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An empirical study on Customer awareness regarding various green initiative taken by Delhi metro: a study conducted in Delhi NCR

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ABSTRACT:

This empirical study delves into the critical aspect of "Customer Awareness Regarding Various Green Initiatives Taken by Delhi Metro." It seeks to uncover the extent to which the passengers of Delhi Metro are aware of the eco-friendly initiatives implemented by the transit authority, their attitudes towards these efforts, and the factors influencing their engagement with sustainable practices while using the metro system. Through rigorous research and analysis, this study aims to shed light on the current state of customer awareness and highlight opportunities for further improvement in the realm of sustainability within the Delhi Metro system. Understanding the dynamics of customer awareness and their role in green initiatives is crucial for fostering a more environmentally conscious urban transport ecosystem and, by extension, a cleaner and healthier Delhi.

the multifaceted nature of environmental awareness and sustainability, highlighting the roles played by age, education level, income level, and, potentially, residential status. These findings contribute to our understanding of the factors influencing individuals' environmental attitudes and behaviors, supporting the growing body of literature in the field of environmental studies.

Introduction:

In today's rapidly evolving world, environmental consciousness has become an imperative facet of sustainable urban development. Cities around the globe are grappling with issues of pollution, congestion, and climate change. In this context, public transportation systems play a pivotal role in mitigating the adverse effects of urbanization on the environment. The Delhi Metro, India's lifeline for urban mobility, has emerged as a beacon of hope in this regard.

The Delhi Metro has undertaken a multitude of green initiatives, aiming to not only provide efficient and convenient transit services but also to minimize its carbon footprint and contribute to a cleaner, greener Delhi. These initiatives range from the incorporation of energy-efficient technologies and eco-friendly station designs to extensive tree plantation drives and waste management programs.

However, the success of these green initiatives ultimately depends on the awareness and engagement of its primary stakeholders: the passengers. Their awareness, perception, and participation in these sustainability efforts can significantly influence the overall impact of the Delhi Metro's green endeavors.

This empirical study delves into the critical aspect of "Customer Awareness Regarding Various Green Initiatives Taken by Delhi Metro." It seeks to uncover the extent to which the passengers of Delhi Metro are aware of the eco-friendly initiatives implemented by the transit authority, their attitudes towards these efforts, and the factors influencing their engagement with sustainable practices while using the metro system. Through rigorous research and analysis, this study aims to shed light on the current state of customer awareness and highlight opportunities for further improvement in the realm of sustainability within the Delhi Metro system. Understanding the dynamics of customer awareness and their role in green initiatives is crucial for fostering a more environmentally conscious urban transport ecosystem and, by extension, a cleaner and healthier Delhi.

Literature review:

Public transportation systems worldwide are increasingly adopting green initiatives to reduce their environmental impact. These initiatives encompass energy-efficient technologies, renewable energy sources, and eco-friendly infrastructure design (Shaaban et al., 2019). Studies emphasize the pivotal role of customer awareness and engagement in fostering sustainable practices within public transportation systems, with passengers who are informed about green initiatives being more inclined to adopt environmentally friendly behaviors (Hasan, M.M., Al Amin, M., Arefin, M.S. *et al.* 2023). The Delhi Metro has garnered widespread recognition for its exemplary green initiatives, including regenerative braking systems, solar power generation, and extensive tree plantation drives. Extensive documentation exists regarding these initiatives and their potential impact on reducing the city's carbon

emissions (Delhi Metro Rail Corporation [DMRC], 2020). To gauge passenger awareness and satisfaction regarding green initiatives, the Delhi Metro system employs surveys and feedback mechanisms, providing invaluable data for refining sustainability efforts (DMRC, 2021).

Impact on Ridership:

Studies suggest that projecting an environmentally conscious image and implementing effective green initiatives can positively influence ridership on public transportation systems. Passengers are more likely to opt for public transport over private vehicles when they perceive it as a sustainable option (Ahmad, H., Yaqub, M. & Lee, S.H 2023).

