

# Social Media Platforms and their Digital Carbon Footprints: Analyzing Awareness Level of Social Media Users of Punjab, Pakistan

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## Abstract

As social media usage has been on the rise, there has been a growing concern about its impact on the environment. This research seeks to analyze the level of awareness of the concept of Digital Carbon Footprint among the social media users of Punjab, Pakistan. It will also identify the pro-environment behaviors that can motivate the social media users to reduce their usage of social media. The survey has been conducted using a quantitative approach with a survey research design to achieve the desired goals. The research is part of Theory of Planned Behavior. A simple random sample technique was used to select the sample ( $n = 335$ ) of respondents aged 18-26 years old from the cities of Lahore, Okara, Faisalabad and Rawalpindi. The results reveal that the social media users are not aware of their digital carbon footprint in Punjab. However, it also highlights the pro-environment behavior that can be used to reduce the usage of social media which indirectly reduces the digital Carbon Footprint. The aim of this research is to promote an eco-friendlier digital society by encouraging responsible social media usage and reducing the carbon footprint.

**Keywords:** Digital Carbon Footprint, Global Warming, Environment, Social Media Usage, Pro-Environmental Behaviors, Theory of Planned Behavior.

## 1. Introduction

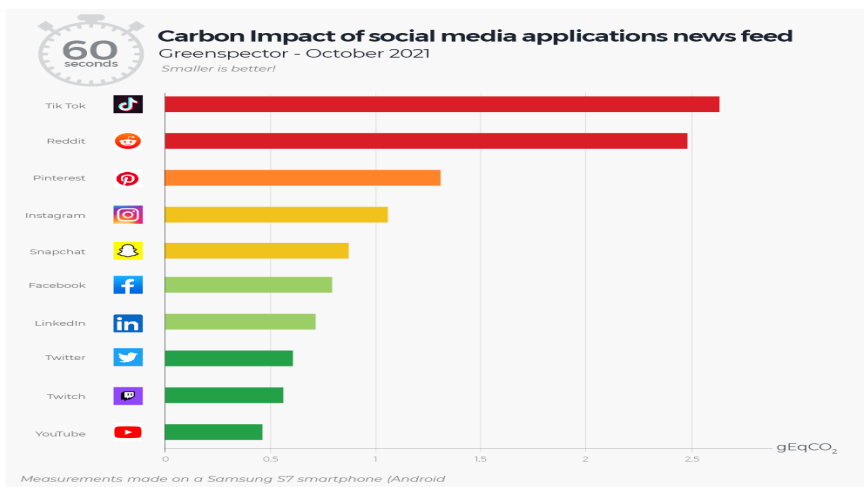
Climate change is a burning issue. In September 2021, approximately 200 health journals including for instance 'The New England Journal of Medicine' issued a shared editorial for emergency action to control global warming. Earth's temperature has increased by 0.14 Fahrenheit each ten years starting 1880 [1]. A global climate report from NOAA National Centers for environmental information, reports that 2021 was the earth's sixth warmest year on record from the year 1880 to 2021. The leading factor of the climate change is the alternation in the concentrations of the Green House Gases (GHG) which includes Carbon dioxide ( $\text{CO}_2$ ), Hydro fluorocarbon (HFC), Methane ( $\text{CH}_4$ ), Sulphur hexafluoride ( $\text{SF}_6$ ), Nitrous Oxide ( $\text{N}_2\text{O}$ ), Per fluorocarbons (PFCs) and Solar Radiations. Each of these gases has been associated with the rise in global warming over the last few decades [2,3]. Carbon dioxide emissions are described to result from several human actions. All of these actions add toward emitting a particular amount of carbon into the environment. Human activities, however, contribute a much larger number of gases each year [4]. Technological advancement has been the advent of a revolutionary change in the way people connect. A drastic change occurred in the way

people interact, after the invention of internet in the year 1983 [5]. It soon becomes the most popular and the fastest way to transfer information by providing a great number of platforms for mutual interaction [6].

