5	0.794	0.617	0.665	0.630
X2.1	0.701	0.832	0.635	0.650
X2.2	0.635	0.838	0.637	0.625
X2.3	0.632	0.768	0.644	0.584
X2.4	0.708	0.795	0.765	0.743
X2.5	0.630	0.855	0.643	0.641

ISSN [Online]: 2776-6411

Y1	0.729	0.714	0.862	0.776
Y2	0.703	0.715	0.845	0.747
Y3	0.672	0.610	0.814	0.698
Y4	0.614	0.653	0.756	0.636
Y5	0.721	0.658	0.817	0.767
Y6	0.682	0.619	0.774	0.691
Y7	0.689	0.726	0.871	0.745
Z1	0.719	0.739	0.823	0.872
Z2	0.588	0.534	0.672	0.740
Z3	0.655	0.629	0.753	0.854
Z4	0.692	0.725	0.775	0.875
Z5	0.674	0.666	0.759	0.892
Z6	0.658	0.723	0.732	0.864
Z7	0.691	0.754	0.774	0.892

The indicators in this study demonstrate clear discriminant validity. For example, in reading the table, X1.1 has a loading of 0.844 on X1_Sustainable Raw Material Availability, which is higher than the loadings on other variables such as X2_Environmentally Friendly Image = 0.697, Y_Product Innovation = 0.700, and Z_Competitive Advantage = 0.671. This interpretation indicates a valid value, meaning that X1.1 is more closely related to X1 than to other variables. Another example is Y.1, which has a loading of 0.862 on Y (its own variable), compared to lower loadings on other variables (X1, X2, Z). Therefore, the discriminant validity is evident and strong.

Table 4. Variance Inflation Factor (VIF)

Indicator	VIF
X1.1	2.298
X1.2	1.909
X1.3	2.219
X1.4	2.065
X1.5	1.863
X2.1	2.353
X2.2	2.974
X2.3	2.5
X2.4	1.946
X2.5	2.553
Y.1	3.428
Y.2	2.682
Y.3	2.457
Y.4	1.993
Y.5	2.754
Y.6	2.012
Y.7	3.177
Z.1	3.408
Z.2	1.903
Z.3	3.512
Z.4	3.948
Z.5	4.216
Z.6	4.184
Z.7	3.945

Multicollinearity is acceptable because none of the VIF values exceed 5, and all predictors remain within the tolerable threshold. Several correlations are moderate. Values above 3 (e.g., 3.428, 3.512, 3.948,

ISSN [Online]: 2776-6411

4.216, 4.184, 3.945) indicate moderate multicollinearity, but they are still acceptable based on common guidelines. Therefore, it can be concluded that since all VIF values are below 5, multicollinearity is not a major issue in this research model.

Table 5. Coefficient of Determination (R-Square)

Variable	R-square	Adjusted R-square
Y_Product Innovation	0.759	0.754
Z_Competitive Advantage	0.798	0.791

Source: Processed data, 2025

Both variables have high R^2 values (> 0.75), indicating that the model has strong predictive power. The small difference between R^2 and adjusted R^2 shows that the model is parsimonious (not overfitted). This implies that the model effectively explains most of the variability in product innovation and competitive advantage.

Tabel 6. Effect Size (f^2)

Variable	X1 (Sustainable Raw Material Availability)	X2 (Environmentally Friendly Image)	Y (Product Innovation)	Z (Competitive Advantage)
X1 (Sustainable Raw Material Availability)			0.368	0.003
X2 (Environmentally Friendly Image)			0.231	0.062
Y (Product Innovation)				0.534
Z (Competitive Advantage)				

Source: Processed data, 2025

The effect of X1 (Sustainable Raw Material Availability) on Y (Product Innovation) is 0.368 > 0.35, which falls into the strong effect category. The effect of X1 on Z (Competitive Advantage) is 0.003 < 0.02, which indicates no direct effect, suggesting that the influence may be indirect and mediated by Y (Product Innovation). The effect of X2 (Environmentally Friendly Image) on Y (Product Innovation) is 0.231 > 0.15, which falls into the medium effect category. The effect of X2 on Z (Competitive Advantage) is 0.062 > 0.02, which falls into the small effect category. Meanwhile, the effect of Y (Product Innovation) on Z (Competitive Advantage) is 0.534 > 0.35, which falls into the strong effect category.

Table 7. Predictive Relevance (Q^2)

Variable	Q^2predict	RMSE	MAE
Y_Product Innovation	0.759	0.519	0.398
Z_Competitive Advantage	0.680	0.601	0.470

In the inner model, the Q^2 values support the predictive power of the Y_Product Innovation (0.759) and Z_Competitive Advantage (0.680). Both indicate high predictive relevance, as they are greater than 0.35. Therefore, both variables demonstrate strong predictive capability.

