Community Engagement to Gender Differentiated Impacts of Climate Change in Social Media

Amit Pariyar, Narayanan Kulathuramaiyer

Abstract*: The Social media has emerged as the most powerful tool to form public opinion on widespread issues. Presently topic on climate change and its impact on natural resources has gained significant interest in online discourse among social media users. With this shallow view on climate change, there is a possibility that its social impacts, for instance gender differentiated impacts of climate change, may become marginalized in online discourse. Besides this, other potential reasons for limited global discourse on social impacts of climate change, inter alia, are meagre role of civil society in global environmental governance, excessive media coverage on the observable destructs and prevailing gender inequalities in the society. The purpose of this research is to examine the status quo on how communities engages in an online discourse associating gender and climate change. To this end, we use keyword-based query method to extract twitter datasets and apply community engagement model to explore parameters such as demographics, geographic coverage, popular mentions, influential authors, popular hashtags and views expressed. The findings reveal varying degree of community engagement and suggests (a) the need for extensive online awareness campaigns (b) higher participation of male alongside female, mostly youths to sensitize gender issues in climate change (c) launching of official hashtags (d) exploiting organization and media outlets (e) strategies to target online campaigns in the climate vulnerable regions. This research contributed by giving future directions on generating online community engagement policies to create awareness on the social impacts of climate change, in particular, to the gender differentiated impacts.

***Index Terms*: Climate Change, Community Engagement, Gender differentiated impacts, Social impacts, Social Media**

I. INTRODUCTION

The present-day transparent and democratic society is the outcome of the interconnected world made possible by the emergence of social media [1] The world has already witnessed how social media platform has empowered communities to engage in open discourse, form a public opinion and instigate a social movement such as Arab Spring [2] the wave of which has inspired many political activism and campaigns [3-4]. In recent times community interest on global challenge pertaining to climate change is also starting to surface in social media. Studies have shown key research trends viz. debates and diversity of opinions on climate change [5-6], polarities in perception to the political commitments and related campaigns [7-8] and the validation of communication model in opinion formation [9-11]. The majority of study on social media discourses takes a macro view on the environmental impacts of climate change. That said there is gap in existing studies that stresses the social impacts of climate change. Climate change and gender issues are intricately related. For instance, studies have reported that in societies where gender inequality is experienced strongly, climate change impacts are faced disproportionately and unevenly among men and women [12-13]. The higher mortality rates of women than men, the rise in the cases of sexual abuses, trafficking, malnourishment, poor sanitation, lack of pre and post-partum facilities during natural disasters are also indicative of women's vulnerability to climate change impacts. The hardships faced by women are even aggravated in societies where the role of women is primarily to safeguard resources such as water, food and fuel for the family [14]. Climate change has reduced their ability to secure these indispensable resources due to declining biodiversity and scarce natural water reservoirs. To meet their household needs women and girls have to walk long distances to collect wood and water which results in less time to fulfil their domestic chores, engage in recreational activity and pursue their education [15]. Hence it bears emphasizing that climate change impact magnifies the existing patterns of gender disadvantage in the society. Despite the seriousness of gender issues in climate change there are several reasons to believe that social impacts of climate change in general and gender differentiated impacts in particular have a marginal coverage in the online social discourse. First when it comes to global environmental governance, study has stressed meagre role of civil society in comparison to the major players, often the national and international caretakers [16]. This leads to knowledge gap with society divided into 'well-informed' and 'uninformed' of the many prevalent issues of climate change including gender. The ignorance on gender issues is further reinforced by the excessive coverage of media on the natural destructs of climate change. Secondly the link between climate change and gender is difficult to ideate with for the general public because it involves defying the societal and cultural norms imposed on women by the society [13]. Furthermore, most of the documented reports on hardships faced by women due to changing climate are made on subjective basis as case stories, and in many cases produced by development agencies, government bodies and scientific communities. There is a possibility that

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the reach of such mediums to general public may not be as impactful as it should be to create awareness about gender issues in climate change. Finally, disintegrated opinion on gender and climate change is also found to occur beyond territorial boundaries. Studies have shown that women from the countries in the South are projected as vulnerable while women from the countries in the North are shown to possess virtues of environmentalism [17]. It is still debated that developed countries consider gender issues in relation to climate change as a problem of developing countries [18]. This hints on the possibility of diverse opinions among global community when contextualizing gender in their climate change discourse. Further in societies where climate change is still believed to be hoax by certain sections, gender differentiated impacts of climate change may be understated in the social discourse.To mainstream gender sensitivity in climate change discourse, this research examines how online communities in social media platform associate gender and climate change. The purpose is to understand community engagement to issues on social impacts of climate change particularly to gender differentiated impacts. To examine online discourses around climate change and gender issues, we seek answers to following research questions.

