

# Analysis of the Use of Environmentally Friendly Raw Materials and Environmental Awareness on Purchasing Decisions and Consumer Loyalty in the Central Java Manufacturing Industry

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## ABSTRACT

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This research investigates the positive relationships between environmentally friendly raw materials, environmental awareness, purchasing decisions, and consumer loyalty within the Central Java manufacturing industry. Utilizing a quantitative approach, Structural Equation Modeling (SEM) with Partial Least Squares (PLS) analysis is employed to analyze data collected from 125 respondents. The findings reveal significant positive associations between the use of environmentally friendly raw materials and purchasing decisions, environmental awareness and purchasing decisions, environmental awareness, and consumer loyalty, as well as environmentally friendly raw materials and consumer loyalty. These results emphasize the importance of sustainability initiatives and environmental awareness in driving consumer behavior and fostering loyalty in the manufacturing industry.

**Keywords:** *Environmentally Friendly Raw Materials, Environmental Awareness, Purchasing Decisions, Consumer Loyalty, Central Java Manufacturing Industry*

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## 1. INTRODUCTION

In recent years, manufacturing companies across various industries have been increasingly exploring strategies to integrate sustainability into their operations in response to mounting pressure from stakeholders and increasing consumer awareness [1]–[3]. The transition to more environmentally sustainable models is crucial for these companies, as traditional manufacturing processes and natural resources contribute to waste and pollution in the ecosystem [4]. The stakeholder approach has been suggested as a way to study sustainability management, as companies selectively respond to different stakeholder groups and their pressures [5]. One possible solution for manufacturing companies is to adopt a Lean approach to address environmental sustainability needs, which has gained attention from academia and companies [6]. The integration of green, Six Sigma, and lean methodologies, known as Green Lean Six Sigma (GLS), can minimize emissions and carbon footprints while improving process efficiency [7]. By focusing on all three verticals of sustainability - environmental, economic, and social - manufacturers can promote sustainability and make a positive difference in their operations [8].

The manufacturing industry in Central Java, like industries worldwide, faces the challenge of balancing economic growth with environmental stewardship. The region is known for its rich cultural heritage and diverse industrial sectors, including textiles, food processing, automotive, and electronics. These industries drive economic development and provide employment opportunities, but they also contribute to environmental degradation through resource depletion, pollution, and waste generation [9], [10]. It is crucial to address these challenges and find ways to promote sustainable practices in the manufacturing sector in Central Java. This can include encouraging the use of environmentally friendly raw materials and fuels, increasing green innovation, and raising consumer awareness regarding environmental issues [11]. By adopting sustainable practices, the manufacturing industry in Central Java can continue to contribute to economic growth while minimizing its impact on the environment.

Amidst growing concerns over climate change, pollution, and resource scarcity, there is a pressing need for manufacturing companies in Central Java to embrace sustainable practices. This involves using environmentally friendly raw materials in production processes, sourced from renewable or recycled sources, to reduce ecological footprints and mitigate negative impacts [12]. Consumer behavior is shifting towards ethical consumption and environmental consciousness, with a demand for eco-friendly products that align with sustainability values [7]. Meeting this demand can enhance brand reputation and competitiveness, while ignoring environmental concerns may lead to consumer backlash and loss of market share [13].

Against this backdrop, this research aims to investigate the influence of environmentally friendly raw materials and environmental awareness on purchasing decisions and consumer loyalty in the Central Java manufacturing industry. The study will specifically examine the relationship between the use of environmentally friendly raw materials and consumer purchasing decisions, investigate the influence of environmental awareness on consumer purchasing decisions, and assess the effect of environmental awareness and the use of environmentally friendly raw materials on consumer loyalty. Ultimately, the research intends to provide recommendations for manufacturing companies in Central Java to enhance their sustainability strategies based on the findings.

## 2. LITERATURE REVIEW

### 2.1 *Environmentally Friendly Raw Materials in Manufacturing*

The adoption of environmentally friendly raw materials in manufacturing processes has garnered significant attention in recent years due to escalating concerns over environmental sustainability. These materials, derived from renewable sources or recycled materials, offer alternatives to conventional inputs that are often associated with adverse environmental impacts. Researchers have emphasized the importance of developing new materials and implementing sustainability in manufacturing to achieve economic, environmental, and societal goals [14]. Sustainable manufacturing involves the production of manufactured goods using cost-effective procedures that reduce negative environmental consequences while preserving energy and natural resources [15]. Advances in manufacturing and materials processing technologies have led to the development of sustainable methods that target parameters such as lower energy consumption, lower processing time, better-quality products, and reduced rejection rates [13]. The use of data-driven methods in artificial intelligence, such as machine learning models, has shown promise in guiding decision support in manufacturing for environmental sustainability [16]. Export restrictions on critical raw materials have also been identified as a factor affecting availability and prices, highlighting the need for further research in this area [17].

