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A study on circular economy in electronics towards consumer perception.

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Abstract
Circular economy supply chain It is a sustainable strategy that seeks to reduce wasteful material use, maximize reuse, refurbishment, recycling, or remanufacturing, and convert it into useful products. In contrast, the circular economy is superior to the linear model. Since the product approaches its final stage, it is treated as useless and throned to the garbage because of these mistakes, third parties like animals are still suffering. Which follows “take-make-Dispose” patterns, where the product is described as waste. Circular economy helps reduce green gas emissions and also makes an environmentally friendly contribution, which will avoid harm to society. It helps to reduce demand when it is expected to be high and makes the economy stable at an equal level. It is a cost-saving procedure by recovering unwanted products that can be refurbished or used for other products, assembling them, and selling the new products at least at a low cost. People should aware to replace the waste product at the same they also benefited. The organization should educate the people by conducting programs and creating awareness among them.

Keywords: Sustainability, circular economy, closed-loop, reverse logistics.

Introduction
In the modern global economy, the idea of a circular economy has become a transformative approach to economic growth and development and minimizes resource management. This leads to maintaining our economic resources and is highly responsible for reducing scarcity. The circular economy provides a deeper understanding to stakeholders about the principles, challenges, and potential benefits to provide more information for decision-making and stay focused on sustainability. Circular economy represents a shift away from the linear traditional model towards more productivity and reduces resource wastage. This shows that they avoid wasting resources, so were corporate benefited, but there are more drawbacks to following this circular economy. To implement this, there will be an initial investment.
The linear traditional model only follows "Take-Make-Dispose.” There will be no more reuse of products when people think they are no longer usable. That product will be thrown off, so it will affect some other place while consumed by animals or other living things. It is also one of the main reasons for creating new diseases. Products, materials, and resources are kept in circulation for as long as feasible with the aid of the circular economy.
It helps to reduce environmental impacts, avoid waste of resources, and minimize resource use. And it helps to improve reputation and customer loyalty. This keeps the customers loyal to the one product brand, and because of this, the organization also developed.
The concept of a regenerative and restorative economic system benefited both the planet and the people. By adopting principles of the circular economy, businesses, governments, and consumers can work together and become more sustainable in the future. This will help to generate a new business structure, and the things that can be sold at a lower price will also benefit customers. Corporations can use the balance amount for creating or investing in other sectors or events; this can improve the money flow. The concept of supply chain management and its principles refer to the way goods are sourced, produced, distributed, consumed, and disposed of throughout the entire value chain. Because of this method, the company wants to improve production in this place,

where resources were wasted without being used properly. To rectify this type of error, the circular economy was introduced, which will make the resources reusable.

Because of this circular economy in supply chain management, businesses can unlock a wide range of markets and enjoy an abundance of benefits, including cost savings, improved efficiency, and improved environmental performance. Through this type of activity, our economy grew compared to other countries. One type of closed-loop system is a circular economy. With continuous circulation, so this will avoid the wastage of other resources in the supply chain. This closed-loop approach aims to minimize waste and reduce the need for virgin materials.

Needs

This circular economy study focused on minimizing waste and implementing this method effectively. There will be rapid change in the economy. The study focused on the supply chain, which is a topic in the circular economy. There will be an open and closed loop method difference, technology integration, supply chain transparency, reverse logistics, and consumer expectations, so this helps to develop the economy without wasting the thing, which is without finishing the life of the product. This circular supply chain helps the customers think and produce at least at a reasonable cost, so the customers benefited. Not only the customers, but also the common people, benefited from this circular economy. This helps to avoid impact in an economy, which is any type of disadvantage, like if a waste e-product is in garbage, there will be some type of animal that is waiting for food and will stand near the garbage to get some food in that garbage, and the e-product damages the animal.

Objectives

- Assess consumer awareness & perception of sustainability initiatives in circular economy.
- Identify opportunity to enhance the role logistics in promoting the circular economy.
- To predict the influence of different factors on what customers think about how well logistics support the circular economy.

Review of Literature

European Commission. (2020) "Circular economy action plan" This paper outlines the goals of the European Green Deal for sustainable development. This circular economy will decrease stress on natural resources. It also helps to improve and create new jobs, which leads to growth. And the predicted 2050 European target is to halt biodiversity loss. And explaining how to, in terms of sustainability, promote circular economy processes. The Europeans use resources as long as possible to ensure that waste is prevented.

Kirchherr. J, Piscicelli. L, Bour. R, Kostense-smit. E (2018) [19] "Barriers to the Circular Economy: Evidence from the European Union (EU)" This study blames various technological barriers. The researcher presented a large-N study on circular economy. There are 208 survey respondents and 47 expert interviewers. In addition to organisational culture, they discovered cultural hurdles and a lack of customer interest and understanding.

Kirchherr. j, Reike. D, Hekkert. M (2017) [20] "Conceptualizing the circular economy: An analysis of 114 definitions" This is the topic the researcher took on in the future prediction with appropriate evidence. He mentioned this paper regarding the present circular economy, and their team also collected 114 economic definitions, which are in 17 dimensions. He also mentioned the importance of the circular economy and explained various circular conceptualizations on this topic.