RQ1: *What is the demography of community engagement? Age, gender distribution.*

RQ2: *How characteristics of community engagement vary with the topic of interest? Influential, popular authors and hashtags.*

RQ3: *How views expressed by community vary with the topic of interest?*

RQ4: *How geographic coverage of community engagement vary with the topic of interest?*

Close to our work is the study of public engagement, user attitudes on online campaigns specific to climate change [10] and gender-based violence [19-20]. We differ in the approach (hashtag vs keyword based) and purpose of the research (isolated vs joint investigation).

II. RESEARCH METHOD

The research method includes data collection and quantitative data analysis in a series of steps. First we formulate query by preparing keywords that match the discussion topics on climate change and gender. Then we execute keyword-based query to extract Twitter data sets made available to us by the Crimson Hexagon under the data philanthropy initiative for climate action [21]. The extracted datasets are then analysed using the community engagement model to identify the degree of community engagement to various discussion topics.

A. Query Formulation

As an initial step we prepare keywords to match our topic of interest and scope of analysis. Table 1 lists the discussion topics and the keywords used to query datasets to extract posts related to each topic. The discussion topics include general topics (‘climate change’, ‘gender’, ‘violence’) and specific topics (‘climate change and gender’, ‘climate change and violence’, ‘climate change, gender and violence’). The assumption is made that posts related to general topics refers to community engagement to unilateral, fragmented issues while posts related to specific topics refers to community engagement to multi-faceted, integrated issues. For instance, the general topic ‘climate change’ is assumed to have posts related to conservation only on climate change. And the specific topic ‘climate change and violence’ is assumed to have posts related to conversation about climate change leading to violence in the form of trafficking. We formulate query by using logical connectives ‘AND’, ‘OR’ and keywords for each topic.

B. Data Collection

By executing keywords, we extract Twitter posts for a period of five years from August 1, 2011 to August 1, 2017. Table 1 gives the quantity of posts extracted for each discussion topics returned with the query. The general topics have large number of posts compared to the specific topics. The returned posts also form the datasets for each topic which are then analyzed for community engagement with the topics.

Table 1: List of Discussion Topics and Keywords

Discussion Topics		Keywords	Total Posts
General	Climate Change (CC)	(climate OR climate change)	97460602
	Gender (G)	(women OR woman OR girl OR gender)	4622325160
	Violence (V)	(violence OR trafficking)	114584907
Specific	Climate Change and Gender (CC and G)	(climate OR climate change) AND (women OR woman OR girl OR gender)	924972
	Gender and Violence (G and V)	(women OR woman OR girl OR gender) AND (violence OR trafficking)	9719361
	Climate Change and Violence (CC and V)	(climate OR climate change) AND (violence OR trafficking)	149990
	Climate Change, Gender and Violence (CC, G and V)	(climate OR climate change) AND (women OR woman OR girl OR gender) AND (violence OR trafficking)	11542

C. Data Analysis

The posts extracted for each discussion topics are quantitively analysed using the community engagement model presented in Fig. 1. The parameters such as demographics, geographic coverage, popular mentions, influential twitter handles, popular hashtags, views expressed are quantified as the frequencies of their

occurrences in the extracted posts. Each parameter gives an account of community engagement on related topics in Table 1. The popular mentions or '@' is interpreted as twitter handles mostly preferred by community to engage with on the topic of interest. The influential authors are interpreted as twitter handles with the ability to reach masses due to highly interactive network of followers. The popular hashtags refer to hashtags that are widespread in the extracted posts. Content analysis is also performed on the extracted posts to collect range of views in each topic. Geographic coverage refers to the posts originating from a specific region. The analysis of parameters particularly popular mentions and influential authors are needed to gather insights on possible communication hub in the online discourse of the topic of interest in Table 1 in order to strategize awareness campaigns in social media.