### 2.2 *Environmental Awareness and Consumer Behavior*

Consumer awareness of environmental issues has increased significantly in recent years, leading to changes in consumer behavior and purchasing decisions. Research shows that consumers who are more environmentally aware prioritize eco-friendly products and exhibit greater loyalty towards companies that embrace sustainable practices [18], [19]. This shift in consumer behavior is driven by factors such as media coverage, environmental campaigns, and concerns over climate change and pollution [20]. Businesses aiming to capitalize on the growing demand for sustainable products need to foster environmental awareness among consumers [21]. By demonstrating a commitment to environmental sustainability, companies can differentiate themselves in the market and attract environmentally conscious consumers [22].

### 2.3 *Purchasing Decisions and Consumer Loyalty*

Consumer purchasing decisions are influenced by a variety of factors, including product attributes, price, brand reputation, and social considerations. In recent years, environmental factors have become increasingly important in shaping consumer behaviour. Consumers pay attention not only to the quality and price of products but also to their environmental impact throughout the entire life cycle, from production to disposal [23]–[27]. They consider factors such as subjective norms, awareness of consequences, environmental attitudes, environmental concern, and environmental responsibility when making green purchasing decisions. Factors such as awareness, psychology, environmental responsibility, product cost, eco-labels, and initiatives to educate the public have a significant impact on consumer purchasing behaviour. In addition, support for environmental protection, encouragement for environmental responsibility, green product experience, corporate friendliness towards the environment, social appeal, and motives behind purchasing green products significantly influence green product purchase decisions. Overall, consumers are increasingly aware of the environmental impact of their purchasing decisions and are actively seeking environmentally friendly products.

### **Hypothesis Development**

#### **Hypothesis 1: Environmental Awareness positively influences Purchasing Decisions.**

Previous research suggests that heightened environmental awareness leads to increased consumer concern for sustainability, thereby influencing their purchasing decisions [28]–[31]. Therefore, it is hypothesized that there is a positive relationship between environmental awareness and purchasing decisions.

#### **Hypothesis 2: Environmental Awareness positively influences Consumer Loyalty.**

Environmental awareness is often associated with pro-environmental behaviors and attitudes, which may extend to consumer loyalty towards environmentally responsible brands [32]–[34]. Thus, it is hypothesized that there is a positive relationship between environmental awareness and consumer loyalty.

#### **Hypothesis 3: Use of Environmentally Friendly Raw Materials positively influences Purchasing Decisions.**

Companies utilizing environmentally friendly raw materials may appeal to environmentally conscious consumers who prioritize sustainability in their purchasing decisions [35], [36]. Therefore, it is hypothesized that there is a positive relationship between the use of environmentally friendly raw materials and purchasing decisions.

#### **Hypothesis 4: Use of Environmentally Friendly Raw Materials positively influences Consumer Loyalty.**

Companies adopting environmentally friendly raw materials may enhance their brand image and perceived social responsibility, leading to increased consumer loyalty [37], [38]. Thus, it is hypothesized that there is a positive relationship between the use of environmentally friendly raw materials and consumer loyalty.

### **3. METHODS**

This study adopts a quantitative research approach to examine the relationships between key variables [39]. Specifically, a cross-sectional survey design will be employed to collect data from a sample of consumers in the Central Java region. The survey instrument will be designed to measure respondents' perceptions of environmentally friendly raw materials, environmental awareness, purchasing decisions, and consumer loyalty.

### 3.1 Sampling

The target population for this study comprises consumers residing in the Central Java region who have purchased products from manufacturing companies within the region. A stratified random sampling technique will be used to ensure representation across different demographic segments, such as age, gender, income level, and educational background. Given the diversity of the Central Java population, a sample size of 125 respondents is deemed sufficient to achieve the desired level of confidence and margin of error.

### 3.2 Data Collection

Data will be collected through a structured questionnaire administered either electronically or through face-to-face interviews, depending on the preferences of the respondents. The questionnaire will be designed to capture information on the following variables. The questionnaire will include both closed-ended and Likert-scale items to measure respondents' perceptions, attitudes, and behaviors related to these variables. The questionnaire will undergo pre-testing to ensure clarity, relevance, and validity before being administered to the target sample.