Geissdoerfer. M, Savaget. P, Bocken. N M P, Hultink. E J (2017) [21] "The Circular Economy - a new sustainability paradigm?" This topic explains the circular economy gained in academia, industry, and policymakers. This research finds gaps and provides conceptual clarity. There were snowballing techniques to investigate the differences and relationships between both. We identify eight different types of literature and most evidence similarities in both concepts.

Ghisellini. P, Cialani. C, Ulgiati. S. (2016) [22] "A review on circular economic: the expected transition to a balanced interplay of environmental and economic system" This explains promoting the adoption of closed-loop production in an economy; circular economics helps to increase the efficiency of resources and focuses on industrial waste and urban. This study focuses on features of the circular economy, advantages, disadvantages, modelling, etc. Talks about China promoting top-down political objectives in other areas and countries, such as Japan, the European Union, and the USA, are bottom-up.

Stahel. W R (2016) [23] "The circular economy" This topic explains about its cycles, such as humans continuing to "make, use, dispose'. He mentions that globally, one-third of plastic waste is not managed or collected. He also explains about closing loops in the industrial system to minimize product waste.

Bocken. N M, de Pauw.I, Bakker. C, Van Der Grinten. B (2016) [24] "Product design and business model strategies for a circular economy" This topic explains in business what a linear model to a circular economy brings and the practical challenges a company faces. This paper explains guidelines and business strategies for moving from a linear to a circular model. And the terminology of slowing, closing, and narrowing resources this circular economic framework opens up future research in the circular economy to key decision-makers.

Tukker, A (2015) [25] "Product services for a resource - efficiency and circular economy-a review" This study explains how our society is moving towards resource efficiency. This literature on PSS in the last decade was found in an earlier review in 2006. There were 300 relevant papers identified, of which 140 were referenced in the review. PSS in last decade in the within those earlier was found PSS also reviews. a wide range of science encompasses such as field business management, ICT, and manufacturing. Geographically, Asia now produces more paper than Europe.

Ellen MacArthur Foundation (2013) "Towards the Circular Economy: Economy and business rationale for an accelerated transition" This study explains why the new economic model has become louder these days. The business has started to reuse the products and restore them. The analysis's promise to the business to prepare for the adoption of the net material cost savings helps to save $630 billion p.a. towards 2025.

MacArthur. E, Stuchtey. M (2013) "Growth within: a circular economy vision for a competitive Europe" Value produced from goods, materials, and structure drives growth

in the circular economy. The advantages of adoption for Europe in terms of families, growth, income, and environmental effects. In this analysis of three of food, mobility, needs. It is the wide- ranging implications business leaders and government.

Methodology

In the research, data were collected through simple random sampling with the help of the SPSS tool; it analysed in depth and provided output below the passage.

As a result, consumers were not much aware of the circular economy and its impact. Structured questioners asked people to receive data; questioners were asked through survey mode on the online platform. People are comfortable giving their data; this research denotes whether the circular economy impacts customers in electronic products. As a result, it actually impacts it, but a lot of them are not aware of it. It is responsible to educate or guide people to know about it.

Correlation: Objective 1

Table 1: The correlation is significant at the 2-tailed 0.01 level.

Variable	What about your perception to improve sustainability in logistics	Did your brand take any initiatives
What about your perception to improve sustainability in logistics	1.000	0.576**
Sig. (2-tailed)		0.000
N	50	50
Did your brand take any initiatives	0.576**	1.000
Sig. (2-tailed)	0.000	
N	50	50

Interpretation

The null hypothesis (H0) states that the two variables do not significantly correlate. In this context: (H0) p= 0

Where represents the population correlation coefficient. This hypothesis suggests that there is no relationship between the perception to improve sustainability in logistics and whether the brand has taken any initiatives.

Alternative Hypothesis (H1): The two variables have a substantial association with one another, in this context: (H1) p = 0

- This hypothesis suggests that there is a relationship (positive or negative) between the perception of improving sustainability in logistics and the brand's initiatives.
- A positive correlation of 0.576 suggests a moderately positive relationship. This means that there is a moderate tendency for the perception of improving sustainability in logistics to be associated with the actual initiatives taken by the brand.

Strong statistical significance is shown by the p-value, which is 0.000 (less than 0.01), meaning the observed relationship is very unlikely to have occurred by chance.

To interpret the correlation in relation to hypothesis testing, we need to understand the alternative hypothesis (H1) and the null hypothesis (H0). Let's break this down step by step using the given information:

We reject (H0) and accept (H1) as the p-value is significantly less than the selected significance level (alpha = 0.01).

Strong evidence supports the conclusion that there is a substantial positive link between the perception of improving sustainability in logistics and whether the brand has taken any initiatives.

Factor Analysis: Objective 2

Communalities

Table 2: Analysis of Principal Components is the extraction method.

