The Role of Facebook in Generating public awareness regarding Climate change in Lahore Pakistan

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Abstract: This study explores user perceptions, engagement, and the credibility of climate change information shared on Facebook. This research seeks to uncover the impact of this influential social media platform on climate change awareness in a specific regional context. Researcher Research validity and reliability depend on sample size. This technique involves assessing confidence level, margin of error, effect magnitude based on study objectives, and statistical test selection. The researcher must also account for attrition and non-response rates to maintain sample size during data collection. The ability to recruit and survey within resources and timetables is essential. The sample size estimate was used for an unlimited population, and 384 responded. Complex situations may require a statistician or statistical software to calculate sample size. The findings offer insights into the dynamics of climate change communication in Lahore through Facebook and provide a foundation for informed policy decisions and awareness campaigns. It is evident that social media platforms, when harnessed effectively, can contribute significantly to advancing climate change awareness and fostering collective efforts toward climate action in the context of Lahore, Pakistan, and beyond.

Key words: Climate Change, Media Policy, Media Coverage, Factors, Agenda Setting

1. Introduction

Global urbanization is accelerating at an unprecedented rate. Currently, over 54% of the global population lives in cities; by 2025, an estimated 66% will do so (UN, 2014). Asia has 46% of its population living in urban areas, compared to the rest of the globe. In Pakistan, 35% of the population lives sin cities and towns, following behind in urban population. Pakistan has the greatest urban population among SAARC countries. Currently, Lahore has an urban population of about 80%, matching the urbanization levels of wealthy countries. Growth and urbanization in Lahore-Pakistan are driven by natural rise, rural-to-urban migration, and international and local investment in diverse sectors. By 2025, Lahore will be among the top 30 cities in the world in terms of urban population proportion due to increased population growth (Shirazi & Kazmi, 2019). Climate refers to the long-term atmospheric conditions lasting 11-40 years. It summarizes variations in temperature, air pressure, wind, humidity, precipitation, etc. Our climate changes with everything else. Research has shown that climate change is accelerating (Halady & Rao, 2010). Humans now face drastic climate change, including rising global temperatures, rising sea levels, warming of the sea, shorter and warmer winters, more severe cyclones, melting glaciers, and many other extreme climatic events. These changes harm humans and the environment (et al., 2014). Local and comprehensive climate change information is needed to develop mitigation solutions. Climate change awareness among kids, educators, farmers, etc., has been studied

extensively. These findings demonstrate that local communities should be educated about climate change (Alfonso, 2021; Parant et al., 2017). Pakistan is highly sensitive to climate change (Mohsin et al., 2022).

Many scholars and the climate change minister say Pakistan is also threatened by climate change. Pakistan is the 7th most vulnerable country to climate change, and some research suggests that most Asian countries' temperatures will be unsuitable or uncomfortable by the end of the 21st century. Over the previous decade, floods, droughts, and heat waves have affected most Pakistanis (Qazlbash et al., 2021). Experts estimate 150 extreme weather events in Pakistan owing to climate change. These climate phenomena include winter pollution, flash floods, landslides, displaced people, summer forest fires, crazy heat waves, and glacier melting in the past 20 years (Poveda et al., 2020). According to climate literature, global warming will reduce workers' cognitive and physical performance, reducing adequate labour supply. Extreme temperatures harm health. There is a controversy about whether humans or natural phenomena cause climate change. According to various studies, this transformation is mostly caused by human activity like the Industrial Revolution and agriculture. These activities impact the global atmosphere, disrupting natural cycles and causing climate change (Aslam et al., 2021). Climate change could be devastating if not addressed now (Cheikhrouhou et al., 2018). Climate change may reduce food output. Because crop yield depends on climatic conditions (particularly rainfall patterns and temperature), stronger tropical cyclones, changing wind speeds, and melting glaciers may increase floods. Increased illness and biological diversity were also detected (Reyer et al., 2017).