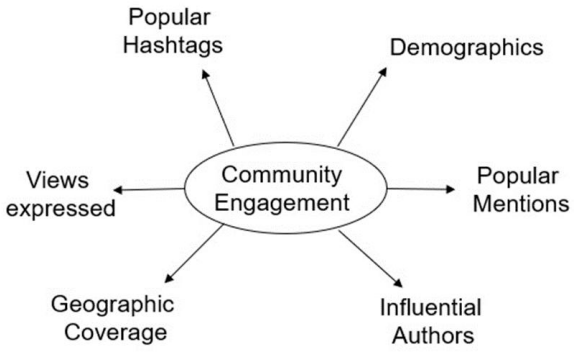

Fig. 1: Community Engagement Model

III. RESEARCH FINDINGS

The findings from analysing community engagement parameters such as demographics, geographic coverage, popular mentions, influential twitter handles, popular hashtags and views expressed are compiled below. Refer to notations in Table 1 throughout the paper.

A. Demographics

Fig. 2 visualizes the gender distribution of the participants for each discussion topics. It is found that the female participation is comparatively higher than men (above 50%) for all topics that include gender. In response to RQ1 this suggests that female population is more sensitive about the issues they are facing such as increasing violence, hardship due to climate change, and climate induced violence such as trafficking. In contrast male participation is found to be higher (above 50%) for topics that lack gender sensitivity such as climate change and violence. This hints that male population is unable to fully comprehend the gender based disproportionate impacts of climate change. From the age distribution in Fig. 3, it is also found that participation of matured age groups above 35 years is higher (above 50%) for most of the topics. The participation of youth age groups is however significantly less which is a serious concern as they represent the future caretakers of the global crisis of climate change. In response to RQ1, this means that youth participation has to be encouraged and made aware that women are more vulnerable to men due to negative consequences of climate change.

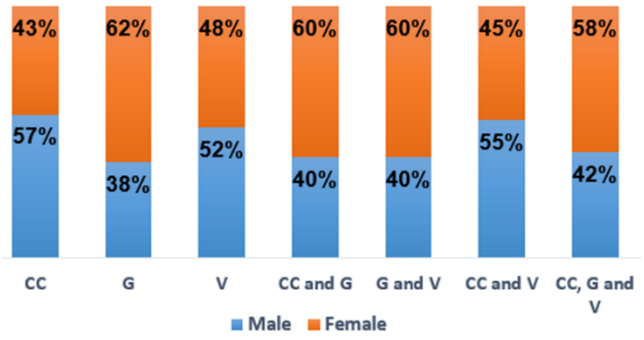

Fig. 2: Gender distribution across discussion topics

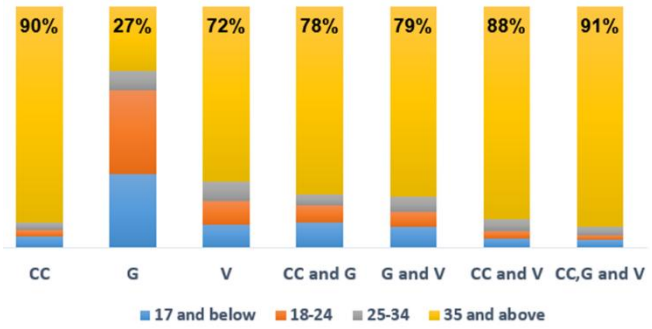

Fig. 3: Age distribution across discussion topics

B. Popular Mentions

In Twitter platform 'mention' or '@' means engaging a particular user in conversation by referring to their twitter handles. Table 2 lists the top twitter handles mentioned across the discussion topics. The data reveals that twitter handle '@realDonaldTrump' is mentioned in six out of seven discussion topics. This shows the popularity of Donald Trump amongst the users to engage in discussion for topics from climate change, gender and violence. This could mean the possibility for either positive or negative conversation with Donald Trump on the topics of interest. Twitter handles '@guardian' '@UN' are also mentioned in majority of discussion topics which shows the increasing role of journalism and international bodies such as UN perceived by users to engage in conversation of global crisis.