Scholarly discussions have revolved around policy implications for promoting green transportation in Indian cities like Delhi. These include the necessity of robust public awareness campaigns, enhanced accessibility, and incentives for sustainable commuting (Nagendra et al., 2018).Multiple studies (Gulia, S., Kaur, S., Mendiratta, S. *et al.*) have underscored its endeavors in energy efficiency, greenhouse gas emissions reduction, and the promotion of public transportation as an eco-friendly alternative to private vehicles. These initiatives encompass regenerative braking, solar power utilization, and rainwater harvesting systems. In-depth examinations (Wang, Xinjian & Liu, Zhengjiang& Wang, Jin&Loughney, Sean & Zhao, Zhiwei& Cao, Liang. (2021).) have delved into passenger awareness and perception of the environmental initiatives spearheaded by the Delhi Metro.

Factors Influencing Passenger Engagement:

Several factors influence passenger engagement with green initiatives. Research by Dhingra and Balani (2017) has identified age, education, and income as significant determinants of passengers' willingness to adopt eco-friendly behaviors while using the Delhi Metro. Understanding these factors is crucial for designing effective awareness campaigns. Other researchers like Chaubey, D.S. (2011) andKala, D. & Chaubey, D. S. (2023)have probed the impact of green initiatives on ridership and sustainable behavior. They indicate that passengers who are aware of and appreciate the environmental efforts of the Delhi Metro are more likely to choose it over other modes of transportation, thereby contributing to reduced traffic congestion and pollution.

The objective of this paper is to fill a crucial gap in the relevant literature by doing an empirical investigation into the levels of customer awareness, perceptions, and attitudes regarding the various green initiatives undertaken by the Delhi Metro.

Research Objectives:

1. To study the awareness level of Delhi Metro passengers.
2. To study about their concerns regarding Environmental sustainability efforts of Delhi Metro.
3. To study the effect of demographic variables on their awareness about green initiatives taken by Delhi metro.

Research methodology:

Research Design:

The currentinvestigationutilizes a cross-sectional research design to gather data for a single time period. Data was collected from a sample of Delhi Metro passengers in the Delhi NCR region.

Sample size:

The sample consistedof 259 Delhi Metro passengers in the Delhi NCR region.

Sampling Technique:

A stratified random sampling approach was used. Stations within different geographical zones in Delhi NCR were considered as strata, and random samples were drawn from each stratum.

Data Collection tools:

Data was collected through a structured questionnaire administered at various Delhi Metro stations as well as online forms were also sent for data collection to ensure a diverse and representative sample.

Variables:

Dependent Variable: Customer Awareness of Green Initiatives (measured on a 5 point Likert scale. 1 = strongly disagree, 2 = disagree, 3= neutral, 4 = agree, 5 = strongly agree).

Independent Variables: Demographic variables (e.g., age, gender, education), metro usage frequency, and factors affecting awareness (e.g., communication channels, station signage).

Hypotheses:

H0: Demographic characteristics of respondents have no effect on Passengers'Environmental awareness and their concern toward Environmental sustainability.

H1: Demographic characteristics of respondents have significant impact on their awareness and their concern towards Environmental Sustainability**.**

Analysis and findings:

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-30 Years	76	29.3	29.3	29.3
	31-40 Years	97	37.5	37.5	66.8
	41-50 Years	52	20.1	20.1	86.9
	Above 50 years	34	13.1	13.1	100.0
	Total	259	100.0	100.0	

Findings:

21-30 Years: There are 76 individuals in this age category, which makes up 29.3% of the total sample. 31-40 Years: This is the largest age group in your sample, with nearly 37.5% of the individuals falling between the ages of 31 and 40 years.41-50 Years: This age group includes 52 individuals, making up 20.1% of the sample. Above 50 Years: There are 34 individuals in this age category, accounting for 13.1% of the total sample.

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	179	69.1	69.1	69.1
	Female	80	30.9	30.9	100.0
	Total	259	100.0	100.0	

Findings:

Male: There are 179 male individuals in the sample, which accounts for 69.1% of the total sample. There are 80 female respondents, representing 30.9% of the total sample.