As a result, the consumption of electrical devices and the amount of data produced is blasting and not only has affected human life but has also greatly impacted the environment. With digitalization at its climax, every online task has an environmental impact. There is an increasing concern about the world's rising carbon emission due to technological advancement. The majority of human actions have been proved detrimental to the environment [7]. In a study conducted by Arun Agarwal et al (2020) stated that, the use of the internet results in the release of approximately 300 million tons of  $\text{CO}_2$  annually, which is the same as flaming gas, oil and coal in Turkey or Poland [8]. Every second spent searching on Google, scrolling instafeed, and uploading a picture all add up to a digital carbon footprint. The global combined digital carbon footprint represented almost 3.7 percent of total greenhouse gas emissions which is tantamount to aeronautics industry discharge levels. As a matter of fact, digital technologies' energy utilization increased by nearly 70 percent

between 2013 and 2020 Fig. shows the absolute CO<sub>2</sub> emissions of all snaps, transferred or sent, in the year 2015 [9]. Facebook, Instagram, and WhatsApp have 80 million, 350 million, and 4.5

billion pictures per day, a remarkable amount of data with a huge impact in terms of CO<sub>2</sub> emissions, which increases every year [10].



**Figure 1: Environmental Footprint for Social Media Applications**

It is critical to take note that there is not a single solution to an issue as overwhelming as environmental pollution. Carbon radiations add remarkably to global warming, and this matter has therefore created a rising problem in the environment today. Main Objectives of this research are To explore the extent to which social media users of Punjab, Pakistan are aware of digital carbon footprint and To find out the pro environmental behaviors that could motivate social media users to reduce social media usage. The Rising CO<sub>2</sub> emissions brought on by growing digitalization and social media usage has made it more difficult to treat the problem currently. The lack of awareness about the digital carbon footprint resulting from social media usage presents a significant challenge in addressing the environmental impact of digital technologies. Individual as well as global effort is needed to reduce the CO<sub>2</sub> footprint of digitalization in order to improve people’s safety and well-being. The issue tended to by this research will just turn out to be seriously squeezing and

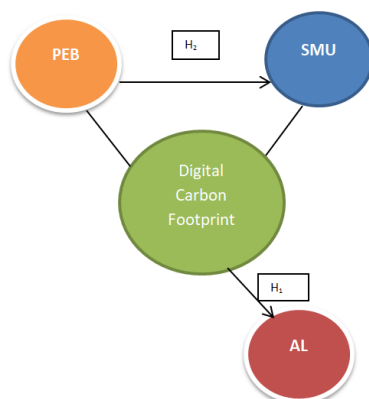
more important in the future as this study answers the following research questions.

RQ<sub>1</sub>: To what extent social media users of Punjab are aware of digital carbon footprint?

RQ<sub>2</sub>: Do pro environmental behaviors motivate social media users to reduce their social media usage?

The importance of this issue is becoming more widely known in the world, but there’s still a lot of work to do in Pakistan. There is also relatively insufficient data on the impact of social media applications on increasing digital carbon footprint so this research may be an addition to the existing body of knowledge in a particular area of study. This research can be helpful to take responsible digital actions by both adopting them individually and within organizations. People need to start understanding their digital impact and take the proper steps to deal with it.

## 2. Conceptual Framework



PEB: Pro-Environmental Behaviors, SMU: Social Media Usage, AL: Awareness Level

**Figure 2: Conceptual Model of Research**

### 3. Literature Review

#### 3.1 Climate Change

Health professionals have been warning for decades that rising temperatures and the devastation of the natural world are already putting people's health at risk. Climate change is one of the biggest issues we face in this century, and its connection to Carbon Dioxide (CO<sub>2</sub>) has been explored thoroughly in scientific studies [1]. Despite the focus on this problem, many human activities have an unseen negative effect on CO<sub>2</sub> release, and the people involved in these activities may not be aware of the damage they are causing or may not be willing to pay the associated price [11]. The evaluation from the United Nations Intergovernmental Panel on Climate Change (IPCC) says things are ready to deteriorate if Greenhouse gas discharges proceed, and clarifies that the fate of the planet depends, to a great extent, on the decisions that mankind makes today. According to the most recent UN Climate Report, global temperatures will rise by 2.7 degrees Celsius above pre-industrial levels by 2100 if greenhouse gas emissions are not reduced. As a result, new approaches to influencing consumer behavior are required [12,13].