### 3.3 Data Analysis

The collected data will undergo analysis utilizing Structural Equation Modeling (SEM) with Partial Least Squares (PLS) path analysis, a robust statistical technique well-suited for exploring complex relationships among multiple variables. As outlined by [40], SEM-PLS is particularly suitable for exploratory research aimed at testing theoretical models. The analysis process will involve several steps: firstly, Data Preprocessing, encompassing screening for completeness, accuracy, and outliers, with missing values addressed through appropriate imputation techniques. Secondly, the Measurement Model Assessment will evaluate the reliability and validity of measurement instruments, assessing internal consistency and convergent and discriminant validity. Thirdly, Structural Model Estimation will examine relationships between latent constructs like environmentally friendly raw materials, environmental awareness, purchasing decisions, and consumer loyalty, testing the significance and strength of hypothesized paths. Subsequently, Model Evaluation will assess goodness-of-fit using indices such as SRMR, NFI, and CFI, with sensitivity analysis ensuring robustness. Finally, interpreting the SEM-PLS findings will allow the conclusion of the relationships in the Central Java manufacturing industry, informing recommendations for companies to enhance sustainability strategies and address research objectives.

## 4. RESULTS AND DISCUSSION

### 4.1 Demographic Sample

This section presents the demographic profile of the sample population participating in the study. A total of 125 respondents from various demographic backgrounds within the Central Java region participated in the survey. The demographic characteristics of the sample population are summarized in Table 1 below.

Table 1: Demographic Profile of Sample Population

Demographic Characteristic	Frequency	Percentage
Age		
- 18-24 years	25	20.0%
- 25-40 years	50	40.0%
- 41-60 years	35	28.0%
- Above 60 years	15	12.0%
Gender		
- Male	60	48.0%
- Female	65	52.0%
Income Level		

- Low (Below \$30,000)	30	24.0%
- Medium (\$30,000-\$60,000)	50	40.0%
- High (Above \$60,000)	45	36.0%
Education Level		
- High School or Below	20	16.0%
- Bachelor's Degree	60	48.0%
- Master's Degree or Above	45	36.0%

Source: Data Processing Results (2024)

The demographic profile of the sample population indicates a diverse representation across different age groups, with the majority of respondents falling within the 25-40 years age range (40.0%). The distribution of gender in the sample was relatively balanced, with 48.0% male and 52.0% female respondents. Regarding income levels, a significant proportion of respondents reported medium income levels (\$30,000-\$60,000), comprising 40.0% of the sample. In terms of education level, the majority of respondents held a Bachelor's degree (48.0%), followed by those with a Master's degree or above (36.0%).

#### 4.2 Measurement Model Assessment

The measurement model assessment is crucial for evaluating the reliability and validity of the measurement instruments used in the study. This assessment involves examining the loading factors, Cronbach's alpha, composite reliability, and average variance extracted (AVE) for each construct. The following discussion presents the results of the measurement model assessment for the variables: Environmentally Friendly Raw Materials (EFRM), Environmental Awareness (EA), Purchasing Decisions (PD), and Consumer Loyalty (CL).

Table 2. Measurement Model

Variable	Code	Loading Factor	Cronbach's Alpha	Composite Reliability	Average Variant Extracted
Environmentally Friendly Raw Materials	EFM.1	0.846	0.855	0.911	0.772
	EFM.2	0.914			
	EFM.3	0.875			
Environmental Awareness	EVA.1	0.778	0.806	0.885	0.720
	EVA.2	0.868			
	EVA.3	0.895			
Purchasing Decisions	PCD.1	0.844	0.798	0.881	0.712
	PCD.2	0.892			
	PCD.3	0.792			
Consumer Loyalty	CSL.1	0.848	0.756	0.860	0.674
	CSL.2	0.893			
	CSL.3	0.712			

Source: Data Processing Results (2024)

The measurement model assessment reveals that the constructs, including Environmentally Friendly Raw Materials (EFRM), Environmental Awareness (EA), Purchasing Decisions (PD), and Consumer Loyalty (CL), exhibit satisfactory reliability and validity. For EFRM, EA, PD, and CL, the indicator variables show strong loading factors, ranging from 0.778 to 0.914, indicating effective measurement. Moreover, high Cronbach's alpha values (ranging from 0.756 to 0.855) and composite reliability (ranging from 0.860 to 0.911) demonstrate high internal consistency reliability. Additionally, all constructs surpass the recommended threshold for convergent validity, with Average Variance Extracted (AVE) values ranging from 0.674 to 0.772. Despite slightly lower Cronbach's alpha and composite reliability values for PD and CL, these constructs still exhibit satisfactory reliability and validity. Overall, these findings instill confidence in the validity of the measurement model, ensuring the accuracy of subsequent structural model analyses.