Marital Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unmarried	111	42.9	42.9	42.9
	Married	148	57.1	57.1	100.0
	Total	259	100.0	100.0	

Findings:

There are 111 individuals in the sample who are categorized as "Unmarried," and they make up 42.9% of the total sample. In the "Married" category, there are 148 individuals, representing 57.1% of the total sample.

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Graduate	55	21.2	21.2	21.2
	post Graduate	91	35.1	35.1	56.4
	Professionals	98	37.8	37.8	94.2
	Others	15	5.8	5.8	100.0

Total	259	100.0	100.0	

Findings:

There are 55 individuals in the sample who have a "Graduate" level of education, and Approximately 35.1% of the individuals surveyed have a postgraduate-level education.The "Professionals" category includes 98 individuals, making up 37.8% of the total sample. In the "Others" category, there are 15 individuals, accounting for 5.8% of the total sample.

Income (Monthly)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Up to 25000	60	23.2	23.2	23.2
	From 25001 to Rs50000PM	102	39.4	39.4	62.5
	Rs50001 to Rs75000Pm	42	16.2	16.2	78.8
	From Rs75001 to Rs100000PM	46	17.8	17.8	96.5
	Above100000PM	9	3.5	3.5	100.0
	Total	259	100.0	100.0	

Findings:

There are 60 individuals in the sample with a monthly income of "Up to 25000," which accounts for 23.2% of the total sample. In the "From 25001 to Rs50000PM" category, there are 102 individuals, representing 39.4% of the total sample. The "Rs50001 to Rs75000Pm" category includes 42 individuals, making up 16.2% of the total sample. In the "From Rs75001 to Rs100000PM" category, there are 46 individuals, accounting for 17.8% of the total sample. [The "Above 100000PM" category includes 9 individuals, representing 3.5% of the total sample.

Residential status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Urban	133	51.4	51.4	51.4
	Semi Urban	82	31.7	31.7	83.0
	Rural	44	17.0	17.0	100.0
	Total	259	100.0	100.0	

Findings:

Urban: There are 133 individuals in the sample with an "Urban" residential status.Semi Urban: There are 82 individuals in the sample from "Semi Urban" areas and there are 44 individuals in the sample with a "Rural" residential status.

Descriptive Statistics

	N	Mean	Std. Deviation	Variance
Environmental Awareness	**259**	**3.6551**	**.72343**	**.523**
I am aware of Delhi Metros' green initiatives aimed at reducing environmental impact	259	3.8263	.83337	.695
I am positive about the efforts put by Delhi Metros' management in implementing these green initiatives	259	3.5019	1.05791	1.119
I have started using Delhi metro more due to the green initiatives	259	3.7297	.96666	.934
I have become more environmental conscious due to the green initiatives of delhi metro	259	3.4286	1.16710	1.362
I think Delhi metro's green initiatives have been effective in reducing environmental pollution and energy consumption	259	3.7143	1.08345	1.174
I think Delhi Metro should further expand its green initiatives to enhance sustainability	259	3.7297	1.02881	1.058

Environmental Sustainability	**259**	**3.7089**	**.52663**	**.277**
Delhi Metro helps reduce air pollution in the city.	259	3.8185	.63022	.397
The use of Delhi Metro contributes to a greener and more sustainable environment.	259	3.6139	.64517	.416
I believe that using Delhi Metro instead of private vehicles helps combat climate change.	259	3.6718	.86065	.741
Delhi Metro's efforts to promote sustainable behavior (e.g., waste reduction, energy efficiency) are effective.	259	3.6023	.79738	.636
I am willing to use Delhi Metro more often in the future to contribute to environmental sustainability.	259	3.7992	.57587	.332
Using the Delhi Metro is more environmentally friendly compared to using personal vehicles.	259	3.7992	.71950	.518
I actively participate in reducing my carbon footprint by using the Delhi Metro.	259	3.6602	.75765	.574
Valid N (listwise)	259			

Findings:

The above table shows the questionnaire and the mean responses obtained for each particular item of the questionnaire. The overall mean for environmental awareness is 3.6551, which shows that the respondents were sufficiently aware about the green initiatives taken by DMRC.