Social media has changed personal and professional communication. Mobile social networking is nearly essential for most users. Social media allows communication and collaboration (Zincir, 2016). Blogs, vlogs, instant messaging, virtual communities, and social networking sites are social media (Chugh & Joshi, 2019). Consumers on social media have various needs (Chugh, 2012). LinkedIn and Viadeo emphasise professional connections, whereas Facebook and MySpace emphasise informal social interaction. However, the border is blurring. Social media includes blogging, discussion forums, bookmarking, and wikis. However, this paper addresses social networking. Social media uses social networking sites to facilitate large-scale collaboration. Users can communicate with social connections via public or private accounts on social networking sites (Boyd & Ellison, 2010). To be clear, social media means social networking sites, especially Facebook. Facebook dominates; thus, social media and Facebook are used interchangeably (Greenhow & Askari, 2017). Recent research has focused on Future Internet evolution directions. Many research approaches and methodologies exist, from disruptive architectural solutions to mobile network paradigms to cyber-physical confluence (Snehi & Bhandari, 2021). Thus, online social networks (OSN) require special attention. Facebook and Twitter are effective in tangible products and cyber-physical convergence. These services are redefining communication and linking. This cyber system may disrupt physical social ties. OSN also provide a lot of social relationship data for user social activity analysis (Corradini, 2020).

1.1 Problem Statement

In recent years, the detrimental effects of climate change have become increasingly evident, particularly in densely populated urban areas like Lahore, Pakistan. Addressing this global crisis necessitates widespread public awareness and engagement. In this context, social media platforms like Facebook have become powerful tools for information dissemination and public discourse. However, the effectiveness and impact of Facebook in generating public awareness regarding climate change in Lahore still need to be explored. This research seeks to address this gap by investigating the role of Facebook as a medium for promoting climate change awareness, assessing its reach, content, and engagement, and evaluating its potential to influence public perception and behaviour in Lahore, Pakistan.

1.2 Objectives

a) To determine the extent to which individuals in Lahore, Pakistan, engage in the central and peripheral routes of elaboration when exposed to climate change information on Facebook.
b) To investigate how the central and peripheral processing of climate change information on Facebook affects individuals' attitudes and beliefs regarding climate change in Lahore.
c) To explore the connection between users' attitudes and behavioural intentions related to climate change actions or advocacy in Lahore, Pakistan, as influenced by Facebook content.

1.3 Research Questions

a) To what extent do users of the climate change material on Facebook Lahore, Pakistan, participate in core or peripheral processing?

b) How does Facebook's primary and peripheral elaboration of climate change information affect Lahore, Pakistan, users' climate change attitudes and beliefs?

c) What is the relationship between Lahore, Pakistan residents' climate change attitudes and views, influenced by their Facebook posts, and their climate change advocacy intentions?

1.4 Significance

The significance of this study lies in its capacity to provide valuable insights into the effectiveness of Facebook as a medium for generating public awareness regarding climate change in Lahore, Pakistan, guided by the Elaboration Likelihood Model (ELM). As climate change continues to pose pressing challenges, understanding how social media, particularly Facebook, influences public attitudes, beliefs, and behavioural intentions is crucial. The findings can inform the development of targeted communication strategies for climate change awareness and action in Lahore, benefiting policymakers, environmental organizations, educators, and the local community. Moreover, by applying the ELM within a specific cultural and geographical context, this study not only contributes to academic literature but also offers a practical foundation for enhancing climate change communication strategies in Lahore and serves as a model for similar research efforts globally, reinforcing the vital role of social media in shaping public perceptions and promoting environmental sustainability (Busalim et al., 2022; Teng et al., 2014).