#### 3.2 Digital Consumption

Increasing annually, digital consumption accounts for 4 percent of global emissions. It is investigated by Patsavellas & Salonitis (2019) that Smartphones with mobile internet and high-speed fixed broadband have drastically altered the methods people use for work, interacting with others, and obtaining knowledge [29]. In 2019, there are 4.1 billion people using 34 billion pieces of equipment or eight pieces of equipment per user. Internet and digital data are becoming increasingly important to the modern world and for this, there are growing demands on Data Centers to provide services of the required quality. Their power consumption rises, and as a result, so does their carbon dioxide (CO<sub>2</sub>) emissions. In the last few decades, Data Centers have become one of the biggest energy consumers on earth and they were estimated to be responsible for around 3 percent of global

energy consumption in 2017, and this will rise up to 4.5 percent by the year 2025. The rising concern about global warming and the objective set by United Nations or the European Union, Energy consumption and the Carbon dioxide emissions related with Data Centers are viewed as one of the extensive problems in attaining the target to limit Earth's temperature to 1.5° Celsius [27,31].

#### 3.3 Carbon Footprint

According to Harkiolakis (2013), The amount of carbon that is released during a process or by an organization or entity is commonly referred to as a carbon footprint. As public concern about pollution and its increasing effects on human health, it became a well-known metric that was used in reports by the government and environmental institutes as well as in conferences and the media. The swift rise in temperature on Earth and its association with human-made CO<sub>2</sub> is one of the most talked-about topics of our time. It has been established that the surge in temperature is strongly connected to the CO<sub>2</sub> emitted into the air, much of which is caused by humans. It is reported that the global carbon footprint of Internet use ranges from 28 to 63 g CO<sub>2</sub> equivalent per gigabyte [10]. A typical high-quality video streaming service emits 441 g CO<sub>2</sub>e/hr (global median) of carbon dioxide (Ultra HD or 4K) at a rate of 7 GB per hour. A monthly carbon footprint of 53 kg CO<sub>2</sub> emissions would be created by streaming videos at this quality for four hours per day [28].

#### 3.4 Digital Carbon Footprint

According to Grinstein et al., (2018) "A digital carbon footprint is the CO<sub>2</sub> emissions resulting from the production, use and data transfer of digital devices and infrastructure" [25]. Digital carbon footprint increases with each minute spent watching a video, browsing the internet, or scrolling through a newsfeed. Fig 3 shows most used Social Media applications worldwide in Jan 2022, ranked according to number of active user monthly (in millions)

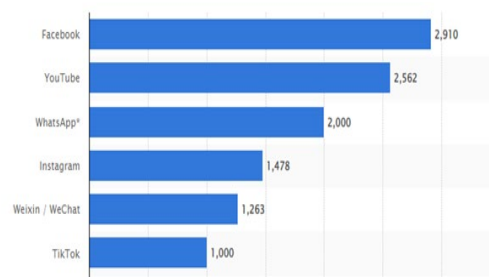


Figure 3: Social Media Applications Worldwide (JAN 2022)