The overall mean for environmental sustainability is 3.7089, which is also sufficient and shows that respondents believe that green initiative of DMRC is relevant.

ANOVA Age)

		Sum of Squares	df	Mean Square	F	Sig.
Environmental Awarenss	Between Groups	3.346	3	1.115	2.160	.093
	Within Groups	131.680	255	.516		
	Total	135.025	258			
Environmental Sustainability	Between Groups	3.383	3	1.128	4.218	.006
	Within Groups	68.170	255	.267		
	Total	71.553	258			

Findings:

In the above ANOVA table, two separate one-way ANOVA tests were conducted using SPSS, one for "Environmental Awareness" and another for "Environmental Sustainability," with age as the independent variable. The significance level (Sig.) for the variable Environmental Awareness was found as 0.093. In this case, since 0.093 > 0.05 (assuming a 0.05 significance level), the test fail to reject the null hypothesis. This means that there is no significant difference in environmental awareness scores among different age groups.

The significance level (Sig.) for the variable Environmental sustainability is 0.006, which is less than 0.05. Therefore, the test rejects the null hypothesis. This suggests that there is a significant difference in environmental sustainability scores among different age groups.

ANOVA(Gender)

		Sum of Squares	df	Mean Square	F	Sig.
Environmental Awarenss	Between Groups	.942	1	.942	1.806	.180
	Within Groups	134.083	257	.522		
	Total	135.025	258			
Environmental Sustainability	Between Groups	.401	1	.401	1.450	.230
	Within Groups	71.152	257	.277		

	Total	71.553	258			

Findings:

In this case, the significance level (Sig.) is 0.180, which is greater than 0.05. Therefore, the testfail to reject the null hypothesis. This suggests that there is no significant difference in environmental awareness scores between different gender groups.

In this case, the significance level (Sig.) is 0.230, which is greater than 0.05. Therefore, the testfail to reject the null hypothesis for environmental sustainability as well. This suggests that there is no significant difference in environmental sustainability scores between different gender groups.

ANOVA(Education)

		Sum of Squares	df	Mean Square	F	Sig.
Environmental Awarenss	Between Groups	11.202	3	3.734	7.690	.000
	Within Groups	123.823	255	.486		
	Total	135.025	258			
Environmental Sustainability	Between Groups	13.607	3	4.536	19.960	.000
	Within Groups	57.946	255	.227		
	Total	71.553	258			

Findings:

In this case, the significance level (Sig.) is very small, approximately 0.000. Since 0.000 is less than 0.05 (assuming a 0.05 significance level), the test rejects the null hypothesis. This indicates that there is a significant difference in environmental awareness scores among different education level groups.In this case, the significance level (Sig.) is very small, approximately 0.000. Since 0.000 is less than 0.05 (assuming a 0.05 significance level), the test rejects the null hypothesis for environmental sustainability as well. This suggests that there is a significant difference in environmental sustainability scores among different education level groups.

ANOVA(Income)

		Sum of Squares	df	Mean Square	F	Sig.
Environmental Awarenss	Between Groups	14.135	4	3.534	7.425	.000
	Within Groups	120.890	254	.476		
	Total	135.025	258			
Environmental Sustainability	Between Groups	12.202	4	3.050	13.054	.000
	Within Groups	59.352	254	.234		
	Total	71.553	258			

Findings:

In this case, the significance level (Sig.) is very small, approximately 0.000. Since 0.000 is less than 0.05 (assuming a 0.05 significance level), the test rejects the null hypothesis. This indicates that there is a significant difference in environmental awareness scores among different income level groups.

In this case, the significance level (Sig.) is very small, approximately 0.000. Since 0.000 is less than 0.05 (assuming a 0.05 significance level), the test rejects the null hypothesis for environmental sustainability as well. This suggests that there is a significant difference in environmental sustainability scores among different income level groups.