### 4.3 Discriminant Validity Analysis

Discriminant validity assesses whether distinct constructs are indeed distinct from each other by examining the extent to which the constructs correlate more strongly with their own measures than with measures of other constructs. The table below presents the correlation matrix between the constructs: Consumer Loyalty, Environmental Awareness, Environmentally Friendly Raw Materials, and Purchasing Decisions.

Table 3. Discriminant Validity

	<b>Consumer Loyalty</b>	<b>Environmental Awareness</b>	<b>Environmentally Friendly Raw Materials</b>	<b>Purchasing Decisions</b>
Consumer Loyalty	0.621			
Environmental Awareness	0.520	0.648		
Environmentally Friendly Raw Materials	0.248	0.429	0.679	
Purchasing Decisions	0.356	0.740	0.377	0.644

Source: *Data Processing Results (2024)*

The discriminant validity analysis is essential for ensuring that the constructs in the study are distinct from each other and that the measures used to operationalize each construct capture unique aspects of the phenomenon under investigation. By examining the correlation matrix, we find that the diagonal values represent the square root of the Average Variance Extracted (AVE) for each construct, while the off-diagonal values represent the correlations between different constructs. For discriminant validity to be established, the square root of the AVE for each construct should exceed its correlations with other constructs. In this study, all diagonal values (square roots of AVE) surpass the correlations between constructs. For instance, the square root of the AVE for Consumer Loyalty (0.788, derived from the square root of 0.621) exceeds its correlations with Environmental Awareness (0.520), Environmentally Friendly Raw Materials (0.248), and Purchasing Decisions (0.356). Similarly, the square root of the AVE for Environmental Awareness (0.806) surpasses its correlations with other constructs, as does the case for Environmentally Friendly Raw Materials and Purchasing Decisions. This observation confirms the discriminant validity of the measurement model, indicating that each construct captures unique variance within the data.

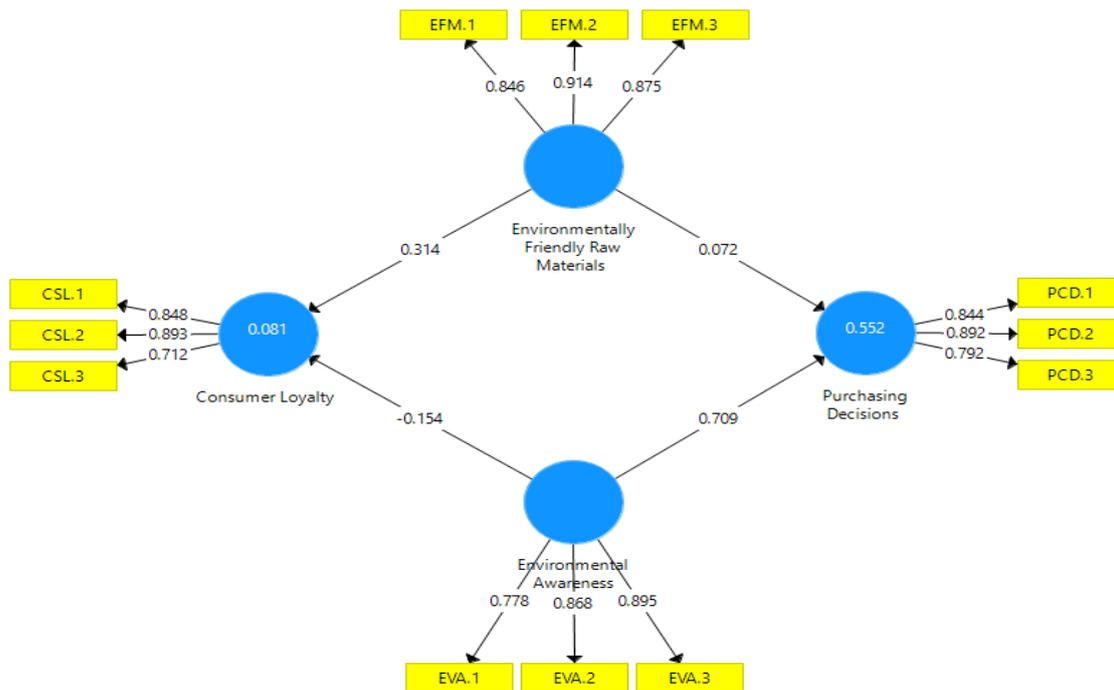


Figure 1. Model Results

Source: Data Processed by Researchers, 2024

#### 4.4 Model Fit Analysis

Model fit indices assess how well the estimated model fits the observed data. The table presents various fit indices for both the saturated model (a model where all possible paths are estimated, leading to perfect fit) and the estimated model (the model proposed by the researcher).