Table 2: Distribution across discussion Topics

Popular Mention	Out of 7 Topics	Influential Author	Out of 7 Topics
@realDonaldTrump	6	@AP	6
@guardian	4	@BarackObama	4
@UN	4	@BBCNews	
@YouTube	4	@BBC	3

@POTUS	3	@billboard	3
		@ABC	3
			3

Further investigation revealed that out of 50 unique popular mentions majority of twitter handles (40%) are that of Individuals. Even among individuals, politicians and celebrity twitter handles are found most preferred to engage in discussion. Twitter handles representing Media and Organization make up 24% and 22% of popular mentions respectively. In response to RQ2 this means that politician and celebrities are perceived as a better ambassador for creating global awareness on crisis of climate change and gender violence, and serve as point of contact for users to share opinions and engage in conversation. Thus, it can be implied that political parties and their views on the global issues have a great impact on the community attitude.

The data also revealed categories of twitter handles mentioned vary significantly across the discussion topics as shown in Fig. 4. It is found that majority of twitter handles (60%) belonging to Organization are mentioned to discuss topics on climate change and gender while Media twitter handles are frequently mentioned (60%) to discuss topics on climate change and violence. In response to RQ2 this suggests that organization have additional impact to sensitize climate change and gender issues while media can play a part in publicizing increasing violence such as trafficking from climate change. For the topics spanning climate change, gender and violence there is no definite choice but Media twitter handles are frequently used (50%) to engage in discussion.

C. Influential Authors

By 'influential' we mean twitter handles that have the ability to motivate individuals or masses to bring about the change for a common good. For this we use klout score of twitter handles provided in the data sets. The score considers factors such as user scalability, network scalability, interaction graph, strength/ reach of influence. Table 2 lists the top influential twitter handles across the discussion topics. The data reveals that twitter handle of Associated Press '@AP' appears in six out of seven discussion topics. This illustrates the significance of 'News' medium among other mediums for the spread of topics of global concern. Four other news medium '@BBCNews' '@BBC' '@billboard' '@ABC' also make it to the list of influential twitter handles appearing in more than two discussion topics. In response to RQ2 this shows the power of digital news medium to trigger a social change. This is also because news medium is believed to be the authentic source of information and possibly the primary source referred at crucial times. From 47 influential twitter handles it is also found that majority (47%) belong to 'Media' and 32% belong to 'Organization' such as UN, UNWomen, UNESCO, UNICEF, WHO and WorldBank. This signifies the role of international bodies and media in initiating a conversation and reaching to large number of audiences, influence their attitude and behaviors and be an agent of change to fight the global crisis. In this move the role of individual that make up 11% of influential twitter handles cannot be ignored. Most notably political leaders especially '@BarackObama' who appears as influential author in four out of seven discussion topics and is known globally for advocating environmental concerns.

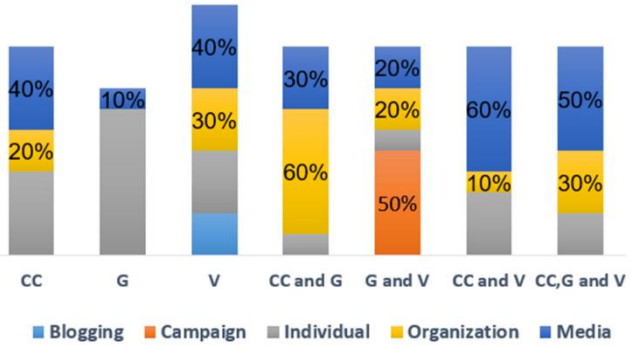

Fig. 4: Distribution of Popular Mentions across discussion topics

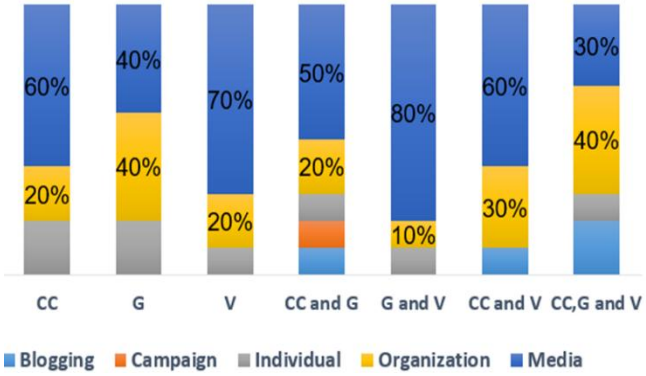

Fig. 5: Distribution of Influential Authors across discussion topics

As shown in Fig. 5, it is also found that categories of influential twitter handles differ significantly across the discussion topics. The majority of twitter handles belonging to Media are found to be influential to sensitize topic of climate change (60%), violence (70%) separately and jointly (60%) as well as gender-based violence (80%). While twitter handles for Organization (40%) and Media (30%) are both comparatively influential to spread aggregated topic of climate change, gender and violence. Since influential twitter handles has an important role to play in igniting social reformation, the role of Media and Organization is suggested to be most impactful. The role of individual influential twitter handles (10 to 20%) is uniform across all discussion topics.