2. Literature Review

Climate change adaptation challenges differ by country and location. Issues are multifaceted. Research has examined climate change adaptation constraints and perceived stresses in underdeveloped countries (Ozor et al., 2010; Antwi et al., 2014). Literature highlights climate change information gaps, resource constraints, financial constraints, labour shortages, and inadequate government support for agriculture extension services. According to Antwi et al. (2017), climate change exposure is caused by both climatic factors (e.g., rainfall, extreme temperature, drought) and non-climatic factors (e.g., income, lack of agricultural equipment). Understanding the combination of these stressors is crucial in addressing the vulnerability of farming households to climate change. According to Adger et al. (2007), considerable knowledge gaps hinder information flow and adaptation, but knowledge alone does not induce adaptive responses. Even recent literature reviews corroborate these conclusions. Adaptation stakeholders and practitioners in developing and developed countries often cite knowledge deficits as a constraint (Bryan et al., 2009; Deressa et al., 2009; Begum & Pereira, 2013; Pasquini et al., 2013; Trivia & Moser, 2008; Gardner et al., 2010; Jantarasami et al., 2010). Tribbia and Moser (2008). Whitmarsh (2011) and Stoutenborough and Vedlitz (2013) emphasise the significance of information as an enabler. Physical restrictions also impact human adaptation. Effective communication techniques can help Pakistani society weather climate change tumults at all levels. Adapting to climate change is crucial to strategic actions to counter risks (Moser & Luers, 2008). Throughout history, Lahore has maintained a lush green character among sub-continental towns. The district's canal irrigation system began in 1859 with the opening of the Bari Doab Canal. The period saw the growth of indigenous trees along roadsides and canals. Trees such as Peepal, Mulberry, Banyan, and Jamun were prevalent, creating a novel vegetation structure in the city and suburbs. After Independence in 1947, urbanisation led to the removal of many indigenous trees, leaving only a tiny percentage in the city (Masood, 2004). Research and interviews with locals in Lahore reveal significant human changes to the city's trees and vegetation. Urbanisation and city development typically impair agricultural or forested terrain, as in Lahore.

Numerous studies have proven the importance of urban vegetation in providing ecosystem services during fast urbanisation worldwide (Tzoulas et al., 2007; Niemelä et al., 2010; Colding, 2011; Bastian et al., 2012; Haase, 2013). Monitoring vegetation in Lahore, Pakistan, a city known for its greenery, is crucial for city development and human health. The study will explore how individuals perceive vegetation change and why preserving trees is crucial for urban residents. Rapid urban expansion and LULC changes impact terrestrial, biological, physical, and climatological processes, causing environmental and ecological issues (Latifovic et al., 2005; Fisher et al., 2006). The number, quality, and distribution of urban vegetation/trees in cities worldwide reflect the history of urbanisation and ecological changes over time (Jim, 2004; Jim & Zhang, 2013). We hypothesised that urbanisation in Lahore over the past two decades has led to a decrease in urban vegetation, which has had significant repercussions on the environment and residents of the city. The perceived socio-environmental implications varied among inhabitants based on their socioeconomic background.
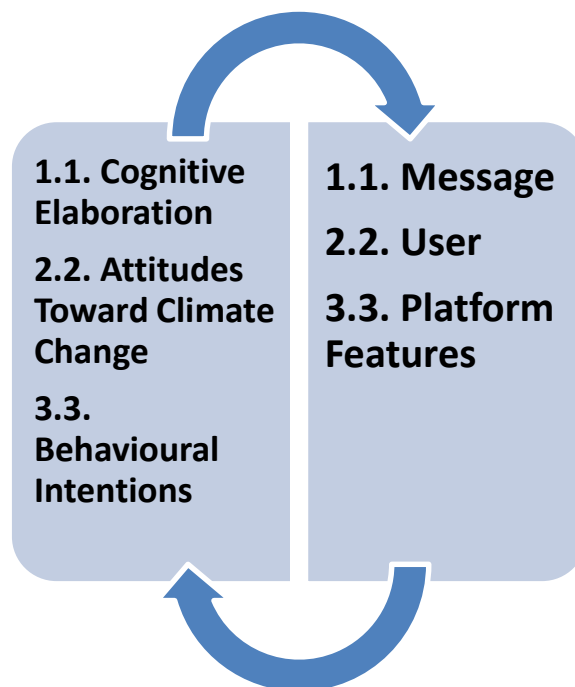
2.1 Theoretical Framework

The Elaboration Likelihood Model (ELM) provides a valuable framework for understanding how Facebook influences public awareness regarding climate change in Lahore, Pakistan. According to (Petty & Briñol, 2012) the ELM, individuals use two distinct information processing routes: central and peripheral. In the context of climate change awareness on Facebook, central processing involves users critically evaluating and profoundly engaging with climate-related information, such as articles, reports, and scientific data shared on the platform. This route may lead to profound attitude and behaviour changes among users who scrutinize the content. On the other hand, peripheral processing occurs when individuals rely on heuristic cues, such as visual elements, headlines, or the credibility of sources, to form opinions about climate change. Understanding the interplay between central and peripheral processing on Facebook can shed light on how the platform's content influences users in Lahore and can guide efforts to optimize climate change communication strategies, ensuring they align with the processing preferences of the target audience.