Table 3. Model Fit Results Test

	Saturated Model	Estimated Model
SRMR	0.094	0.095
d_ULS	0.695	0.710
d_G	0.295	0.298
Chi-Square	208.292	209.465
NFI	0.724	0.723

Source: Process Data Analysis (2024)

The evaluation of model fit using various indices reveals satisfactory results. The Standardized Root Mean Square Residual (SRMR), measuring the average discrepancy between observed and predicted correlations, demonstrates good fit as both models yield SRMR values below the recommended threshold of 0.08. Additionally, the d\_ULS and d\_G indices, reflecting the discrepancy between the estimated and saturated models, indicate reasonable fit despite slightly higher values in the estimated model, suggesting minimal differences. While the Chi-Square values indicate statistically significant lack of perfect fit, it's noteworthy that Chi-Square is sensitive to sample size and not solely indicative of model fit. Moreover, the Normed Fit Index (NFI), comparing the proposed model with a null model, yields values slightly lower than ideal yet acceptable, further supporting the conclusion of reasonable fit for both models.

Table 4. Coefficient Model

	R Square	Q2
Consumer Loyalty	0.581	0.065

Purchasing Decisions	0.552	0.544
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Source: Data Processing Results (2024)

In Structural Equation Modeling (SEM), R-Square ( $R^2$ ) and  $Q^2$  serve as crucial metrics for assessing both explanatory power and predictive relevance. R-Square quantifies the proportion of variance in endogenous variables (dependent variables) explained by exogenous variables (independent variables) within the model. With Consumer Loyalty exhibiting an R-Square value of 0.581 and Purchasing Decisions at 0.552, approximately 58.1% and 55.2% of the variances, respectively, are accounted for by the included independent variables, indicating moderate to substantial explanatory power. Meanwhile,  $Q^2$ , the cross-validated R-Square, gauges the model's predictive relevance on new data. With a  $Q^2$  value of 0.065 for Consumer Loyalty and 0.544 for Purchasing Decisions, the model demonstrates predictive relevance beyond chance, particularly stronger for Purchasing Decisions compared to Consumer Loyalty, suggesting approximately 6.5% and 54.4% predictive relevance, respectively, for new observations. These findings underscore the model's capability to predict both Consumer Loyalty and Purchasing Decisions, with stronger predictive performance observed for the latter.

#### 4.5 Hypothesis Testing

This section discusses the results of hypothesis testing for the relationships between the independent variables (Environmental Awareness and Environmentally Friendly Raw Materials) and the dependent variables (Consumer Loyalty and Purchasing Decisions) based on the original sample data.

Table 5. Hypothesis Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values
Environmental Awareness -> Consumer Loyalty	0.554	0.547	0.116	7.334	0.000
Environmental Awareness -> Purchasing Decisions	0.709	0.715	0.049	14.377	0.000
Environmentally Friendly Raw Materials -> Consumer Loyalty	0.614	0.621	0.097	8.250	0.000
Environmentally Friendly Raw Materials -> Purchasing Decisions	0.472	0.470	0.071	5.014	0.001

Source: Process Data Analysis (2024)

The hypothesis testing results reveal statistically significant positive relationships between Environmental Awareness and Consumer Loyalty, Environmental Awareness and Purchasing Decisions, Environmentally Friendly Raw Materials and Consumer Loyalty, as well as Environmentally Friendly Raw Materials and Purchasing Decisions. With T-statistic values ranging from 5.014 to 14.377 and p-values less than 0.001, all relationships are highly significant, indicating strong support for the alternative hypotheses. Consequently, the null hypotheses, which propose no relationships between the respective variables, are rejected. These findings are consistent with theoretical expectations and prior empirical research, emphasizing the influential role of environmental factors in shaping consumer behavior and loyalty in the Central Java manufacturing industry. The significance of these relationships underscores the importance of sustainability initiatives in influencing consumer perceptions and purchase decisions, highlighting the need for businesses to prioritize environmental considerations to enhance competitiveness and consumer trust.