D. Popular Hashtag

We also extracted twitter hashtags from the dataset and categorized them as official and unofficial. Hashtags that are launched by an organization as a campaign or have a twitter handle were considered as official. While hashtags that were used without any specific mission and used randomly to make a point by an individual were considered as unofficial. Out of top 46 hashtags extracted, the data reveals that 35 hashtags (76% of hashtags) are unofficial while only 11 (24% of hashtags) are official as in Fig. 6. In response to RQ2 this raises a concern that we need more official hashtags in order to sensitize the topic of global concerns.

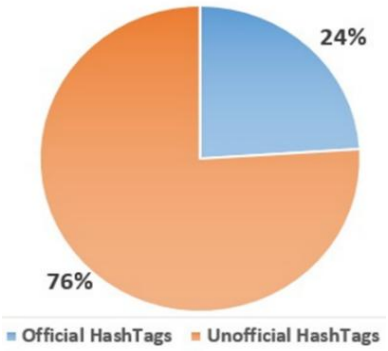

Fig. 6: Distribution of Popular Hashtags

E. Views Expressed

We also performed qualitative content analysis of the posts to identify the views expressed. The views that are consistent with the scientific consensus and/or promoting action to prevent climate change, gender or violence were classified as Activist. The views in opposition to the scientific consensus and/or opposing action to prevent climate change, gender or violence are classified as Sceptic. For view that could not be identified based on information provided we classified as Unknown. To identify views expressed in the posts we first sampled top 10 retweets from each discussion topics. The posts with maximum retweets are certain to reach wider network of followers and draw more attention. The views expressed in such posts give a glimpse of whether supportive attitudes proliferate in online platforms. Fig. 7 visualizes the views expressed in discussion topics. In response to RQ3 the data reveals that climate change and gender violence have higher activist views about 80% and 90% respectively. The reason could be plentiful coverage and importance given to climate change and gender violence such that it has raised awareness among the general population. While views over how climate change is resulting in gender differentiated impacts is low (40%) which means more awareness programs are needed to educate the general population.

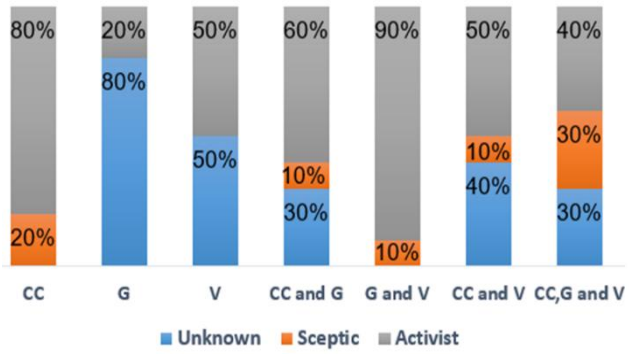

Fig. 7: Distribution of Views Expressed across discussion topics

F. Geographic Coverage

To understand geographical distribution of users participating in discussion topics we also filtered datasets from the originating region. As shown in Table 3, data reveals that Australia, Canada, India, Indonesia, United Kingdom, United States of America have population who are highly interested in discussing topics of climate change, gender and violence either jointly or separately. Geographically the discussion is concentrated in the industrially developed countries. It is worth noting that Spain has only single entry for having user population who are interested in discussing aggregated topics of climate change and gender violence. In response to RQ4 the data also reveals that countries with serious consequences of climate change on increasing violence mostly faced by women are underrepresented when it comes to user engagement in discussing topic of interest. This suggests that more and more user engagement is necessary for population from counties which is highly vulnerable to climate change.