2.2 Hypotheses

H_1: It is more likely that the Facebook users in Lahore, Pakistan, who centrally handle climate change information, are more positive and aware of the challenges.

H_2: If the High-credibility Facebook posts from scientific organisations and environmental specialists in Lahore, Pakistan, then it will increase central processing and positive climate change attitudes.

H_3: The higher Cognitive elaboration and users' intentions to engage in climate change-related behaviours are mediated by Facebook's central processing of climate change information, and the higher elaborate processing leads to more positive behavioural intentions.

Theoretical Framework of ELM

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1.1. Cognitive          1.1. Message
Elaboration
                        2.2. User
2.2. Attitudes
Toward Climate          3.3. Platform
Change                  Features

3.3.
Behavioural
Intentions
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3. Methodology

The quantitative methodology for the study, "The Role of Facebook in Generating Public Awareness Regarding Climate Change in Lahore, Pakistan," employs the Elaboration Likelihood Model (ELM) and a structured approach to data collection and analysis. First, a representative sample of Facebook users in Lahore will be selected through stratified random sampling. Data will be collected through surveys that assess users' demographics, climate change knowledge, Facebook usage patterns, cognitive elaboration levels (central and peripheral processing), attitudes toward climate change, and behavioural intentions related to climate change actions and advocacy. Climate change-related content on Facebook will also be systematically collected and categorized based on message framing, source credibility, and visual elements. Quantitative analysis entail regression models to examine the relationships between

independent variables (content characteristics, user characteristics) and dependent variables (cognitive elaboration, attitudes, behavioural intentions) while accounting for potential moderating and mediating factors. Findings will provide quantitative insights into how Facebook influences climate change awareness and action in Lahore, guided by the ELM. Researcher choosing a sample size is essential to ensuring research validity and reliability. This procedure involves determining the confidence level and margin of error, evaluating the effect size depending on study objectives, and choosing the correct statistical tests. The researcher must additionally account for attrition and non-response rates to maintain sample size during data collection. Also significant is the possibility of recruiting and surveying people within resources and schedules. The sample size calculation was applied to an unlimited population, and this study had 384 responses. Complex scenarios may require a statistician or statistical software to determine sample size.

3.1 Measuring Variables
3.1.1 Central Processing
Conceptual Definition: Central processing in the ELM refers to the deep and critical cognitive evaluation of climate change information encountered on Facebook. It involves careful consideration of facts, arguments, and evidence related to climate change. This can be measured quantitatively by assessing the extent to which users engage in detailed reading, critical thinking, and systematic evaluation of climate change content on Facebook.

3.1.2 Peripheral Processing
Peripheral processing involves using heuristic or peripheral cues on Facebook to form judgments about climate change without in-depth cognitive engagement. These cues may include source credibility, visual appeal, or emotional tone. Peripheral processing can be operationalised by examining the reliance on superficial cues, such as likes, shares, or the credibility of sources, when users interact with climate change content on Facebook.

3.1.3 Attitudes toward Climate Change
Attitudes encompass individuals' overall evaluations and beliefs regarding climate change. This study's attitudes relate to how Facebook exposure influences users' views on climate change issues. Measure attitudes quantitatively through survey items that assess users' beliefs, feelings, and perceptions about climate change before and after exposure to Facebook content.

3.1.4 Behavioral Intentions
Conceptual Definition: Behavioral intentions in this context refer to users' inclinations and intentions to take specific actions related to climate change, such as supporting environmental initiatives, reducing energy consumption, or sharing climate-related content. Assess behavioral intentions through survey questions about users' likelihood of engaging in climate change-related actions or advocacy due to their Facebook interactions.

3.1.5 Climate Change Content Characteristics
Conceptual Definition: These characteristics encompass the features of climate change-related posts and content on Facebook, including message framing (e.g., alarming vs hopeful), source credibility (e.g., governmental vs. grassroots organizations), and visual elements (e.g., images and videos). Operationalized these characteristics by analyzing the content of climate change posts on Facebook, categorizing them based on framing, source credibility, and the presence of visual elements.