Referring to Sharma & Dash(2022) study, there is a strong connection between the carbon footprint and the utilization of cloud computing applications [7]. This technology, which has been gaining prominence in the past couple of years, is known to be a great consumer of energy. Cloud computing is the process of storing and retrieving data remotely, which means people can access it from any place. A study conducted in 2009

by Harvard physicist Alex Wissner says that using a simple website produces 20 mg of CO<sub>2</sub> every second [30]. The findings of Corecon (2019) clearly indicates that the yearly amount of CO<sub>2</sub> released due to the photographs and images uploaded on Facebook, Instagram and WhatsApp is quite massive [10]. Every day, 80 million, 350 million and 4.5 billion pictures are shared through these three platforms respectively, leading to an increase

in CO<sub>2</sub> emissions year after year. In a similar study conducted by Marks et al., (2020) streaming online data is responsible for 58-60 percent of internet traffic and emits 300 million tons of carbon dioxide every year, which roughly adds up to 1 percent of overall emissions (First 2022) BBC reported that 58 percent of all downstream traffic on the internet is video, followed by web browsing at 17 percent, gaming at 7.8 percent, and social media at 5.1 percent [9]. Other forms of media streaming include YouTube, 11.4 percent, embedded video on Webpages 13.1 percent and web searching 7.8 percent [15].

According to Statista (2022) Social media usage is one of the most popular online activities [16]. In 2021, over 4.26 billion people were using social media worldwide, a number projected to increase to almost six billion in 2027. The time that individuals spend on social media and messaging applications every day averages out to two hours and 24 minutes, which is an increase of thirty minutes since 2015. The amount of energy required to store or send data, whether for emails, cloud storage, or websites, accounts for a significant portion of the digital footprint. The data centers require a ton of power not exclusively to continue working yet in addition for cooling also and in 2019 represented 1 percent of the global energy consumption. Without taking into account the impact of Covid-19, internet use accounts for 3.7 percent of worlds emissions which is equivalent to global air traffic and is expected to double by 2025 [17].

#### 4. Theory of Planned Behavior (TPB)

The current study can be related to the Theory of Planned Behavior (TPB) which can be used to explain the relationship between social media usage and pro-environmental behavior.

The Theory of planned Behavior suggests that attitudes, subjective norms, and perceived behavioral control influence a person's intention to engage in a particular behavior. In this

case, if users have positive attitudes toward reducing their digital carbon footprint, perceive social norms that support sustainable practices, and believe they have control over their actions; they are more likely to form intentions to reduce their digital carbon footprint.

The intentions formed under this theory can lead to actual behavior change. If social media users intend to reduce their digital carbon footprint, they may start employing measures such as reducing the use of data-intensive media, opting for eco-friendly hosting platforms, or supporting environmentally conscious social media initiatives.

#### 5. Methodology

For this research, the researcher has chosen Descriptive Research design for collecting data in which the desired characteristics of the population is measured using survey methodology. The population for the survey design is considered to be the educated youth of Punjab, Pakistan who uses Social Media applications (Instagram, Facebook, TikTok and YouTube) Sample selected by the researcher are the College and university students of age between 18-25 from four districts (Lahore, Rawalpindi, Faisalabad and Okara) of Punjab, Pakistan. Researcher selected the sample through simple random sampling technique in which Students from department of Social Sciences, Pure Sciences, Multimedia Arts and Engineering were selected from different private sector universities and public sector universities of these districts. The sample of this study is based upon 335 respondents. For this research, a questionnaire has been used as a research instrument developed by the Yu et al., (2013) , Aakster (2021), Gupta & Bashir (2018) in which most relevant items were selected [18-20]. The selected items were developed at five-point Likert scale. Researcher did slight modifications in the questionnaire by developing some questions using nominal scale with eight-point response anchor.