Variable	Initial	Extraction
Did your brand take any initiatives	1.000	0.776
Opinion: Did logistics most effectively promote circular economy	1.000	0.704
What about your perception to improve sustainability in logistics	1.000	0.655
How frequently have electronic devices been changed by you	1.000	0.884

Total Variance Explained

Table 3: Analysis of Principal Components is the extraction method.

Component	Initial Eigenvalues	Extraction Sums of Squared Loadings	Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %
1	1.959	48.972	48.972
2	1.061	26.517	75.488
3	0.611	15.263	90.752
4	0.370	9.248	100.000

Component Matrixa

Table 4: Analysis of Principal Components is the extraction method.

Variable	Component 1	Component 2
Did your brand take any initiatives	0.881	-0.006
Opinion: Did logistics most effectively promote circular economy	0.687	-0.482
What about your perception to improve sustainability in logistics	0.800	0.121
How frequently have electronic devices been changed by you	0.265	0.902

Two parts were taken out.

Interpretation

Communities & Total Variance Explained

- The high communalities (ranging from 0.655 to 0.884) suggest that the factors account for a substantial amount of the variation in the observed variables. This supports H1, indicating a meaningful underlying factor structure.
- The fact that two components explain 75.49% of the total variance also supports the presence of a factor structure, further rejecting H0 in favour of H1.

Component Matrix

- The clear factor loadings, where some variables are strongly associated with Component 1 (e.g., initiatives taken by brands, perception of sustainability) and one variable strongly with Component 2 (frequency of changing electronic devices), show that the dataset can be reduced into two underlying factors.
- This evidence rejects H0 and supports H1, indicating the presence of a distinct underlying factor structure.

Conclusion

- We accept the alternative hypothesis (H1) and reject the null hypothesis (H0) in light of the factor analysis results.
- This means that the dataset has a significant underlying factor structure, where variables can be grouped into two main factors:

Factor 1: Relates to brand initiatives and sustainability perceptions.

Factor 2: Relates to consumer behaviour in terms of electronic device changes.

- The significant factor structure implies that the variables used in your study are not random but are related and can be explained by a smaller set of underlying factors.

Regression: Objective 3- Model Summary

Table 5: Model summary with R and error metrics.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.582a	0.339	0.311	0.89440

Predictors: (Constant),

- What about your perception to improve sustainability in Logis,
- How frequently have electronic devices been changed by you

ANOVA[b]

Dependent Variable: Did your brand taken any initiatives Coefficient

Table 6: Regression analysis summary with statistical significance.

Model	Sum of Squares	DF	Mean Square	F	Sig.
Regression	19.282	2	9.641	12.052	0.000a
Residual	37.598	47	0.800		
Total	56.880	49			

Predictors: (Constant): What about your perception to improve sustainability in Logis, How frequently have electronic devices been changed by you

Table 7: Regression coefficients and their statistical significance.

Model	Unstandardized Coefficients	Standardized Coefficients	T	Sig.
	B	Std. Error	Beta	
1 (Constant)	1.007	0.486		2.074
How frequently have electronic devices been changed by you	0.170	0.084	0.491	2.074
What about your perception to improve sustainability in logistics	0.617	0.132	0.562	4.661

Dependent Variable: Did your brand taken any initiatives

Interpretation

Model Summary

R Square is 0.339, indicating that about 33.9% of the variance in the dependent variable "Did your brand take any initiatives" is explained by the predictors.

Adjusted R square is slightly lower at 0.311, accounting for the number of predictors in the model. ANOVA Table:

Given that the significance value (p) is less than 0.05 (0.000), the model as a whole appears to be statistically significant. As a result, we reject (H0) and accept (H1), showing that the dependent variable's variance is significantly explained by the predictors taken together.

Coefficients Table:

In the variable "How frequently have electronic devices been changed by you?" at 0.491, the pvalue is higher than 0.05. This implies that the predictor in the model is not statistically significant.

For the variable "What about your perception to improve sustainability in logistics?" The p-value is 0.000, which is less than 0.05. This indicates that this predictor is statistically significant in explaining the dependent variable.

Conclusion

We reject the first objective (H0) and accept the alternative hypothesis (H1) as the p-value is significantly less than the selected significance level (alpha = 0.01), for first objective.

According to the second aim objective, we accept the alternative hypothesis (H1) and reject the null hypothesis (H0). The significant factor structure implies that the variables used in your study are not random but are related and can be explained by a smaller set of underlying factors.

We reject the null hypothesis that there is no association between the predictors and the dependent variable since the total model is statistically significant in the third objective ($p < 0.05$), for third objective.

One of the predictors is

- Perception to improve sustainability in logistics is a significant predictor (p = 0.000).
- Frequency of changing electronic devices is not a significant predictor (p = 0.491).

Thus, the perception of sustainability initiatives has a significant impact on whether a brand has taken initiatives, while the frequency of changing electronic devices.

This results in the circular economy awareness improving among customers compared to the past; the key point is that it reduces the manufacturing cost by reusing it. If the customer is aware of circular economy, they avoid wasting it, so it is important to spread circular economy benefits. Even though it consumes costs for collecting, it is good for the economy's sustainability. Developed countries like foreign countries focus on sustainability and recycling, which is also happening; this also benefits our economy.

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