4. Findings

Table 1: Climate Change Information from Facebook

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-	Mean Difference	Std. Error Difference	Lower	Upper

		tailed)							
Climate Change Information from Facebook	Equal variances assumed	.195	.659	1.230	371	.219	.143	.116	-.086	.371
	Equal variances not assumed			1.179	135.993	.240	.143	.121	-.097	.382

This section reports the t-test results assuming that the variances of the two groups being compared (likely related to climate change information from Facebook) are approximately equal. Here are the key components: F: This is the test statistic for Levene's Test when variances are assumed to be equal. Sig.: This is the p-value associated with the F statistic. In this case, it is 0.659, which indicates whether there is a significant difference in variances. A high p-value suggests that the assumption of equal variances is met (i.e., variances are not significantly different). Following Levene's Test, you have the results of the t-test for Equality of Means: t: This is the t-statistic for the t-test, which measures whether there is a significant difference in means between the two groups. Df: Degrees of freedom associated with the t-test. Sig. (2-tailed): This is the two-tailed p-value for the t-test. It tells you whether the difference in means is statistically significant. Then, you have information about the mean difference between the groups: Mean Difference: The average difference in scores between the two groups. Std. Error Difference: The standard error associated with the mean difference. Finally, the confidence interval for the mean difference: Lower: The lower bound of the confidence interval. Upper: The upper bound of the confidence interval. This section reports the t-test results when it is assumed that the two groups being compared are unequal. This assumption is made when Levene's Test indicates a significant difference in variances. The components in this section are similar to those in the "Equal variances assumed" section.

Table 2: Information shared by scientific organizations and environmental specialists on Facebook Cross tabulation

			Very Credible	Credible	Somewhat	Rarely	Not at all
Gender	Male	Count	13	4	4	30	38
		% within Gender	14.6%	4.5%	4.5%	33.7%	42.7%
		% of Total	3.5%	1.1%	1.1%	8.0%	10.2%
	Female	Count	39	16	22	72	136
		% within Gender	13.7%	5.6%	7.7%	25.3%	47.7%
		% of Total	10.4%	4.3%	5.9%	19.3%	36.4%
Total		Count	52	20	26	102	174
		% within Gender	13.9%	5.3%	7.0%	27.3%	46.5%
		% of Total	13.9%	5.3%	7.0%	27.3%	46.5%

The table 2 provided appears to be a cross tabulation (also known as a contingency table) that displays the distribution of responses related to the credibility of information shared by scientific organizations and environmental specialists on Facebook, categorized by gender. Let us break down the table: Now, let us interpret the table: The numbers in each cell represent the count of individuals who fall into a specific combination of credibility level and gender. For example, 13 males find the information "Very Credible." % within Gender: These percentages show the distribution

of credibility responses within each gender category. For example, among males, 14.6% find the information "Very Credible." % of Total: These percentages represent the distribution of credibility responses relative to the total number of respondents. For example, 3.5% of all respondents find the information "Very Credible." The table shows how individuals of different genders perceive the credibility of information shared by scientific organizations and environmental specialists on Facebook. For instance, a higher percentage of females find the information "Not at all" credible compared to males (47.7% vs. 42.7%). Conversely, more males find the information "Rarely" credible compared to females (33.7% vs. 25.3%). The table provides insights into the distribution of credibility perceptions among males and females in response to the information shared by scientific organizations and environmental specialists on Facebook.

Table 3: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.449[a]	5	.020
Likelihood Ratio	14.625	5	.012
Linear-by-Linear Association	.811	1	.368
N of Valid Cases	374		

Table 3 presents the results of a chi-square analysis, a statistical test used to examine the association or independence between two categorical variables. In this case, it assesses the relationship between two variables. The break of the table: The result of the Pearson Chi-Square test, a common chi-square test. It measures the overall association or independence between two categorical variables. The value is 13.449, with 5 degrees of freedom (df). The Likelihood Ratio is another measure of association or independence between categorical variables. It is an alternative to the Pearson Chi-Square test. The value here is 14.625, also with 5 degrees of freedom. This statistic assesses the linear association between two categorical variables when one variable has a natural ordering or ranking. In this case, there is only one degree of freedom (1 df). The value is 0.811. This represents the number of valid cases or observations in the analysis. It tells you how many data points were used in this chi-square test, and there were 374 valid cases in this case. Now, let's interpret the results: These statistics (Pearson et al.) provide measures of the association between the two categorical variables under consideration. The significance level for both tests is typically set at 0.05. In your table: The Pearson Chi-Square has a p-value (Asymp. Sig. or asymptotic significance) of 0.020, which is less than 0.05. This suggests a statistically significant association between the two categorical variables. The Likelihood Ratio test also has a p-value of 0.012, less than 0.05. This further supports the presence of a significant association. This statistic is used when one of the variables has an ordered or ranked structure. In your table, the p-value for this test is 0.368, more significant than 0.05. This suggests that no significant linear association exists between the variables with a natural order.