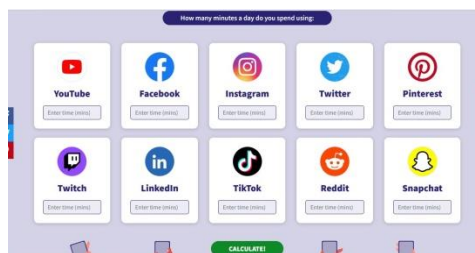
Variable	Indicator	No of items	Cronbach's Alpha
Awareness	Climate Change (Yu et al., 2013)	3	0.89
	Internet Pollution	3	0.79
Social Media Usage	Social Media Platform	1	0.92
	Social Media time	5	0.81
	Socialization (Gupta & Bashir, 2018)	3	0.77
	Entertainment (Gupta & Bashir, 2018)	3	0.81
Pro-Environmental Behavior	Attitude & Behavior (Aakster, 2019)	10	0.84
	Digital Behavior (Aakster, 2019)	7	0.89

Figure 4: Cronbach's Alpha Test Reliability

#### 6. Social Media Carbon Footprint Calculator

In order to calculate Carbon Footprint of Facebook, Instagram, YouTube, TikTok and Twitter is calculated through 'Compare

the Market' website. It works by adding time (number of minutes) spent on each social



**Figure 5:** Compare the Market Social Media Carbon Footprint Calculator

## 7. Results and Discussion

### 6.1 Statistical Tests

This research looks into the suggested hypotheses by using the responses collected from the social media users of Punjab.

#### Hypothesis 1:

**H1:** There is lack of digital carbon footprint awareness among social media users of Punjab.

Variable	Mean	St.Div	t-value	df	p-value
Awareness	18.87	5.00	9.416	334	.000

**Table 1:** One sample t-test was used in SPSS Statistical Software

#### Interpretation

The one sample-t test was conducted to examine the awareness of digital carbon footprint among social media users. The p value was found to be less than 0.05 the findings suggested that there is lack of awareness about digital carbon footprint among social media users of Punjab. In conclusion, the proposed hypothesis

has been proved significant

#### Hypothesis 2:

**H2:** There is a relationship between pro-environmental Behaviors and social media usage.

		Social Media Usage	Pro-Environmental Behavior
Social Media Usage	Spearman's rho	1	-.524
	Sig (2-tailed)	-	.000
	N	335	335
Pro-Environmental Behavior	Spearman's rho	-.524	1
	Sig (2-tailed)	.000	-
	N	335	335

**Table 2:** Spearman's rho Test Was Used in SPSS Statistical Software

#### Interpretation

According to rule of thumb for interpreting the size of correlation coefficient Pearson correlation of social media usage and pro-environmental behavior was found to be moderately negative ( $r = -.054$ ) Hence, H2 is supported. This shows that an increase in pro-environmental behaviors would decrease the social media usage

## 8. Conclusion

This research aimed to reveal the extent to which social media users of Punjab, Pakistan were aware of digital carbon footprint, and whether individual actions of social media users motivate to reduce their digital carbon footprint. For this purpose, relationships between variables were investigated by using the descriptive analysis as well as statistical analysis. It appears that the participants of this research represent a diverse group with a

high level of education. Firstly, it was revealed that social media has become an important part of the daily lives of youth, with a noteworthy percentage of the population actively involved in various social media platforms. This extensive usage contributes to the global digital carbon footprint. Secondly, the study explored a lack of sufficient awareness among social media users about the environmental impact of their online actions. While many respondents expressed concerns about climate change and environmental pollution, their understanding of the association between social media usage and digital carbon footprint was very limited. This endorses a need for educational campaigns, TV programs, documentaries and initiatives to raise awareness and promote responsible digital behaviors among people. Furthermore, the research highlighted that Individuals can play a vital role by adopting environmentally conscious behaviors, Such as, outdoor/indoor games, spending time in creativity, altruism,

family/friends time etc. and also through their digital behavior such as, screen time application, implementing energy saving measures on their smart phones, posting less picture/videos on their social media accounts. This research underscores the importance of sustainable practices by individuals that could help reducing global warming. By increasing awareness, promoting responsible online behaviors, and boosting sustainable practices within the social media ecosystem, we can strive towards a more environmentally friendly digital future in Punjab, Pakistan, and beyond.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

1. Approval: all experimental protocols were approved by Lahore Garrison

University.

2. Accordance: All the methods were carried out in accordance with the relevant guidelines and regulations

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