ANOVA residential status

		Sum of Squares	df	Mean Square	F	Sig.
Environmental Awarenss	Between Groups	3.052	2	1.526	2.960	.054
	Within Groups	131.973	256	.516		
	Total	135.025	258			
Environmental Sustainability	Between Groups	2.865	2	1.432	5.338	.005
	Within Groups	68.689	256	.268		

Total	71.553	258			

Findings:

In this case, the significance level (Sig.) is approximately 0.054. Since 0.054 is slightly greater than 0.05 (assuming a 0.05 significance level), the test fails to reject the null hypothesis for environmental awareness. This suggests that there is no significant difference in environmental awareness scores among different residential status groups at the 0.05 significance level. In this case, the significance level (Sig.) is 0.005, which is less than 0.05. Therefore, the test rejects the null hypothesis for environmental sustainability. This indicates that there is a significant difference in environmental sustainability scores among different residential status groups.

Finding of the study:

In the context of environmental studies, it is essential to examine the factors that influence individuals' environmental awareness and sustainability scores. To this end, our research sought to investigate the potential impact of age, gender, education level, income level, and residential status on these two key dimensions: "Environmental Awareness" and "Environmental Sustainability."

Age and Environmental Awareness: Our analysis revealed that age does not exhibit a significant influence on individuals' environmental awareness scores ($p > 0.05$).

Age and Environmental Sustainability: Conversely, our investigation uncovered a noteworthy discrepancy in sustainability scores among different age groups ($p < 0.05$).

Gender and Environmental Awareness & Sustainability: In our study, we found no significant gender-based differences in either "Environmental Awareness" or "Environmental Sustainability" scores ($p > 0.05$).

Education Level and Environmental Awareness & Sustainability: Our research established that both "Environmental Awareness" and "Environmental Sustainability" scores significantly differ among various education level groups ($p < 0.05$).

Income Level and Environmental Awareness & Sustainability: Similarly, our analysis demonstrated a significant difference in both "Environmental Awareness" and "Environmental Sustainability" scores among different income level groups ($p < 0.05$). This implies that income level exerts an influence on individuals' environmental awareness and sustainability.

Residential Status and Environmental Awareness: While our study did not uncover a significant difference in "Environmental Awareness" scores among different residential status groups ($p > 0.05$), it is important to note that the p-value approached the significance level.

Conclusions:

In conclusion, our research sheds light on the multifaceted nature of environmental awareness and sustainability, highlighting the roles played by age, education level, income level, and, potentially, residential status. These findings contribute to our understanding of the factors influencing individuals' environmental attitudes and behaviors, supporting the growing body of literature in the field of environmental studies

Recommendations:

- **Age and Environmental Sustainability:** Given the significant difference in environmental sustainability scores among different age groups, organizations and policymakers should consider tailoring environmental initiatives and awareness campaigns to target specific age demographics.
- **Education and Income**: The significant differences in environmental awareness and sustainability scores among education and income groups suggest opportunities for targeted environmental education and outreach programs. These programs should be designed to address the unique needs and perspectives of individuals with varying educational backgrounds and income levels.
- **Residential Status and Environmental Sustainability**: Since there is a significant difference in environmental sustainability scores among different residential status groups, efforts should be made to understand the specific factors contributing to these variations. Tailoring sustainability initiatives to specific residential contexts may enhance their effectiveness.

Limitations and Future Scope of the Study

- While we can identify disparities in environmental awareness and sustainability levels among different groups, we cannot definitively ascertain the exact causes of these differences based solely on this analysis.
- Another limitation of this study is its reliance on a specific sample size and demographic characteristics. The findings are contingent on the chosen sample, which may not fully represent the broader population.
- The survey questions and response options may influence how participants perceive and respond to environmental awareness and sustainability items. Therefore, it is essential to acknowledge that limitations associated with survey design may impact the validity of the study's conclusions.
- This study focuses on specific factors related to environmental awareness and sustainability and may not account for all external influences. Cultural factors, regional differences, and other contextual variables that were not considered in the analysis.

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