GOLDEN RATIO
ISSN [Online]: 2776-6411

Table 8. Model Fit Test

Indicator	Saturated model	Estimated model
SRMR	0.067	0.067
d_ULS	1.333	1.333
d_G	1.118	1.118
Chi-square	574.13	574.13
NFI	0.758	0.758

The SRMR value in this study is 0.067, which indicates that the model fit is acceptable, reflecting an acceptable level of goodness-of-fit.

Table 9. Path Coefficients

Path Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P values
Sustainable Raw Material Availability → Product Innovation	0.51	0.505	0.082	6.217	0
Sustainable Raw Material Availability → Competitive Advantage	0.048	0.05	0.091	0.529	0.597
Environmentally Friendly Image → Product Innovation	0.404	0.407	0.081	4.976	0
Environmentally Friendly Image → Competitive Advantage	0.212	0.22	0.103	2.065	0.039
Product Innovation → Competitive Advantage	0.669	0.658	0.097	6.901	0

Table 10. Indirect Test

Path Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P values
Sustainable Raw Material Availability → Product Innovation	0.51	0.505	0.082	6.217	0
Sustainable Raw Material Availability → Competitive Advantage	0.048	0.05	0.091	0.529	0.597
Environmentally Friendly Image → Product Innovation	0.404	0.407	0.081	4.976	0
Environmentally Friendly Image → Competitive Advantage	0.212	0.22	0.103	2.065	0.039
Product Innovation → Competitive Advantage	0.669	0.658	0.097	6.901	0

ISSN [Online]: 2776-6411

Although sustainable raw material availability has a positive and substantial effect on product innovation (t-statistic = 4.731 > 1.96, p-value = 0 < 0.05), it does not directly affect competitive advantage (t-statistic = 0.529 < 1.96, p-value = 0.597 > 0.05) when testing the hypothesis. Conversely, product innovation (t-statistic = 4.976 > 1.96, p-value = 0 < 0.05) and competitive advantage (t-statistic = 2.065 > 1.96, p-value = 0.039 < 0.05) are both significantly influenced by an environmentally friendly image. With a t-statistic of 6.901 > 1.96 and p-value = 0 < 0.05, product innovation directly and substantially enhances competitive advantage. These results reinforce the role of product innovation as a strategic mediator in the model. It is evident that sustainable raw material availability and an environmentally friendly image have significant indirect effects on competitive advantage through product innovation. This implies that competitive advantage is not solely determined by resources or environmentally friendly brand perceptions but also by the firm's ability to transform these factors into sustainable and value-added innovations. The theoretical contribution of this study is to strengthen the resource-based view and competitive advantage theory, which emphasize the importance of developing internal capabilities such as innovation in creating competitive value.

Additionally, this study provides new empirical contributions in the context of Indonesia's cosmetics industry, which has rarely been explored in academic literature, particularly using a PLS-SEM approach. Practically, the findings offer important implications for corporate managers in designing sustainability strategies. The availability of raw materials and environmentally friendly image should be considered strategic inputs to drive sustainable product innovation. Companies need to invest in R&D processes, ensure stable raw material supply, and build positive public perceptions of their environmental commitment to generate innovations that differentiate them in the market. Regarding limitations, this study only involved respondents from the Greater Jakarta area and focused on a single industry sector. Moreover, the model does not include other variables such as organizational culture or regulatory pressures that may also influence innovation and competitive advantage. Future research is recommended to expand the geographical scope, consider a longitudinal approach, and incorporate additional mediating or moderating variables. Overall, the findings of this study emphasize the importance of integrating sustainability practices and innovation as a strategic pathway in building sustainable competitive advantage with broader impacts in the context of modern industries.

IV. Conclusion

This study concludes that the availability of sustainable raw materials and environmentally friendly corporate image have a significant and positive impact on product innovation and competitive advantage in the cosmetic raw material distribution industry in Indonesia. Specifically, access to sustainable resources not only supports the operational aspects of business but also serves as a strategic driver for product development aligned with modern environmental values. Meanwhile, an environmentally friendly corporate image enhances market differentiation and strengthens brand credibility, both of which foster innovation and long-term competitive positioning. The role of product innovation as a mediating variable is proven to be substantial. Although the availability of sustainable raw materials alone may not directly increase competitive advantage, its transformation into innovative offerings significantly improves the company's market position. This reinforces the theoretical proposition that innovation is a crucial channel through which resource-based advantages are translated into tangible competitive outcomes. These findings contribute to the existing literature by empirically validating the mediating effect of innovation within the context of sustainability strategies, particularly in the niche yet rapidly growing cosmetic supply sector.

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GOLDEN RATIO
ISSN [Online]: 2776-6411

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