Table 3: Distribution across Geographic Regions

Discussion Topic	Top 10 Geographic Region
Climate Change (CC)	United States of America United Kingdom Canada Australia India Indonesia France Germany South Africa Netherlands
Gender (G)	United States of America United Kingdom Canada India Indonesia Philippines Nigeria Brazil Australia South Africa
Violence (V)	United States of America United Kingdom India Canada Australia Nigeria South Africa Indonesia Pakistan Brazil
Climate Change and Gender (CC and G)	United States of America United Kingdom Canada Australia India France Indonesia Nigeria South Africa Kenya
Gender and Violence (G and V)	United States of America United Kingdom Canada Australia India South Africa Nigeria Indonesia Kenya Pakistan
Climate Change and Violence (CC and V)	United States of America United Kingdom Canada Australia Indonesia India Nigeria France Brazil Mexico
Climate Change, Gender and Violence (CC, G and V)	United States of America Indonesia United Kingdom Canada Australia India France Spain Kenya Nigeria

IV. DISCUSSION

This research made interesting findings on community engagement in online discourse on social impacts of climate change particularly to gender differentiated impacts.

A. Active Participation of Female and Matured age groups

Female population is highly supportive of the topics where gender references are integrated such as gender violence and climate change which is congruent with past studies which suggested higher female participation in topics that address gender issues. Compared to matured age groups youths are least participatory which has to be encouraged with

incentives such as volunteer, workshops, raising prospects for their job in the topic of interest.

B. Danger of Biased Views

Political parties and their views on global issues in Twitter serve as a reference for community to share opinions and engage in conversation. We note that online communities prefer to engage with '@realDonald Trump' for discussing topics on climate change impacts whose administration is criticized for their stern America first policy side-lining environmental concerns. This hints on possibility for negative repercussions on online social discourse.

C. Significant Role of Media and Organization

In order to reach masses in spreading awareness on global concerns Media and Organization play an important role. Specifically, it is found that media are most influential to spread topics of climate change, violence separately and jointly as well as gender-based violence.

D. Presence of Unofficial hashtags

The majority of extracted hashtags are unofficial without any definite mission. This stresses that plentiful official hashtags to address specific topics of interest is required to be launched.

E. Lesser Activist views on Aggregated Topic

We noted majority of activist views on discrete topics of climate change and gender, but their aggregated topic over how climate change is resulting in gender differentiated impacts received fewer activist views. This suggest that more awareness is needed to educate about hardships that climate change has created for women mostly in developing countries.

F. Negligible Participation from Climate Vulnerable country

Though Africa and Southeast Asia regions have majority of least developed countries vulnerable to climate change impact, the communities in these regions are least engagement in online discourse. This suggests that region specific online campaigns are needed to encourage community engagement from climate vulnerable regions. The limitation of our work is that the query formulated for each discussion topics are explicit and to the point, for instance (climate OR climatechange) to extract post discussion about climate change, and (climate OR climatechange) AND (women OR woman OR girl OR gender) AND (violence OR trafficking) to extract posts discussion climate change and its gender differentiated impacts. There are rooms for improving the query formulated by adding more logically implicit contexts and increasing the keywords, for instance adding keywords such as global warming, anthropogenic, policy, women trafficking, sexual harassment, and physical violence as in previous studies (Karuna et.al, 2016). Another limitation is that twitter dataset from English language is used for this study which creates a language bias. Our work is only representative of English language twitter user communities.

V. CONCLUSION

Social media is a big part of digital society which has empowered communities to raise their voices and express their concerns on widespread issues. Climate change is a global concern which has garnered significant interest among social media users in their online discourse. But majority of online discourses build upon a shallow view of climate change mostly on its environmental impacts while its social impacts particularly gender differentiated impacts probably go unnoticed. The potential reasons are (a) meagre role of civil society in global environmental governance (b) excessive coverage of media on the observable destructs (c) challenge in confronting the contemporary social norms rooted with gender inequalities (d) limited access to documented reports and (e) disintegrated views between developed and developing countries. This research examined the status quo of community engagement in online discourses on gender differentiated impacts of climate change by analyzing the twitter datasets and suggested the need for extensive awareness campaigns to involve male participation alongside female, and target youth participation. The findings also suggested potential biases from the political views in addition to the significant role played by Organizations and Media in sensitizing climate change and gender issues. The need for launching official hashtags and strategies for region specific campaigns especially to climate vulnerable regions is also suggested. The results draw a conclusion on varying degree of community engagement to the social impacts of climate change and highlighted the need to mainstream discourses on gender issues in climate change. This research contributed by giving future directions on generating community engagement policies to create awareness on the social impacts of climate change, in particular, to gender differentiated impacts.

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