Table 4: Relationships between climate change and Facebook information

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.801	2	.401	2.218	.110[a]
Residual	67.020	371	.181		
Total	67.821	373			

Table 5: Climate Change Information on Facebook

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.601	.118		13.584	.000
Climate Change Information on Facebook Deep Thinking	.057	.027	.114	2.102	.036
Climate change information on Facebook take actions	.022	.028	.043	.784	.433

Tables 4 and 5 are related to the regression analysis results. Regression analysis is used to explore relationships between variables and to predict one variable based on others. The breakdown down the table: In the "Regression" section, there are two predictor variables included in the model: "Climate Change Information on Facebook Deep Thinking" and "Climate change information on Facebook take actions." The F-statistic for the regression model is 2.218, with a p-value of 0.110. This suggests that the model is not statistically significant at the conventional significance level of 0.05. The regression model includes two predictor variables: "Climate Change Information on Facebook Deep Thinking" has a coefficient (B) of 0.057 and a p-value of 0.036, indicating that it is statistically significant in predicting the dependent variable. "Climate change information on Facebook take actions" has a coefficient (B) of 0.022 and a p-value of 0.433, suggesting that it is not statistically significant.

4.1 Discussion and Conclusion
The provided statistical information about whether there is a significant difference in means between groups related to climate change information from Facebook, considering equal and unequal variances. The p-values in the "Sig. (2-tailed)" column are used to determine whether the differences are statistically significant (i.e., whether the means are significantly different from each other). The confidence interval provides a range within which the population mean difference will likely fall. This crosstabulation allows to explore potential gender-based differences in how individuals perceive the credibility of climate change-related information shared on Facebook by scientific organizations and environmental specialists. It can be a valuable tool for identifying trends and patterns in data related to gender and credibility perceptions. The results from the Pearson Chi-Square and Likelihood Ratio tests indicate a significant association between the two categorical variables being analyzed. This means that the variables are not independent of each other. However, the Linear-by-Linear Association test does not show a significant linear relationship between the variables in a natural order. The analysis is based on 374 valid cases.
The regression analysis suggests that "Climate Change Information on Facebook Deep Thinking" has a statistically significant relationship with the dependent variable. At the same time, "Climate change information on Facebook take actions" does not have a statistically significant relationship. The overall model is not statistically significant at the conventional significance level of 0.05. In conclusion, the study "The Role of Facebook in Generating Public Awareness Regarding Climate Change in Lahore, Pakistan", illuminated numerous key aspects of how social media, particularly Facebook, affects climate change awareness in this location. Key study findings and conclusions. According to studies, Facebook has a significant role in climate change knowledge dissemination in Lahore, Pakistan. It had become a significant venue for climate change knowledge, news, and updates, raising public awareness. According to the study, scientific organisations and environmentalists provide climate change information on

Facebook. This information has varying trustworthiness. Some content is trusted, but users are also skeptical.
The data shows that Facebook users' climate change responses are complex. Users who deeply and critically study the content raise climate change awareness and favorable attitudes. Not all users act on the information they encounter. Climate change information on Facebook is viewed differently by gender. These disparities emphasize the necessity for gender-specific awareness campaigns and information distribution tactics. Facebook is important for climate change awareness, but it could increase the reliability of shared information and encourage more users to take action. These data show that Facebook is useful for climate change awareness in Lahore, Pakistan. We require continual efforts to provide credible information, engage consumers in critical thinking, and push them to take effective climate change activities. Policymakers, environmental organizations, and social media platforms in Lahore and beyond may work together to educate and empower climate change activists.

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