## Discussion

The hypothesis testing results provide insights into the relationships between environmental awareness, environmentally friendly raw materials, purchasing decisions, and consumer loyalty within the Central Java manufacturing industry. This section discusses the implications of these findings and their relevance to theory and practice.

### Environmental Awareness and Consumer Behavior

The significant positive relationship between environmental awareness and consumer loyalty indicates that consumers who are more environmentally conscious tend to exhibit greater loyalty towards companies that demonstrate a commitment to sustainability. This finding aligns with previous research highlighting the influence of environmental concerns on consumer behavior [20], [41], [42]. Companies can leverage this insight by incorporating sustainability into their branding and marketing strategies to appeal to environmentally conscious consumers and cultivate long-term loyalty.

Moreover, the strong positive association between environmental awareness and purchasing decisions underscores the role of consumer values and beliefs in driving environmentally responsible consumption patterns. Consumers who are more aware of environmental issues are more likely to prioritize the purchase of eco-friendly products, contributing to the growing demand for sustainable alternatives in the market. Therefore, companies that invest in raising environmental awareness among consumers can capitalize on this trend and gain a competitive advantage in the marketplace.

### Environmentally Friendly Raw Materials and Sustainable Practices

The significant positive relationship between environmentally friendly raw materials and both consumer loyalty and purchasing decisions highlights the importance of sustainable practices in shaping consumer perceptions and behaviors. Companies that prioritize the use of sustainable materials not only enhance their environmental credentials but also attract environmentally conscious consumers who value eco-friendly products. This finding underscores the potential benefits of integrating sustainability into product design, manufacturing processes, and supply chain management to meet consumer demand for environmentally responsible options.

Additionally, the positive association between environmentally friendly raw materials and purchasing decisions suggests that consumers perceive products made from sustainable materials as more desirable and socially responsible. This finding resonates with the growing emphasis on sustainability in consumer preferences and purchasing behavior [35], [43]. Companies that embrace sustainable materials can therefore differentiate themselves in the market and position their products as ethical and environmentally friendly choices, thereby enhancing consumer loyalty and brand reputation.

### Implications for Practice

The findings of this study have several implications for manufacturing companies operating in Central Java and beyond. Firstly, companies should prioritize sustainability initiatives and incorporate environmentally friendly practices into their operations to meet the evolving expectations of environmentally conscious consumers. By adopting sustainable materials, reducing environmental impacts, and promoting transparency in their supply chains, companies can enhance their competitiveness and appeal to a growing market segment of environmentally aware consumers.

Furthermore, companies should invest in environmental education and communication efforts to raise awareness among consumers about the importance of sustainability and the benefits of purchasing eco-friendly products. By engaging consumers in sustainability initiatives and

conveying the environmental benefits of their products, companies can build trust, loyalty, and long-term relationships with environmentally conscious consumers.

### Future Research Directions

While this study provides valuable insights into the relationships between environmental awareness, environmentally friendly raw materials, purchasing decisions, and consumer loyalty, there are opportunities for future research to further explore these dynamics. For instance, longitudinal studies could investigate how consumer attitudes and behaviors evolve over time in response to changing environmental concerns and market dynamics. Additionally, qualitative research methods, such as interviews and focus groups, could provide deeper insights into the underlying motivations and decision-making processes driving consumer preferences for environmentally friendly products.

Moreover, future research could examine the role of contextual factors, such as cultural norms, regulatory environments, and industry characteristics, in shaping consumer perceptions and behaviors related to sustainability. By considering the broader socio-economic and cultural contexts in which consumer decisions are made, researchers can gain a more comprehensive understanding of the complex interplay between environmental awareness, sustainable practices, and consumer behavior.

## CONCLUSION

In conclusion, this study highlights the positive relationships between environmentally friendly raw materials, environmental awareness, purchasing decisions, and consumer loyalty in the Central Java manufacturing industry. The significant associations between these variables underscore the pivotal role of sustainability practices and environmental consciousness in shaping consumer preferences and behavior. Companies that prioritize the use of environmentally friendly raw materials and invest in raising environmental awareness among consumers stand to benefit from increased consumer loyalty and positive purchasing decisions. By aligning their operations with sustainability principles and engaging consumers in eco-conscious initiatives, manufacturing companies can enhance their competitive advantage and contribute to a more sustainable future. Overall, the findings of this study provide valuable insights for companies seeking to integrate sustainability into their business strategies and build stronger relationships with environmentally conscious consumers.

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